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The Landscape of Career and Technical Education Faculty Data Use for Decision-Making and Program Improvement in National Science Foundation–Advanced Technical Education Programs in Washington State

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Over the last ten years, in Washington community and technical colleges (CTC) there has been a great leap forward in access and use of data for setting and measuring goals, monitoring progress, and identifying equity gaps. Despite much progress, faculty members in career and technical education (CTE) programs still often have difficulty accessing and using data that would drive program improvements. The purpose of this research is to gain knowledge about the current state of affairs surrounding technical education faculty access to and use of student-level data; second, we seek to shed light on the constraints CTE faculty face in accessing and using data for data-informed decision making. Our research revealed much variation in faculty access and use of data, with some creating customized solutions for daily use and others only accessing data for external needs such as accreditation or mandated program review processes. While the need for data may be exacerbated by the COVID-19 crisis, faculty report data use on campus has dropped during the crisis and been replaced by immediate concerns over financial health, enrollment and instructional delivery challenges. Rather than continue to advance data-driven decision-making, we may be seeing colleges retrench to past organizational norms and customs.

Keywords: data for decision-making, data use, community and technical colleges, faculty

In Washington state's career and technical education (CTE) programs, about 30 percent of first-time-in-college students earned an associate degree or certificate in entry cohorts from 2010 to 2012. Almost 60 percent exited with no credential after four years and historically underserved students of color were overrepresented in the group to leave college without a credential (Prince, 2019). These outcomes are not unique to Washington (Humphreys & Gaston, 2019). For CTE programs, often led by a single or small group of full-time faculty members who also act as program administrators, achieving exceptional outcomes requires a culture of inquiry and action that rely on data to systematically diagnose, assess and benchmark student progress, and make informed decisions regarding progress and completion (Wyner, 2019; Phillips & Horowitz, 2017).

At the same time that more information is needed, resource constraints limit data analysis to improve CTE programs and ensure their sustainability. Many factors contribute to limited data use, including budget cuts and staff furloughs, unclear program improvement goals and metrics (Maxwell & Person, 2016), the lack

of widespread knowledge and awareness of relevant data sets, shortfalls in research capacity, and constraints in the ways data are used to tell stories about student success (Ewell, 2010).

This article examines the data access, use, and needs of faculty who direct and teach in CTE programs that were developed or significantly enhanced by National Science Foundation-provided Advanced Technological Education (ATE) funds in career and technical colleges (CTCs) in Washington state. Our aims with this research are twofold. First, we seek to gain knowledge about the current state of affairs surrounding CTE faculty access to, and use of, student-level data in the Washington CTC context. Second, we seek to shed light on the constraints Washington CTE faculty face in accessing and using data for data-informed decision-making.

This paper is structured as follows. First, we review the literature on what is known regarding data availability and use in community college CTE programs before turning to our research questions and three-strand research approach involving expert panels representing CTE programs in Washington, document review of sixteen ATE funded programs, and results of semi-structured interviews at three partner colleges and with other statewide experts. Our findings are organized around five themes that emerge consistently in at least two of the three research strands. Finally, we discuss the implications of COVID-19 with regard to data access and use before concluding with a discussion of the next steps in this three-year research project.

Data Use in CTE Programs

Little literature exists documenting the how, why, and when CTE faculty use data in community college settings for data-driven decision-making (Welton, 2018). Through building a culture of evidence, initiatives such as Achieving the Dream (ATD), a Lumina Foundation-led effort to increase community college completion, endeavor to place data knowledge and use at the center of campus completion and equity efforts. A survey conducted of early adopter ATD colleges in Washington found that CTC administrators at these colleges were more likely to engage with data compared to college faculty who did not examine data on a regular basis (Kerrigan & Jenkins, 2013). The authors concluded from this observation that faculty were not the intended end-users of available data. Such observations extend long-standing perceptions that CTE faculty have not been considered data users in the designing of data sets and may be reluctant to adopt new processes that require increased use of data (McFarlane, 2012).

Most scholarship in this domain has employed a case study approach to illustrate the successes of colleges in using data for continuous program improvement, with some examples of use by faculty in technical programs (Maxwell & Person, 2016; Phillips & Horowitz, 2017). Work in the Pathways to Results (PTR) initiative, which is primarily centered in Illinois, has emphasized building campus-wide partnerships to examine data for equity gaps to improve technical and academic pathways. PTR encourages faculty to use data to try solutions to close equity gaps and evaluate whether those solutions produce more equitable program (Pickel & Bragg, 2015). The PTR process involves practitioner teams in using data to identify barriers and gaps in the P-20 pipeline from public schools to college and to improve programs of study, particularly in science, mathematics, engineering, and technology (STEM) fields. It is one of the only data-driven processes we find in the literature that focuses on data-use in CTE programs. Integrated in the PTR process is reflective practice that enables faculty to understand how the changes they make to programs and practices close equity gaps in student outcomes (Bragg & Durham, 2012).

Data use by CTE faculty tends to be limited despite these kinds of efforts and frameworks to infuse data into decision-making processes. Indeed, these kinds of processes, where faculty take a deep dive into their program data with the aim of improving student outcomes (and sometimes focus on equity), are rare and often

require considerable professional development and investments to shift institutional data processes in order to succeed (Maxwell & Person, 2016; Phillips & Horowitz, 2017; Rockey, 2018). Much of community colleges' organizational capacity for data-driven decision-making is a function of administrators' skills sets that may tend to be lacking on some college campuses (Kerrigan, 2014). Moreover, even where data are analyzed a unified theory of change is often missing for assessing whether program improvements are being achieved (Maxwell & Person, 2016). Ambiguous goals contribute to inaccurate measurement, making it hard to use data for meaningful program improvement.

Extant research has documented that the concepts of "data" and "research" among community college technical faculty do not have shared meanings. In the case of "research", this term may have a negative connotation whereby faculty are understandably more interested in participating in the research as opposed to having their programs be the subject of research (Badway & Somerville, 2010). Badway and Somerville (2010) interviewed faculty and program directors funded by NSF ATE and found that pivoting to the term "information" was helpful when questioning faculty about the data they needed for program improvement. Through these interviews The authors also found that faculty ATE leaders identified their data needs across a broad range of topics including best methods of improving student academic preparation prior to entering ATE programs, promising practices related to curriculum development and recruitment of students, skills that technicians must demonstrate to meet industry needs, and characteristics of effective partnerships between educational programs and industry. This varied list speaks to the multiplicity of data required to effectively meet the needs of faculty engaged in program management, and of students and employers in CTE programs, as well as to the importance of ensuring that data gathered are logical and meaningful to the faculty who need or seek to use them.

The research objective of this article is to establish baseline knowledge of data use and constraints in NSF ATE programs in Washington state, with a focus on faculty-identified student-level outcomes that are viable for analysis for the purposes of program improvement and more equitable student outcomes. We aspire to infer more broadly about CTE in Washington based on this ATE-focused analysis. To achieve this research objective and inferential aspiration, we base this paper's research and analysis on answering two questions:

1. What is the current landscape of data use by CTE faculty in community and technical colleges in Washington state, focusing specifically on programs that have received NSF-ATE funding?
2. What are the constraints Washington CTE faculty face in accessing and using data for data-informed decision making?

Method

The broad nature of our research questions, combined with the variation in and between technical programs in Washington CTCs, required that we implement multiple strands of qualitative inquiry to inform and potentially triangulate our findings. These qualitative strands included document review (Bowen, 2009), use of the expert panel method (Galliers & Huang, 2012, Martín et al., 2014), and semi-structured interviews (Adams, 2010). These methods were employed with stakeholders at the three colleges that represent the study's partners: Seattle Central College, Green River College, and Renton Technical College. Each strand of inquiry provides complementary insights and, together, they reveal the themes that ultimately emerge.

Document Review

To understand more about the technical programs in emerging workforce areas funded by the NSF-ATE program in the last 10 years in Washington (2010 to 2020, n = 34), we asked all 34 program principal investigators and their colleagues to share their grant application nar-

rative and their most recent evaluation report. Eighteen programs responded to our request and provided documents for review by our research team. Of these, 16 were determined to be technical education programs that developed, extended, or enhanced student pathways, which relates to our focus on program improvement in student outcomes (as opposed to colleges that secured NSF-ATE funds for other activities, e.g., faculty professional development). Using a framework for qualitative document analysis (Bowen, 2009), these 16 grant applications and subsequent evaluation reports were coded to identify the data cited in them regarding: program demand, student enrollment or projected enrollment, any information about student special populations served, student demographics, student outcomes or projected student outcomes, labor market information, and any other category of data that was referenced. We focused attention on mentions of measurement of academic momentum points (particularly intensity of enrollment and math course completion), labor market outcomes, and empirical strategies for program evaluation (Jenkins & Bailey, 2017). We also noted any disaggregation of data.

This analysis revealed that the 16 programs represent traditional and emerging labor market needs, including IT, software development, specialized manufacturing, sustainable building technologies, and other industries. As such they offer a viable representation of the types of programs currently being developed and enhanced in CTCs nationwide. These documents provided valuable data on the development and operation of many program components which, in turn, provided the research team with a foundation of knowledge about the state of data utilization among NSF ATE funded programs in Washington (Hatry, 2010). A complete list of the programs we reviewed in this phase can be found in Appendix A.

Expert Panels

Turning to expert panels, this qualitative method of data collection provides "a forum in which leading experts in a given field are invited to share their experiences and thoughts" (Galliers & Huang, 2012, as cited in Lewthwaite & Nind, 2016b, p. 417). Group interviews and focus groups allow for modest interactions between participants whereas expert panels take the "value of dialog as a guiding principle" to encourage and deepen a conceptual exchange of ideas among a diverse group of thought leaders (Lewthwaite & Nind, 2016a). Whereas other forms of qualitative inquiry utilizing expert perspectives seek to cultivate varying degrees of consensus (e.g., the Delphi method, see Brady, 2015), debate and disagreement within an expert panel is considered an important tool that potentially reveals multiple facets of the underlying research concepts of interest.

To explore our research questions from multiple perspectives, we implemented two expert panels comprising distinct groups of stakeholders in Washington state. The first panel was composed of 12 individuals, including college presidents, state and institutional research professionals, college deans and faculty, and an employer representative from one of Washington's key high tech industries. This first expert panel met as this research project's advisory committee in January, 2020. The second expert panel was implemented as part of a workshop with institutional research professionals involving Washington's 34 community and technical colleges that coincided with the State Board of Community and Technical Colleges' (SBCTC) quarterly Research and Planning Commission (RPC) meeting, held in March, 2020.

Our work with each expert panel followed a similar data collection protocol developed by the research team. First, the group of experts was randomly divided into subgroups. Each subgroup was given an initial question/prompt developed by the research team related to student-level data and technical education. Experts in each subgroup were invited to engage, reflect, and debate these prompts and record their ideas on large sheets of paper. Subgroups then rotated through each of the prompts and

added to, questioned, and expanded upon the responses of the previous subgroups. Once all panelists had engaged each of the prompts (see Table 1), the expert panel reconvened as a large group to reflect on patterns and themes to emerge from this exchange of ideas.

The research team took notes throughout each expert panel activity and paid especially close attention to observing and recording the expert panel's reflections in the final phase of the activity. Upon the completion of each expert panel, members of the research team analyzed the data for broad themes and coded recurring topics that appeared within the responses to each question/prompt. Following the approach recommended by Martín et al. (2014), these codes and themes were organized in a manner so as to provide structure and meaning to the qualitative findings (see Appendix B and C for the codes and themes to emerge from this analysis).

Semi-Structured Interviews

Semi-structured interviews took place throughout the first year of this study, from September, 2019 to August, 2020, following a conventional semi-structured interview protocol in which a member of the research team began the interview with a set of uniform questions but allowed subsequent questions to follow whatever direction emerged from the interviewee's responses (Adams, 2010). These in-depth interviews were conducted in-person and via electronic correspondence with the State Board of Community and Technical Colleges' (SBCTC) Director of Research and Planning and three ATE faculty program directors throughout the state.

Qualitative semi-structured interviews were also implemented extensively at our three partner colleges with ATE-supported programs.

Table 1
Expert Panel Prompts

Theme	Advisory committee prompts	Research and planning commission prompts
Program Improvement	How is program improvement for technical programs being done now?	How do, or how could, institutional research professionals and college faculty work together to improve technical education programs?
Measuring Equity	How is equity considered/addressed in program improvement efforts for technical education programs?	How is equity measured, or how could it be measured, in technical education programs?
Opportunities to Improve Data-Informed Decision Making	How can colleges expand their capacity (or efforts) to improve technical education programs?	What are the potential challenges and opportunities our research team faces as we implement this research project?
What Data Do Technical Faculty Need?	What information about student outcomes do faculty need to facilitate data-informed improvements to technical education pathways and programs?	What student-level data do you, or have you ever, provided to technical education faculty or staff? What were the reason(s) for providing these data?

These three partner colleges, which will factor centrally into the ongoing comparative case study research to be implemented during the second and third years of the project, were purposefully chosen to represent a diverse set of institutional contexts, technical program subject areas, credential levels, program scope and size, and varying internal capacities to access and utilize student-level data (see Table 2). Members of the research team interviewed all three Co-PIs (one from each partner college) and other campus leaders at each of the partner colleges, such as deans, technical faculty in the focal programs, and directors of institutional research (IR). These interviews focused on what data technical faculty have access to, by what means and how often faculty access data, what data faculty find most useful, and how IR professionals and faculty use student-level data from technical education programs in their day-to-day duties. In describing our findings from these semi-structured interviews in the section that follows, we generally focused on themes that emerged across interviews rather than attributing a single observation to a particular college.

Findings

The three complementary strands of research, i.e., document review, expert panels, and semi-structured interviews, led us to identify five themes that emerged in at least two of these three strands. Over the course of this research project themes were developed iteratively from open codes until a sufficiently broad interpretive theme emerged.

The availability of student-level outcomes data varies widely by college

A consistent theme to emerge from our interviews with a diverse group of stakeholders was that there are student-level data available at colleges, but technical program faculty are not the primary intended end-users of such data. Technical faculty on each campus have access to data dashboards produced and maintained by the state Board for Community and

Table 2
Partner College Characteristics

College	Setting	Program, Years	Credential(s)	Student Headcount	Faculty
Green River College	Suburban	Expanding Career and Educational Learning in Information Technology (EXCEL-IT), funded 2014-2019	3 credentials; 2 Associate of Applied Science degrees; 2 Bachelor of Applied Science (BAS) degrees	~80 students in each annual BAS cohorts	12 full time faculty members, ~ 5 adjuncts
Renton Technical College	Suburban	Computer Network Architecture, funded 2017-2019	Bachelor of Applied Science	22-24 students in each annual cohort	1 full-time faculty, 2 adjuncts
Seattle Central College	Urban	Sustainable Agricultural Education (SAgE program) funded 2009–2011, 2012-2014	24-28 credit “degree emphasis” program earned concurrently with an associate’s degree	74 students in core courses	2 full-time faculty teach the majority of the core courses

Technical Colleges (SBCTC) that report student enrollment, progress, and outcomes and are disaggregated by student demographics (e.g., race, gender). The development of these dashboards represents a major leap forward. However, because of their broad, institutional-level view, faculty report that these dashboards are used mostly by college administrators and are not granular enough to "drill down" into programs. For example, programs are not defined in the data so a faculty member cannot look at student outcomes in their particular technical education program, therefore limiting the use of such data to technical faculty already seeking to improve program-level outcomes.

Some colleges in the system, including one of our three partner colleges, produce more granular dashboard information or ad hoc reports. To gain information that is actionable, ATE faculty sometimes make special requests to their college Institutional Research (IR) office. The ATE program team at one partner college makes data requests to the Institutional Effectiveness office for a variety of reasons: to obtain demographic data on students within the program; for enrollment and completion data for publications, grant proposals and applications or grant reports; and when looking for demographic data for the entire college or the college's entire service area that the program might use to identify and close equity gaps. However, while in some instances we observed that faculty work with their IR offices for such specific program information, we likewise observed with the same frequency that faculty very rarely or never had contact with IR or any other office on campus that might potentially provide data for program improvement efforts.

In some instances, technical faculty report that they do not know what data they can request or to whom at their college such requests would be made. A systematic document review of the 16 relevant NSF-ATE proposals revealed little specificity about proposed metrics or momentum points for measuring success beyond enrollment targets. Given that many of the NSF-ATE grants funded new or enhanced pathways, it is perhaps not surprising that they would not be monitoring longer-term student outcomes such as completion. However, only a small fraction of the 16 technical programs whose documents we reviewed indicated that faculty regularly reviewed data, a finding reinforced by our interviews. We also noted that most data seemed to be produced for grant reporting purposes or evaluator reports rather than for data-driven program improvement.

External pressure looms large as a motivating factor for data use and can complicate and constrain efforts to use data for program improvement

One of the most common reasons CTE faculty examine program data relates to the requirements that arise from accreditation and institutional program viability or program-review processes. Even though these external pressures are common across the state's colleges, including the three institutions that comprise this study's partner colleges, most faculty do not appear to have a consistent framework or set of metrics regarding student progress that they could rely on for program improvement. This lack of consistency and systemization of data across programs, even those within the same college, speaks to both the difficulty in establishing frameworks and the individual nature of each program.

Each college, and often each technical education program within the college, has an established program review process that is most often faculty-driven and intended for continuous improvement but also required for college-wide accreditation standards. Some colleges have established a program viability process that is most often administration-driven and intended to identify or compare programs that may be underperforming in terms of enrollment or other factors. The data required to complete these processes is locally driven. No statewide framework for program review exists after initial program approval is granted by the SBCTC. Program review is typically conducted only every five years while program viability assessments may occur at any time but are especially

common during times of financial distress in colleges (as with the Great Recession and now with Covid-19).

A constraint with regard to data use on some campuses is a sometimes tense relationship between IR offices and faculty, particularly when accountability processes such as "program viability" studies compete with the need for data to support continuous improvement processes (Badway & Somerville, 2010). At two of our partner colleges, recent budget constraints have led to the development of "program viability" or "program audit" processes. These processes, while understandable to manage challenging financial circumstances, reveal differences in how administration and faculty approach and use data. An examination of the 13-factor viability rubric at one of the three partner colleges found that nine factors were economic (i.e., cost per-FTE, revenue per-FTE, graduate entry-level wage), while only two were student outcome-based (retention and completion). We find some evidence that trust in data is not high among technical faculty (i.e., faculty fear that student outcome data may reflect poorly on the faculty member) and that faculty might hesitate to ask for data that could uncover potential issues that they fear might reflect negatively on them or their program.

Aside from these accountability efforts, college staff report that much of the motivation for data use at their colleges has been from college efforts to identify equity gaps. College-wide equity efforts have led colleges to disaggregate data to look for retention and completion equity gaps, especially for students of color. However, small cell sizes for underrepresented groups often make such disaggregation in technical programs challenging due to student privacy concerns.

CTE faculty data use varies by capacity, technical skills, interest, and the extent and form of institutional support

Faculty sometimes create sophisticated customized systems to obtain the data they need. This creative approach allows the faculty member to essentially become the researcher, developing and answering their own questions about the program. Data on student employment and satisfaction with the program were sometimes also collected by faculty directly from students through Canvas, SurveyMonkey, and Qualtrics (see Blume et al., 2021).

Select faculty members who have a background in data management (e.g., those in IT and related programs) appear to be more aware of what is within the realm of the possible in terms of access, querying, analysis, and reporting. Faculty members and program staff at the college where we observed this pattern use a variety of data sources and tools to help manage their program and have leveraged their own expertise in data systems and technology to create a variety of enhanced tools that allow them to access and use data. In this instance, however, the data analyzed generally constitutes basic enrollment and completion data by course or by program. Yet, even with this expertise and data-driven focus within a given program team, a varying level of experience around knowing what data is available and how to access it means utilization of data for program improvement is not consistent or generally well developed.

Technical faculty do a fair amount of manual collection of data and then use their skills to improve the data's usability. At the same partner college noted above, job placement data is collected manually by faculty and staff through personal communications and LinkedIn updates. The information is saved on a spreadsheet in a shared electronic location. Likewise, faculty manually collect data on baccalaureate program application numbers and other information for the program. Individual faculty members in this particular program who are familiar with Python (an advanced programming language) use the data collected to generate visualizations, e.g., to plot enrollment trends over time. Such tech savvy faculty also have Python scripts that scrape public web screens to collect information to which they do not have direct access, such as scraping their own college's "class finder" site to see how

many open seats remain in each class. Such ad hoc approaches to data collection and analysis demonstrate an entrepreneurial spirit among some technical program faculty and also their desire to perform research on their own programs rather than being the subject of research performed by administrators (Badway & Sommerville, 2010; Blume et al., 2021). Another tool at this college, The SQL Engine, is an internal application developed by campus IT administrators that allows for select users to write and save queries in SQL that query the legacy mainframe database system. This provides an interface to access real-time college data. Program faculty have a saved query available for their use that helps with daily monitoring of course enrollments in the department during registration season to assist in managing sections. The faculty also maintain a saved query for GPA tracking to help faculty verify and monitor student progress and GPA. An IT faculty member was awarded a special project grant to build a layer on top of the SQL Engine so that program faculty and staff who do not know SQL can access real-time college data in a more user-friendly interface. This interface provides helpful enrollment snapshots of students enrolled in specific technical education AAS and BAS programs. For example, faculty can now see a table of all students in the program, which classes they have completed and their grades, and can also see what individual students still need to complete. Before this tool existed, faculty had to run degree audits manually for each student and enter them into a collective spreadsheet. This new tool allows faculty to see overall completion progress for the program and can help inform faculty to make sure the appropriate number of sections of classes are available so that students have an efficient path to complete the program on time.

These program management and improvement efforts at two of the three partner colleges are somewhat unique and driven by the motivation, skills, and experience of the faculty members at these partner colleges as well as by their desire to create and use their own data and research skills. In many cases capacity constraints of both faculty and IR offices, coupled with privacy concerns, limit such innovative efforts at accessing data and developing and answering research questions targeted at program improvement.

Uniqueness and innovation in the design of CTE programs, and especially programs awarded NSF ATE funding, challenges existing data structures and processes

Program uniqueness and modest enrollments present certain challenges for data analysis of student outcomes. For example, the program at one of the partner colleges is an "emphasis" rather than a certificate or degree. Faculty and administrators may not be aware of which students intend to obtain the emphasis until a student completes a significant number, if not all, of the credits required for the program emphasis. Uniqueness in the design of ATE programs is one of the features that make them so innovative and attractive, but can also make it challenging to collect and use data within systems that are built for traditional programs with larger student populations. Small "n sizes" can also present a challenge for disaggregating data and discerning patterns among racial minority students or women, for example in IT. Often, small sample sizes raise concerns for sharing student-level data outside of the IR function of the college; for this reason some technical education programs may never see the type of granular data that could allow them to make program improvements targeting particular subgroups of students.

Given these concerns, we found it noteworthy that some evaluators of the 16 NSF ATE projects included enrollment numbers and disaggregated student demographic enrollment information in their reports. For example, the evaluator for the creation of a new baccalaureate pathway in Sustainable Building Science Technology at a college in metro Seattle noted that the program exceeded target numbers in overall enrollment as well as the enrollment of female and veteran students. The same program also conducted a student experience sur-

vey that revealed high levels of student satisfaction. In our document analysis, however, we observed few examples of equity measures included in grant proposals. The enrollment targets for specific populations in the program at the college noted above is an exception, but interviewees indicated that faculty and administrators recognize that more recently awarded and future ATE grants are emphasizing that greater attention be paid to underserved student populations, implying that data and such measures will be needed.

Addressing limited access to student-level data presents an opportunity for CTE faculty to improve programs and therefore improve student outcomes

Despite the challenges we observed related to using student-level data, we found that technical faculty expressed a broad openness and interest in utilizing student-level data as long as the process was faculty driven and not punitive. Faculty who have access to data on their campus or who have created their own creative and entrepreneurial access to data are often acting as researchers; these faculty uncover issues, develop research questions, and access data that help them uncover solutions to program challenges. Likewise, we found broad interest from both IR staff and administrators to engage with faculty around providing access to data and developing partnerships to find potential solutions to any issues uncovered. State-level administrators confirmed that in many colleges no meaningful program review process means that an opportunity exists for intervention to improve student outcomes, including retention and completion and equity in these across groups, before more draconian program audit or program viability processes threaten a program's existence.

Effects of COVID-19

The first phase of this research study concluded in mid-March 2020 just as Washington, and in particular the Seattle area where the study's three partner colleges are based, was struck with the COVID-19 pandemic. The state's CTC system moved quite suddenly to an almost entirely on-line delivery system, along with most other systems of public education. At that point the landscape in which we had designed and had been studying our research questions changed dramatically. In particular:

- One of the partner colleges had their IR director position indefinitely furloughed. The IR director position at another partner college was vacated with the administration announcing no immediate plans to hire for the position, but faculty pooled grant funding for the position and a new director was ultimately hired. Such reductions in staff are reminiscent of layoffs in IR offices that occurred during the recession of 2008 and ensuing years which, in turn, lead to delay or entirely prohibit faculty requests for student-level data.
- With the urgency to move their CTE curriculum to on-line delivery, faculty shifted their attention to more immediate instructional issues; simultaneously, though, enrollment and completion concerns took center stage so data were potentially, if not more, relevant to organizational and departmental decision-making.
- At least one of the partner colleges performed widespread program audits due to budget shortfalls, which led to the closure of several CTE programs.
- Staff furloughs across various departments at colleges are leading to delays in response to data requests, in processing grants, and in accessing programmatic information.

Conclusion

We find large variation in data access for CTE faculty across programs and colleges, ranging from virtually no access to an array of granular, descriptive statistics at the program level. Although some faculty are not provided much, if any, data by their institution, some are able through their own technical skills and en-

trepreneurial ingenuity, to create their own data to obtain the information they need. These faculty act as researchers to develop a theory of change they rely on for making programmatic, data-driven decisions. However, more often we find little evidence of data use for program decision making.

Constraints to data use include limited resources, difficulty accessing data due to privacy concerns, hesitancy to uncover potential issues that may have thorny solutions, financial difficulties at the colleges, communication gaps and mistrust between IR and faculty, and a sometimes-adversarial relationship created by tension between program oversight and program improvement. These constraints have been exacerbated by the COVID-19 pandemic and, while it is possible that the need for data is at an all-time high as colleges face unprecedented enrollment and retention challenges, IR staff are often some of the first college staff to be furloughed or go unreplaced.

We posit that a major opportunity to improve CTE and overall CTC outcomes exists if: (a) colleges support faculty in using student-level data; and (b) a collaborative process is implemented (e.g., PTR) by which to use data to improve student and program outcomes. While data-driven improvement efforts have focused at the institutional level, or within academic transfer programs, CTE programs–and especially CTE faculty–have not been seen as a major consumer of data or targeted in efforts to improve sometimes murky student outcomes. An opportunity exists to potentially have a large positive effect on student outcomes as most faculty in technical programs are a motivated, dedicated group who are asking to be part of the conversation about using data for program improvement. As those closest to students with a large amount of influence over program design, curriculum, and structure, these faculty can be integral to the improvement of student outcomes. Building from the idea that technical faculty know their programs best, we contend that technical faculty represent an untapped resource when it comes to accessing, analyzing, and acting upon student-level outcomes data to improve technical education programs and pathways and, by extension, the student outcomes (e.g., employment) that motivate investments in technical education in the first place.

In the next phase of our three-year research study we aim to address the issues raised in this article by proposing and testing a set of basic, common data metrics that could be used in faculty-driven program improvement processes at our three partner colleges. These metrics are based on several frameworks already known and used in Washington CTCs, including an analysis involving leading and lagging indicators (Phillips & Horowitz, 2017), momentum points and milestones (Leinbach & Jenkins, 2008), and disaggregated data that reveals equity gaps using Pathways to Results (Bragg, 2017) and the Equity Scorecard (Dowd & Bensimon, 2015) frameworks. In implementing the use of these frameworks, we plan to rely heavily on the process described in the Pathways to Results literature, one of the only data-driven frameworks to have been tested in CTE programs. Our objective is to contribute evidence to the broad literature on data-usage at American community colleges and demonstrate the value of empowering faculty to improve their technical education programs and pathways with data-informed decision-making processes.

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Appendix A

ATE Programs Examined as Part of Document Review

Award Number	Title	Start Date	Organization
0903329	SAGE Project - Sustainable AGriculture Education	05/15/2009	Seattle Central Community College
1002931	Meeting the Challenge of Energy Management in a Carbon Constrained World	08/01/2010	Edmonds Community College
1003223	National Health IT Technician Certification, Curriculum and Implementation	09/01/2010	Bellevue College
1400490	Advancing Training Pathways for the Sustainable Energy Workforce	07/01/2014	Bellingham Technical College
1400688	Expanding Career and Educational Learning in Information Technology (EXCEL-IT)	09/01/2014	Green River Community College
1502032	The Pacific Northwest Photonics Technology Project	07/01/2015	Lake Washington Institute of Technology
1565577	Rural Access Mechatronics Program	09/01/2016	Clark College
1601140	Next Level Networking Project	08/01/2016	Renton Technical College
1601216	Composites Recycling Technician Education Program	07/01/2016	Skagit Valley College
1700629	The Northwest Network for Application Development and Technology Connections (AppConnect NW)	08/15/2017	Lake Washington Institute of Technology
1800937	Aligning Students into Accelerated Pathways in Engineering, Technology, and Building Science	09/01/2018	Seattle Community College District Office
1800968	Practicing Radical Innovation in Manufacturing Education	09/01/2018	Green River Community College
1800981	Northeast Washington Geospatial Technician Education Project	09/01/2018	Spokane Community College
1902320	Creating a Collaborative and Student Internships to Enhance Education and Career Pathways in Cybersecurity	10/01/2019	Spokane Falls Community College
1902504	Building a 1+3-Year High School to College Pathway to Prepare Students for High-demand Jobs in Information Technology	07/01/2019	Seattle Community College District Office
1902610	Agriculture Mechanic Technicians: Meeting the Demands of Rural Washington's Agricultural Industry	07/15/2019	Big Bend Community College

Appendix B

Expert Panel Codes, Advisory Committee (January, 2020)

We report here findings from the expert panels in a manner similar to Martín et al. (2014), reviewing themes and codes that arose from this strand of data collection.

Themes	Codes
Needed Institutional and System Support for Data-Informed Program Improvement	● Financial support ● Professional development ● Goal-setting ● Consistent, usable data ● IR staffing ● Incentives
Measuring Equity	● Ambiguity of measures ● Uncertainty ● Demographics ● Gaps ● Translate analysis to action ● Variation within/across colleges
Data-Informed Decision Making Challenges and Opportunities	Challenges ● Incentives are needed ● Access to data ● Resistance ● Mistrust (of intentions when using data) ● Program improvement vs. accountability/ accreditation/external pressure/program viability Opportunities ● Qualitative data ● Industry/employer connections ● Equity emphasis ● System re-design and SBCTC changes
What data do technical faculty need?	● Enrollment, completion, retention ● Employment/wages ● Course outcomes ● Employer expectations/employer feedback ● Industry changes ● Prior education ● Disaggregation ● Barriers to learning

Appendix C

Expert Panel Codes, Research and Planning Commission (March, 2020)

We report here findings from the expert panels in a manner similar to Martín et al. (2014), reviewing themes and codes that arose from this strand of data collection.

Themes	Codes
Equity measures and interventions vary widely	● Hesitance ● Small n ● Disagreement ● Uncertain definitions ● Opportunities ● Needed
Partnerships between IR and faculty can be challenging and incentives are limited	● Mistrust (of IR by faculty) ● Accountability ● Program viability ● Program review ● Communication/understanding gaps ● Limited capacity (of both IR and faculty) ● Organizational barriers to direct communication ● Few incentives
IR professionals desire to partner with faculty is high	● Opportunities (metric development, goal setting) ● IR as a service organization ● Quantitative research ● Qualitative and survey research
Faculty data needs and reasons for requesting data vary widely	● Teaching and learning interventions ● Student experience ● Labor market outcomes ● Accountability/accreditation