PROFESSIONAL DEVELOPMENT IN CTE DATA DRIVEN METHODS:

DEVELOPMENT OF A RESEARCH-BASED INTERVENTION

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Introduction

Data-driven decision making is a prominent topic in educational literature; however, use of this practice is often limited to policy makers and administrators, with little attention paid to the needs and processes of the classroom teachers (Little, 2012; Boudett, Murnane, City & Moody, 2005), who are the key to school improvement. As Sanchez, Kline and Laird (2009) state, "A district's capacity to provide the structures and processes for the collection, analysis and use of student data is pivotal to the success of students in the classroom . . ." (p. 15). Data analysis provides the path for determining and focusing on needs for improvement efforts (Schmoker, 2001). With appropriate data training, both teachers and administrators should be able to determine student skills and instructor effectiveness, and then combine those results to improve overall instruction (Wayman, 2005; Wayman & Cho, 2008).

There is a dearth of research on CTE teachers' implementation of data-driven decision making with CTE test data. The most applicable publication is a NOCTI white paper, *Using Standardized Test Data to Improve Instruction in Career-Technical Education*, which discussed the value of standards-based testing and how students, teachers, and schools can realize benefits from using data (Kister, 2002). Thus, the goal of this research project was to define the need for CTE teacher professional development in the area of assessment data and follow this work by developing a specific, research-based intervention to be used as part of an annual process of instructional planning.

Rationale

The reliance on standardized testing for reporting school, teacher, and student performance frequently overshadows the true purpose of testing: program and student improvement. A survey conducted by the authors in the initial phase of this project defined the status of CTE educators; those who understand test data interpretation and uses are better equipped to encourage teachers who have used data for classroom improvement to maintain this practice and help those who have not used data to see its value for classroom improvement (Foster, Pritz & Kelley, 2009). In that survey, educators with favorable opinions of testing noted that the main reason for the change was a better understanding of tests and the use of assessment data. Cromey (2000) found that when teachers understood the process and function of tests, they were more likely to see them as a tool rather than a threat, and to recognize and raise informed objections to misuse of test information.

Models of Professional Development

This era of accountability encourages today's schools to have a more concentrated focus on professional development and school improvement (Jaquith, Mindich, Chung Wei and Darling-Hammond, 2010). Standards of the National Staff Development Council (2010), a main professional development advocate, mention data use stating that professional development should improve student learning by using disaggregated student data, thus providing the professional learning priorities, progress monitoring, and ability to sustain continuous improvement efforts within schools. However, delivery models of professional development are varied and often subject to resource limitations (Killion & Hirsh, 2012). A literature review by Smith, Hofer, Gillespie, Solomon, and Rowe (2003) indicated that there are no strong conclusions about which type of professional development delivery method is most effective; professional development delivery modes have shifted from the traditional workshops toward models such as study circles, coaching models, collaborative problem-solving teams, and

practitioner reflection and inquiry. Although the specific delivery method differs somewhat, research has indicated that effective professional development for K-12 teachers should (1) be longer than the traditional workshop, (2) contain topics that can be directly applied to the work context, (3) model and promote analysis and reflection, (4) vary the type of activities, (5) encourage teachers to form a professional learning community within their school, and (6) be part on an ongoing strand throughout the year that is connected to comprehensive, student-focused change processes (Little, 2012, Banilower, Boyd, Pasley & Weiss, 2006; Darling-Hammond, Wei, Andree, Richardson & Orphanos, 2009; Dembosky, Pane, Barney & Christina, 2005; Guskey, 2003; Killion & Hirsh, 2012; Lewis, 2000; Smith et al., 2003).

Unfortunately, Darling-Hammond et al. (2009) note that much of the present day teacher professional development fails to use newer models, remaining focused on short-term, standardized sessions that usually do not improve teacher's content knowledge or methods. Jaquith et al. (2010) found that when professional development strategy is derived from a broad group of professionals, the result is different than decisions made in a top down manner. Efforts must be made to find the most effective and lasting types of professional learning, as more evidence links effective professional learning implemented by a well-prepared facilitator to both teacher and student improvement (von Zastrow, 2010).

Killion and Hirsh (2012) summarize the most effective professional development strategies as those that support both collaborative and formal learning, and ensure authentic professional learning on tasks of immediate importance. The most important factors for authentic professional development specifically geared toward the use of assessment data are a strong work connection and links to a comprehensive change processes. As Sitler (2009) notes, when teachers are taught to research their students by tracking individual learning, the result is a heightened awareness of most difficult curricular areas, which informs teaching. However, the available research also indicates that most educators lack skills to properly use their own data (Cromey, 2000; Dembosky et al., 2005, Schmoker, 2003). This lack of skill and training tends to be especially acute among CTE teachers, many of whom enter the teaching field via alternative routes and did not experience traditional teacher preparation that contains some basic data training (Bottoms & McNally, 2005). This fact was corroborated by the findings of the 2009 needs survey conducted by the authors in the initial phase of this project (Foster et al., 2009). In that survey, over 46% of the administrators responding indicated that CTE teachers had not received general professional development in the use of technical assessment data. When asked about professional development related to specific uses of test data (e.g., interpreting and applying data), between 41% and 54% of CTE teachers indicated that such professional development was not available, but they wish it were. The majority of the survey respondents indicated that using standardized test data was valuable, and of those who were not using such data to inform instructional improvements, the majority indicated that they should be. Of the teachers who were using data to make instructional decisions, over 30% were self taught. The information gathered from the 2009 survey became the basis for developing an intervention workshop that included post workshop mentoring to teach CTE teachers and administrators a process by which they could to use assessment results to improve instructional and student outcomes as part of an annual cycle.

Professional Development Model for the Present Study

Current research indicates that effective professional development for teachers must be of a relatively long duration, strongly contextualized, collaborative, activity-based, include an emphasis on analysis and reflection, and be connected to comprehensive change processes focused on improving student learning (e.g., Darling-Hammond et al., 2009; Smith et al., 2003; Wayman, Midgley & Stringfield, 2005). Smith et al. (2003) indicate that effective professional development alone is unlikely to result in effective long-term change unless other factors are taken into account, such as time, resource availability, organizational support, and the feasibility of implementation and continuation of learning within the school system.

Ultimately, teacher change must lead to student change. Although it is difficult to clearly demonstrate the impact of teacher changes on student change due to the number of variables involved (e.g., teacher, student, and system variables; the non-linear and often indirect nature of change), a number of studies have shown the impact of teacher effectiveness on student outcomes (e.g., Darling-Hammond, 2000; Sanders & Rivers, 1996). Wenglinsky (2000) was able to demonstrate a connection between teacher professional development and student achievement in a study involving math and science teaching. The NOCTI-NRCCTE study did not attempt to gather data on student outcomes in the one-year timeframe; however, improved student outcomes resulting from the improved practice of educators should be explored.

The goal of the intervention was to develop and pilot professional development for CTE teachers on the use of technical assessment data for data-driven decision making that is both based on sound principles of learning and delivered in a manner that is sustainable within a school system. For the cycle to be complete, it is imperative that teachers be able to diagnose problems by looking at evidence (data) and then receive the training to be able to plan instructional modifications around that evidence (Butler & McMunn, 2006). Data-driven decision making must be viewed as a continuous cycle and not a one-time effort.

Structure of the Intervention

As indicated above, the literature regarding professional development for CTE educators in the use of data to inform program and instructional decisions is virtually nonexistent; thus the authors of this research study began filling this gap by designing a research-based intervention to increase knowledge and skills of educators in the use and interpretation of assessment data as part of an annual cycle and to prioritize instructional improvements. The materials development was based on findings from the initial survey (Foster et al., 2009), as well as the research literature and other NRCCTE projects. The professional development was delivered by trained facilitators who mentored the educators as they applied the initial training at their school.

Research Questions

Three research questions guided the intervention's development about CTE educators' use of assessment results. These are:

1. Have educators increased their knowledge about technical assessment data?
2. Are educators able to apply their knowledge of technical assessment data to improve instruction as a result of the professional development?
3. Will educators be more motivated to apply their learning about technical assessment data to instructional improvements as a result of the professional development intervention?

Method

Sample Selection

Although the term *assessment data* is often broadly defined and originates from a variety of sources, the primary focus of this study was on standardized summative data from technical assessments, since they are required by Perkins IV legislation. Although many educators can benefit from professional development on the use of assessment data, the target audience (population) was teachers and administrators of secondary CTE programs, as they were the subjects of the prior year's survey research that defined the needs. By selecting educators from the same sample population, participants in the intervention were a subset of the original research population and, therefore, had a defined need for the content of the intervention.

A total of nine secondary CTE school sites in five states were selected as pilot sites for the professional development on the use of assessment data. Five of these were assigned to Round 1 of the pilot and four comprised Round 2, which was planned to start a month later to allow for modifications from Round 1. Selection criteria were based in part on survey findings, subsequent phone interview with the administrator, and site visit. The first priority was to select sites from the survey participants who had (a) multiple CTE programs from among the four occupational clusters sampled in the survey (health, business, construction and manufacturing), (b) an interest in improving their use of data for decision making, and (c) willingness to participate in the training, coaching, and data collection phases of this project. For each of the survey sample's five states, schools meeting these criteria were culled from the survey responses and prioritized based on the criteria.

Sites that responded positively to the invitation to participate were visited by a team member (a) to gain a more thorough understanding of their intentions and potential to be responsive to the initiative and (b) to offer a more complete description of the project and details related to participation directly to the sites' educator teams. Project staff members were assigned to visit specific schools and these same staff members continued to monitor the progress of the pilot test. The administrator and a total of two to five teachers from each school participated in the program. The total sample size from all sites was 48 individual educators (31 teachers and 17 administrators); only 50% of the pilot participants entered teaching through a traditional teacher preparation program. Data was collected from these subjects during the pilot intervention using a series of surveys and tests.

Table 1.
Pilot teacher representation from four occupational clusters.

Cluster	Teachers
Business Cluster	5
Construction Cluster	9
Health Cluster	8
Manufacturing Cluster	9

Designing Research-Based Professional Development

The goal of the present study was to provide professional development to teach educators to use data relevant to their school situation. Materials and interactive activities for this intervention were developed so the educators could analyze datasets from their programs and develop an applicable individualized plan. This training was designed to incorporate standard nationally generalizable principles of data analysis and interpretation. Therefore, the teachers'

students took a standardized technical assessment at two points—once as a pretest to provide material for use in the professional development intervention and again as a posttest for an additional opportunity to use skills on real student data. These tests were a source of data for educators to use as the basis for their initial instructional improvement plans. Each educator developed a plan as a part of the training and implemented it with facilitator coaching. Data from these tests were not used to draw conclusions about students, as this was beyond the project's scope; teachers, not the students, were the research subjects.

The use of standardized data from their own students not only provided a link to their classrooms to make the training more relevant, but also provided teachers with the information needed to customize and contextualize their initial action plans to the needs of their students, programs, and schools (e.g., remediating particular students, reteaching targeted subject matter, planning more exercises and hands-on activities, acquiring more teaching resources).

Schools currently using technical assessments could choose to use those existing data for the professional development process. For those who do not use technical skills assessments, NOCTI donated from its standard test battery the assessment and subsequent data report that most closely matched the school's program. NOCTI tests, both at the professional level and at the student level, have been a standard of CTE programs for decades; these assessments are current, valid, and reliable reflections of the needs of industry in over 70 different occupational areas. Any lack of alignment between test and curriculum content was taken into account when the data were interpreted (e.g., building trades students taking carpentry tests), as were other relevant factors (e.g., depth of content as determined by hours of participation).

The Materials Development Process

The stimulus materials for the intervention included a Facilitators' Guide containing all educator worksheets and handouts and a PowerPoint for the initial training workshop, consisting of four major components: (1) content related specifically to the study and how it is being conducted (e.g., what types of interactions they are expected to have with the educators and how often; what kind of data will be gathered and when); (2) content that the educators will receive; (3) content directed specifically toward the delivery of the training (e.g., interactive activities, strategies for differentiation to allow individual educators to address the specific needs of their students and programs); and (4) content related to establishing and maintaining a facilitating/coaching/guiding relationship with the participants in the post-workshop interval.

Participants learned not only how to interpret different levels and types of assessment results, but also strategies for using results to determining instructional strengths and weaknesses, adjusting lessons, and tracking the impact of the revisions. The content of the intervention workshop was comprised of background material on the test development process, common formats of standardized tests, and the characteristics of formative, summative, and locally developed assessments. Content also included interpreting the information presented on standardized test reports at the group and individual level, and the meaning of test terminology. Information was incorporated on external factors that can reflect in individual test scores, as well as interpreting multiyear trends. Misuses of test data also were reviewed.

All materials were reviewed internally and externally, including the facilitators. Once the pilot program was operational, a systematic process was established to make iterative changes and improvements based on information gathered from experts, participants, and facilitators.

Facilitators

To provide the training at the nine pilot sites, a total of five facilitators were selected, one located in each of the participating states. The facilitators were selected based on their skill and experience with training and informal coaching. Project staff conducted facilitator training on the material content, the delivery methods, and subsequent follow-up strategies.

Once the facilitators were trained in the process, they conducted the program to the selected educators at the pilot schools. The initial training was delivered locally at each individual school. Pretest measures were gathered in advance. After the workshop, facilitators followed the progress at each of their schools through a twice-monthly meeting with participants about applications of the training to their jobs and classrooms and how they were implementing and progressing with their initial plans. Facilitators provided advice and guidance concerning any issues. Between these meetings, participants were encouraged to discuss implementation among themselves as a site-based team.

Electronic Sharing Site

As mentioned earlier, an important aspect of professional learning is the development of a community of practice among the educators involved at the pilot sites. To encourage this, the project needed an electronic means of communication that was more flexible than group emails and enabled staff and educators to post documents, such as action plans and descriptions of implementation strategies, in a secure online environment. After examining various social networking sites, NOCTI developed a website exclusively for the project. The "sharing center" website has a section for participating educators with a separate section for facilitators and project staff, all of which are password protected. This site offers the capacity to have threaded conversations, as well as to make resources available to everyone participating in the project. For example, as facilitators asked for additional materials, project staff uploaded lists of online resources for statistical terms and examples of calculations on a fictitious set of scores. As the project progressed, the participants' action plans for instructional improvement were posted, and the capability for threaded discussion was added to enable in-depth dialogue.

Data Collection

To measure and evaluate the results of the professional development strategy, several instruments were used during spring semester 2010. Data was collected on participants prior to the intervention, immediately after the intervention, midway in the mentoring period, and at the conclusion of the project. Closely aligned to the content standards, pre- and posttests were designed by the project staff to measure participants' learning and retention of data concepts and applications. Items on the pre- and posttests were objective rather than self reported. The posttest and post-posttest included a qualitative component to monitor the action plans participants developed during the training and were implementing in their school environment.

Results

Pre-workshop Questionnaire

The pre-workshop questionnaire was administered by the facilitators, thus having a 100% response rate. Most questionnaire results are reported on a six-point scale. Most of the participants (89.1%) indicated that their schools used some type of end-of-program technical skills assessment, even if assessment was teacher designed. Most participants (89%) indicated

that their schools used end-of-program assessments for multiple purposes. Table 2 summarizes the top ranked uses of end-of-program technical assessment data.

Table 2.
Top-rated uses of end-of-program technical assessment data in pilot schools.

Data use	Percentage of respondents
To maintain a continuous improvement process	75.6%
To make improvements to programs in areas in which scores are weak	65.9%
To help document school and program progress	53.7%
To help students receive certification for the job market	53.7%

While most participants indicated that their schools used end-of-program technical assessment data, 68.1% also indicated that they themselves could use some improvement in using data skillfully; teachers reported a greater need than administrators. Table 3 shows the breakdown of self-reported skill level for the 48 subjects.

Table 3
Subjects' perceived skill in using technical assessment data for classroom improvement

	Overall	Administrators n=17	Teachers n=31
Not at all skilled	4.3%	0.0%	6.5%
I know a little but could use a lot of improvement	25.5%	12.5%	32.3%
OK, but I could use some improvement	42.6%	43.8%	41.9%
Adequate for my needs	14.9%	37.5%	3.2%
Very skilled	12.8%	6.3%	16.1%

The pretest score mean from all sites was 63.7%. The 17 administrators, who perceived themselves as more skilled with data, actually scored higher than teachers on the knowledge pretest with a mean of 68.6% compared to 60.9% for teachers.

Post-workshop measures

Participants completed an evaluation and a posttest of the knowledge assessment at three intervals after the workshop was complete: post workshop, an interim evaluation during the mentoring process, and a final survey at the project conclusion. These instruments were administered in person by the facilitators with the exception of the interim survey, which was sent by mail.

Quantitative measures

To summarize the quantitative measures on the post workshop survey, the mean quality rating for the workshop content and materials was 5.20 and facilitator effectiveness mean was 5.34. Whether the materials used in the workshop were relevant to improving teaching, learning, and student achievement was rated positively with a mean of 5.17 and whether materials from the workshop will be useful at the participant's school had a mean of 5.26. A comparison of the key items in the three surveys appears below in Table 4.

Table 4.

Mean evaluation survey ratings of the intervention and process

As a result of this professional development (and ongoing mentoring)	Post (n=48)	Interim (n=42)	Final (n=47)
My knowledge increased	4.98	4.29	4.61
My abilities increased	4.74	4.02	4.48
My data skills increased	4.98	4.34	4.72

Table 4, continued

I feel that this professional development will be	Post (n=48)	Interim (n=42)	Final (n=47)
Applied in my classroom	5.20	4.60	4.88
Easy to adapt for my purposes	5.11	4.50	4.68
Helpful in planning for improved instruction	5.32	4.58	4.93
This professional development will impact (has impacted)	**Post (n=48)**	**Interim (n=42)**	**Final (n=47)**
How I teach	5.05	4.23	4.54
How I plan instruction	5.38	4.41	4.70
The way my organization uses data	5.24	4.21	4.50
Student learning outcomes	5.36	4.13	4.53
The way I monitor student progress	5.17	4.53	4.60

The ratings were positive overall; however, the lower ratings of the first group of items seems to indicate that participants were not as confident about their gain in knowledge, abilities

and skills as they were about their ability to apply the data cycle process to their instructional settings. Also, the interim survey ratings were all lower than both the post- workshop survey and the final survey, possibly due to the smaller number of respondents, or to the realization of the challenges in applying data skills in a dynamic environment.

An overall gain of about 8% was seen on the knowledge assessment, which contained items measuring assessment terminology and interpretation of charts and tables. A gain of 20% was measured from pre- to posttest for the terminology items, while the interpretation item scores were almost unchanged from pretest to posttest.

Quantitative results from post-post test

The last instrument was a re-administration of the knowledge test. The overall mean score of the post-posttest (67.6%) was lower than the posttest mean (71.9%), but still above the pretest (63.7%). When scores on the two types of knowledge items (assessment terminology and data interpretation) were separated, the post-posttest drop was due to a 12% loss in scores in terminology item scores (Figure 1), while there remained little change in scores of the interpretation items (Figure 2).

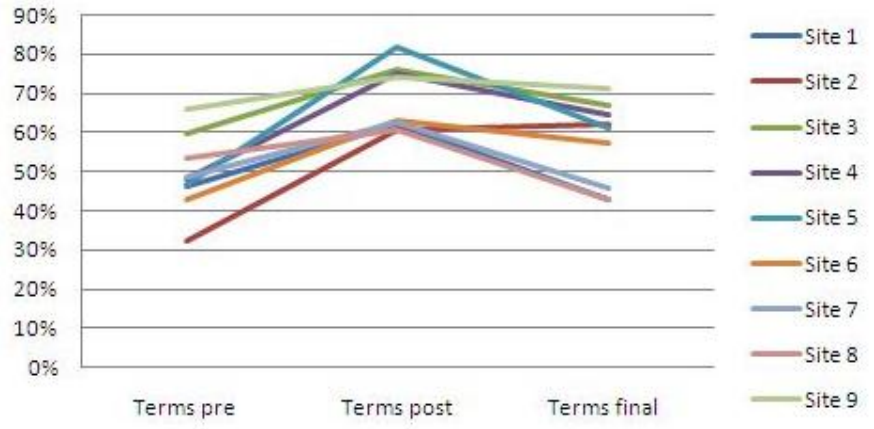

Figure 1. Score Differences for Terminology Items

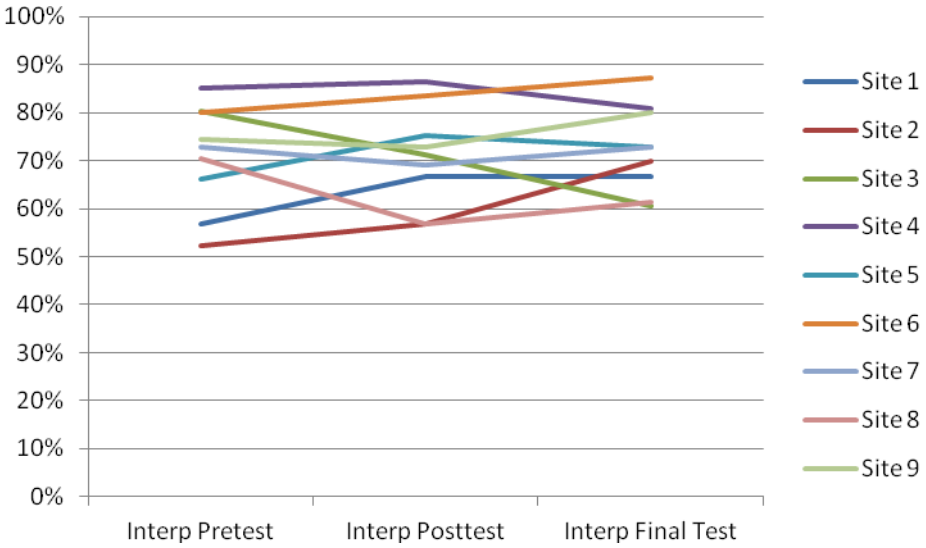

Figure 2. Score Differences for Interpretation Items

The gain followed by a drop in scores related to knowledge of terminology may indicate that participants came in with a lower knowledge level, thus were able to gain more knowledge in the workplace. The subsequent drop may indicate a lack of retention that could be alleviated with more review and exercises related to terms built into the mentoring process. While the above results may indicate that participants entered with suitable knowledge in data interpretation or are not gaining additional knowledge through the program, there may still be gains in ability to apply the knowledge to their particular situations and make targeted plans that address findings. This was not a part of the knowledge assessment. However it should be noted that, when site averages were examined separately, the interpretation of the situation was less clear cut. As can be seen in figures 1 and 2, the same trend of pre-post gain, post-final loss for items related to terms was pretty consistent across sites. However, the situation with the items related to interpretation show more variance across sites. It is likely that other factors (e.g., entry-level knowledge, facilitator workshop delivery quality, facilitator mentoring quality, site-specific factors) are having an impact.

Qualitative data on post-workshop survey

Open-ended items collected qualitative data on the intervention. When asked what changes they anticipated as a result of the workshop on the post-workshop survey, a most frequent comment was that close review of data would be central to their decision making. As one administrator wrote, "We will be implementing some of the training materials in our professional learning communities in regards to data." Several administrators revealed plans to use a team-based approach within their schools for data analysis, which was reflected in this comment, "As test coordinator, I plan to get more involved with analyzing the score report data by working more closely with the instructors." Several teachers also stated that they would be more aware of curricular areas where students would benefit from different teaching strategies; one teacher wrote, "Use (sic) test questions analysis, I will reteach content areas, were student's scores lowest," while another commented, "My teaching and planning will now take in account past and present assessment to help my students progress instead of just what is covered in what time frame."

Educators mentioned several strengths of the workshop; sample comments state "It gives me more understanding of the testing process and the use of data from the results" and "We came up with short and long term goals and reviewed pre test results and meanings." The educators also mentioned weaknesses found in the intervention, most commonly needing more time for the workshop, possibly offering it in more than one day; as one participant wrote, and "Not enough time to practice the new ideas." The educators also would like to see the workshop earlier in the year, as the data analysis would have more impact and that more discussion could occur about actual strategies for addressing areas in the data deemed problematic. The administrators requested specific assignments so they could be better incorporated into the team.

One final question in the post-workshop survey asked participants whether or not they would recommend the workshop to others. Of the 15 administrators responding, 14 indicated that they would. The reason given by the one negative person was the lack of activities geared toward administrators. Of the 26 teachers responding, 25 indicated that they would, with the negative. Person stating, "still remains to be seen how this will impact the shops." Evidence that the intervention achieved its intended outcomes is embedded in verbatim feedback received from the facilitators after their workshops:

- "It went well and was well received by the teachers. I found that there was an overall understanding of the importance of using data but a lot of uncertainty about how to use the data. The teachers are anxious to really analyze their own data. We need to make sure we encourage them to use as much data as they have at first to really get to root causes of the achievement gaps."
- "The workshop was a great success and the feedback from the participants was extremely positive."

Additional evidence was posted by the educators themselves on the project's sharing website. One example is the following: "I am excited my program is a part of this project. I think the information I have already acquired from the pretest scores has given me valuable insight as to curriculum changes I need to make. This project will help me to see the changes that need to be made to better prepare my students for the world of work or higher education. Thank you for the opportunity to grow professionally and improve my program."

Qualitative data on interim survey

The mentoring portion of the intervention occurring after the workshop included regular contact with the facilitator. Midway through the mentoring period, participants received a mailed questionnaire about the mentoring process and additional reflections on the workshop. They also were asked about progress toward their goals and related activities. Six participants did not respond to this survey; the lower response likely was due to administration by mail.

Participants were positive about the mentoring/coaching and indicated that they were addressing their action plans and using the techniques from the workshop in their schools; however, there was a desire for more structured mentoring and communication across the sites. Once again, a desire surfaced to have this type of professional development begin earlier in the year (e.g., fall semester) to allow more mentoring and more time to devote to action plans. This main difficulty was well summarized by one teacher who stated, "We have been very busy with other tests as well as our own tests and projects"; related comments from two administrators noted, "Additional time needed as a team to discuss and share" and "It was hard to implement the strategies and have success in such a short period of time."

In terms of their successes, several indicated seeing positive improvements based on the instructional changes they had made. One teacher mentioned this process, "I developed my own action plan and am using it. I took the three areas in which my students scored the lowest. I reviewed the curriculum, revised it and then re-taught."

Participants offered several ideas for improvements to the initial workshop, such as lengthening the workshop, increasing professional development time to work on action plans and goals, having more student data available for the planning process, and ensuring facilitators were sufficiently knowledgeable and experienced about the topic. When asked about improvements to the facilitation process, most participants suggested adding more structure to the mentoring.

Overall participants found value in learning to use technical assessment data for making instructional improvements; as one teacher commented, "I would say the ability to view students through the many lenses of different data venues has been interesting and enlightening." Many also indicated that they would continue to use assessment data for making such improvements after the project concluded and that participating in the project increased their motivation for ongoing data use.

Qualitative data on final survey

The final questionnaire was administered in person by the facilitator at the team's final session. Due to an absence, the response rate for the final survey was only 98%. Most felt that their action plans were a success, but that results needed more time, a main obstacle to the process. However, most noted that they were better able to diagnose and allocate time to student weaknesses. In the open-ended comments, a teacher noted, "This has really opened my eyes to the use of data in the classroom," and another teacher wrote, "Learned a lot about the data and how to implement changes in the classroom to reflect a positive change."

An administrator indicated plans to use the workshop content in the future by stating, "Has been a very worthwhile experience for selected participants (teachers). Hope to use information gathered from pilot to do more in professional development in gathering and utilizing data." Another administrator suggested, "Have a follow-up process to do further training and professional development in utilizing testing and data collection to help drive program improvement."

Discussion

The professional development content and process were monitored closely; refinements and improvements made throughout the design and delivery phases of the study, especially between Round 1 and Round 2. The qualitative and quantitative data collected during the project were examined using the measure noted to answer the following were achieved as a result of the intervention:

1. Did educators' knowledge about assessment data increase (knowledge assessment)?
2. Can educators apply their knowledge of technical assessment data to improve instruction (implementation of the action plan, self-report questionnaire and facilitator feedback)?
3. Will educators be more motivated to apply their learning about technical assessment data to instructional improvements (self-report questionnaire)?

It was recognized that, if this intervention was to operate as intended, it needed to be effectively implemented on several levels:

- First, the initial training had to be developed and delivered in a manner that improved knowledge of data use, provided them with the tools to transfer that knowledge to the school environment (e.g., the development of an initial action plan), and enhanced their motivation to apply the knowledge to make instructional improvements.
- Second, participants needed to be willing and able to actively apply their knowledge, skills, and plans to their school environment in ways that were (a) relevant to the needs of their particular schools, programs, and students, (b) feasible given their particular circumstances, and (c) likely to result in instructional improvements that would lead to student gains.
- Third, the professional development had to be an ongoing process that began with the initial training but continued in the school setting via facilitator coaching and participant collaboration. The professional development also needed to actively address barriers to implementation as they arose.
- Fourth, the intervention had to show measureable gains in participant understanding and use of data in a school setting, and instructional improvements based on the use of data.
- Last, the participants needed to show motivation and intent to apply their skills in the future to sustain the improvement cycle.

With each of these conditions met, the intervention was considered successful and with hope will result in lasting, integrated changes where the use of standardized assessment data

informs instructional improvements and increases in student achievement. The intervention has been titled Career and Technical Educators Using a Data Driven Improvement Model or CTEDDI.

Recommendations

The values and comments received from the pilot participants were positive overall and encouraging, indicating occurrence of professional learning and the ability to apply that learning in the school context. Implementation of the data–based action plans was feasible, but not without challenges. Based on the feedback received from participants and facilitators throughout this project, several changes and improvements are planned for the process and materials. In addition, in the next year, more review and revision will take place using the pilot site participants from the current study, as well as teachers from other programs in the pilot sites, and educators from other schools and states, where possible. The facilitators from the current study will also play an ongoing role in continuing to refine the materials and process.

This intervention addressed those needs by providing educators with (1) the knowledge and skills needed to understand and use assessment data for instructional improvements in a manner that meets standards for effective professional development, (2) the tools and resources to apply those skills in their school settings, and (3) the coaching and motivation to work collaboratively to continue to use their skills in a focused and integrated manner to plan for improvement. Indications at this point are that they will continue to use standardized assessment data to inform instructional improvements and, it is anticipated, enhance student achievement in the long term. This professional development provided CTE educators with the skills and motivation to begin and continue to use standardized assessment data as a tool to make instructional improvements.

A main benefit of the CTEDDI process is the ability to individualize the action plans. As educators continue to integrate the use of data into determining, making, and evaluating the effectiveness of instructional improvements, these improvements will be more effectively targeted toward the specific needs of their own students, programs, and schools, resulting in higher quality improvements and a more focused use of resources. As instructional improvements become more targeted and effective at this "grass roots" level, student achievement will be likely to improve, resulting in better prepared students entering higher education and the workforce, and subsequent long-term gains in workforce quality, productivity and global competitiveness, goals not only of CTE, but of our nation.

The findings resulting from this project will continue to contribute to improvement of practice in career and technical education. If technical assessments are to be taken by students for the purpose of measuring achievement, the resulting data should be used, not only for accountability needs, but also to assist educators in improving programs and individual instruction for higher achievement. This research-based professional development will be offered in future years. It is anticipated that states will request such offerings, and that a train-the-trainer model can be established to prepare facilitators to disseminate knowledge.

Conclusions

It is clear that that use of data-driven decision making in education is here to stay. No Child Left Behind (PL 107-110, NCLB) is based on accessing and utilizing student achievement data. NCLB and the Carl D. Perkins Career and Technical Education Improvement Act of 2006 (P.L. 109-270, Perkins IV) both rely heavily on professional development to achieve their goals.

Perkins IV legislation requires that standards-based technical assessments be administered and that each state's implementation plan describe how professional development will, among other charges, assist in accessing and utilizing data including occupational information, student achievement data, and data from assessments. Each year the U.S. Government Office of Vocational and Adult Education (OVAE) negotiates targets with each state to enable annual comparisons.

Current NCLB legislation requires that schools report data by disaggregated group, which enables generalizations about subgroups of students and programs. Unfortunately, these data are usually based on one assessment and are not granular enough to enable specific program improvement. Perkins legislation requires data from a percentage of program completers each year, enabling a closer view of student achievement and program improvement, but more depth must guide the improvements needed to build competencies at a higher level.

The NOCTI-NRCCTE project provided a more granular view of the data, utilizing both pre- and posttests of individuals and groups. The resulting data provided the basis for sustained program improvement through professional development, which is now a technical assistance offering. As envisioned, this project (1) established patterns for professional development using CTE student technical competence data and (2) built a community of CTE educators and administrators at and among the pilot sites by providing support and additional opportunities for using data for decision making.

The use of student assessment data to inform curriculum and instruction is at the heart of both Perkins and NCLB, as well as most credentialing groups. This interpretive practice should lead to better student engagement and, ultimately, higher student achievement. It also is critical to use such data not only to inform a one-time improvement planning event, but to be part of a continuous cycle of improvement where student outcomes are reviewed annually by individual teachers as part of an ongoing process (Dunway, Kim & Szad, 2012). This individualized teacher-level data plan should be done in addition to any improvement plans done at the building level. Such outcomes cannot occur unless educators receive effective professional development to acquire skills in using and interpreting data from standardized technical assessments as part of an annual cycle of planning.

If educators do not have the skills to use assessment data, the educational goals of Perkins and NCLB legislation cannot be realized. In addition, much of the professional development educators receive, including the small amount they may receive on the use of data, fails to align with key factors for success as defined in the research, including being strongly contextualized for individuals, being continuous and ongoing, being collaborative, and being connected to a comprehensive change processes (e.g., Smith et al., 2003; Dunway, Kim & Szad, 2012).

With hope, this research-based intervention, CTEDDI, will assist the CTE educators who lack the basic data interpretation skills to fully use results of standardized summative student assessment (Boudett et al., 2005) and produce the documentation that shows how data is being used to improve instruction, which often is needed for accreditation. However, more research and development are needed to ensure that the process is sustained long term. Dunway, Kim and Szad (2012) found that teachers' positive perception of a process does not guarantee its usage.

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