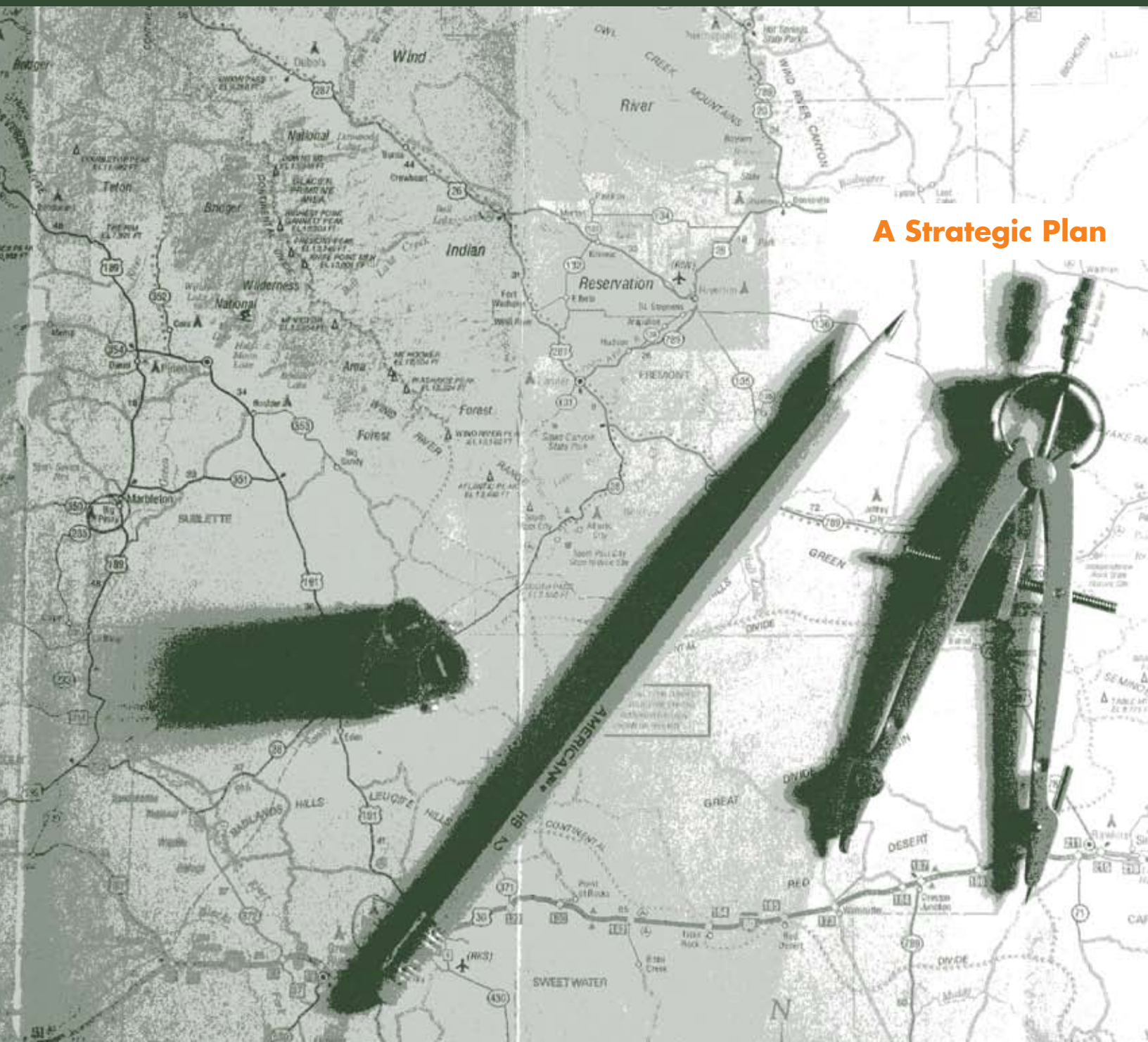
New Directions for High School Career and Technical Education in Wyoming



A Strategic Plan

New Directions for High School Career and Technical Education in Wyoming

A STRATEGIC PLAN

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INTRODUCTION

New Directions for Career and Technical Education in Wyoming's High Schools

What role should career and technical education play in Wyoming's system of education? In an era when public schools focus almost exclusively on raising academic achievement and state policies aim to prepare all students for postsecondary education, the question may seem oddly out of place. A growing number of Wyoming school administrators, for example, report that the requirements of the federal *No Child Left Behind* (NCLB) legislation threaten career and technical education

(CTE) in Wyoming's high schools. Boosting students' academic achievement to avoid NCLB's fiscal and administrative sanctions, they warn, reduces many students' options to take elective courses and may squeeze CTE from the high school curriculum.

Wyoming's new Hathaway Scholarship Program dramatically expands opportunities for the state's young people to enroll in postsecondary education. But in advancing this important goal, the Program consigns career-oriented programs to the lowest of the four postsecondary pursuits. The message, probably unintended, is that career-focused education is not compatible with more academically demanding postsecondary baccalaureate degree programs. Unwittingly, it perpetuates the longstanding divisions between academic and vocational curriculum and relegates CTE to the second-class status that has plagued vocational education for more than a century.

Ironically, realizing higher levels of academic achievement and postsecondary attainment, rather than being at odds with CTE, may *depend* on promoting new opportunities for high school students to engage in challenging technical education, creating options that connect academic and CTE coursework in new comprehensive programs of study. Seldom is there only one right way to realize broad policy goals, and raising academic achievement and rates of successful postsecondary transition may best be accomplished by offering *multiple pathways* to the full range of postsecondary options and career opportunities.

Many students otherwise capable of high levels of academic mastery find conventional academic classes boring and disconnected from their interests in the world outside school. Consequently, the best route to lasting success in further education, careers, and civic life, for students who choose them, may be programs that integrate academic and technical curriculum to help students understand *why* they need to achieve at higher levels and *how* they can use both academic and technical knowledge creatively and effectively.

Building a Strategic Plan for Wyoming

This report, therefore, offers a plan for improving CTE in Wyoming, but it is about more than just technical education. Realizing the potential of CTE to contribute to students' mastery of both academic and technical knowledge depends not only on strengthening the CTE curriculum, but also on embedding CTE in a larger program combining core academics with applied learning. It is a plan focused on preparing students for postsecondary education *and* career, both options and not just one or the other.

This plan calls for breaking down the rigid separation between academic and technical instruction in high school to capitalize on students' curiosity about the workings of the modern world. And it builds on this interest to deepen their understanding of core concepts in mathematics, science, English, and social studies.

Expanding upon the traditional goal of vocational education—to prepare students for employment in specific occupations—the plan calls for providing workforce preparation in broader programs, organized around major career clusters that, in their entirety, comprise the major components of the modern economy. Offering practical preparation for employment in a wide range of careers, these programs by necessity stress mastery of core academic knowledge. But they also emphasize cross-disciplinary problem solving and are intended to expand students' understanding of technology and emerging fields, an industry's role in the larger political economy, critical features of

public policy and governmental relations, essential environmental and safety issues, and ethical and social concerns.

Let's be concrete. Wyoming has been enjoying a boom in its extractions industries, and oil, gas, and coal production will likely figure prominently in the state economy for some time to come. The industry's needs for innovation, capital, and labor are at an all-time high, with companies mounting major initiatives to recruit workers from out of state. How should the state's systems of education and training respond?

One strategy is to ramp up tightly focused programs targeting high-demand jobs like welders, pipefitters, drillers, derrick operators, pumpers, seismic technicians, and so on. For adults who have already left high school, who have already completed additional formal education or training, or who are unemployed or under-employed in lower-paying jobs, this strategy is appropriate. And, of course, the state's community colleges and other providers of employment training are already expanding programs to meet these specific labor market demands.

Should Wyoming's high schools also seek to prepare students for these immediate job opportunities? It depends. If high schools encourage some students to enroll in narrow, occupationally specific CTE programs, at the expense of mastering a broader, more lasting foundation of academic and technical knowledge, the answer is probably no. Both students and policymakers can easily be seduced by the high wages produced by labor shortages and other short-term economic conditions, but narrowly focused programs are rarely in the best long-term interests of young people.

Only recently, in places like Silicon Valley and other regions of the country enjoying the high-tech boom, high schools rushed to create programs preparing website designers, network administrators, C++ programmers, and server installation technicians. When the "dotcom" bust occurred only a few years later, many of these young people, who had initially commanded salaries of $60,000 or more, found themselves out of jobs and ill-equipped to move quickly and easily into another occupation. Promoting high school CTE that just turns out more workers for the oil and gas fields (or any other industry) is not likely to fare much better.

Career Education for the 21st Century

Nevertheless, technically focused education can be an essential component of the high school curriculum. Offering occupationally specific preparation as part of a broader program of challenging academic and technical study can help students enjoy the benefits of short-term labor market opportunities. Outfitting them with rigorous skills can also ensure they achieve lasting success as they go on to higher education and a career. Consider, for example, a broad, multi-year high school program focused on the extractions industry.

Beginning in grade nine and continuing through their senior year in high school, students enrolling in such a program would complete the core academics needed to enroll in community college, the University of Wyoming, or other postsecondary institutions. Along with core academics, each year students would take a yearlong CTE course in Natural Resource Systems, selecting from a cluster of courses addressing such topics as Energy and Environmental Technology; Resource Extraction and Refining; Managing Renewable and Nonrenewable Energy; or Energy Engineering.

Besides stressing basic academic standards, teachers of core academic courses in this broad program of study would help students connect their

particular academic discipline (social studies, for example) to important aspects of the energy and natural resources industry. In world history, for example, they might explore how the availability of energy resources and changes in energy technology helped shape patterns of human settlement, economic development, and socio-political conflict. A challenging course in earth science would emphasize geologic formations associated with oil and gas and introduce students to the scientific principles underlying seismic prospecting. Their geometry class would illustrate how to derive and solve problems in the fabrication of tools, machines, and containers used in producing energy—problems involving perimeter, area, circumference, volume, and surface area of various geometric figures.

Similarly, where appropriate and feasible, career and technical education coursework would integrate high-level academic skills into project-based lessons. For example, a welding program might require students to explain the chemical reactions associated with different types of welding gases, while a construction technology class might require students to use algebraic formulas to correctly lay out, cut, and install a staircase.

All students would participate in an intensive work-based learning experience in their junior and senior years. For example, students might learn oxy-fuel cutting, basic welding, and more advanced electric arc-welding processes, obtaining certification that would give them a leg up in the labor market. Others might opt for internships in petroleum engineering, stratigraphy, or photogeology. Regardless of students' particular career or occupational interests, this program by design would be appropriate for students aspiring to all forms of postsecondary education: two- and four-year degrees, graduate school, apprenticeship, the military, or formal employment training.

This comprehensive program of academic and technical study focused on the extractions industry is just one example. Throughout the state, other options might include programs organized around other major industries such as Health Science; Business Management and Administration; Arts, Audio/Video Technology, and Communication; Hospitality and Tourism; and so on. While the small size of many Wyoming high schools limits opportunities to offer students a rich and diverse curriculum, in academics as well as CTE, most high schools could offer at least two programs of study. By employing a range of regional strategies—making more effective use of Board of Cooperative Educational Services (BOCES) sites or local community colleges, for example—as well as enhanced distance learning initiatives, more options could be made available to most young people across Wyoming.

Fully integrating academics and CTE into challenging new programs of study will not be easy. There are many important policy issues and practical implementation challenges that must be addressed. This plan does not claim to have all the answers. It does seek to offer a framework for moving toward providing all of Wyoming's young people with educational opportunities to ensure their continuing success in further education, the world of work, and the life of their communities. While we recognize the importance of strong CTE programs in middle schools and postsecondary institutions, this plan focuses primarily on high school programs with an understanding that the foundation for these programs may be laid in earlier grades.

This report is organized into four major chapters. Chapter 1 examines the current state of CTE in Wyoming. Recent court-ordered changes to the delivery system have provided a solid footing on which to build challenging new options for high

school students, and this section briefly summarizes student participation in the system, existing state standards and assessments, program financing, and other features of the current system. Chapter 2 briefly summarizes what a system of integrated academics and CTE might look like in Wyoming, and lays out the guiding principles and core components of the pathways model.

Chapter 3 outlines and analyzes the essential policy considerations for strengthening CTE in high schools and embedding it in comprehensive programs of academic and technical study. It addresses such issues as the need for more fully developed programs of study, content standards and assessment, curriculum design and integration, support of innovative delivery systems, teacher preparation and professional development, articulation with postsecondary education, and implications for school finance, including adequate funding for vocational supplies, equipment, and capital outlay. Chapter 4 offers some concluding observations and suggested next steps to guide state policymakers and educators in implementing plan recommendations.

CHAPTER 1

Career and Technical Education in Wyoming Today

Career and technical education is an integral part of most Wyoming students' educational experiences. Among high school seniors in 2005–06, more than half (51 percent) had "concentrated" in CTE, completing three or more CTE courses in one program area during their high school years.[1] These data do not account for the many students who take one or two courses, or multiple courses in various program areas.

1 A Vocational Education Concentrator is defined as an unduplicated student who has taken three or more semester courses in a vocational program, or is currently enrolled in a third course.

Wyoming's data tracking system makes it difficult to cite a headcount for these students; however, if their experiences are similar to those of students nationwide, then likely nearly all of Wyoming students enroll in at least one CTE course during high school. Ninety-seven percent of students nationwide took at least one CTE course during their four years of high school[2] and, on average, students are taking more courses in CTE than any other discipline, except English[3] (U.S. Department of Education 2006b, table 132). Finally, it is worth noting that CTE is currently offered in all districts serving Wyoming high school students, as well as at 11 community college campuses, 2 University of Wyoming campuses, and numerous private institutions.[4]

Outcomes of CTE Participation

Wyoming students who concentrate in career and technical coursework (i.e., complete three or more courses in a sequence) appear to benefit from their experience. Approximately 97 percent of concentrators were eligible to graduate in 2005–06. And among concentrators graduating the preceding year, over 97 percent were either enrolled in postsecondary education, military, or advanced training, or employed at follow-up in 2005–06, with the majority reporting enrollment in some form of postsecondary education[5] (Resendez and Azin 2005; PRES Associates 2006b; PRES Associates, personal communication, 2006).

Analyses of students' academic performance on the Proficiency Assessments for Wyoming Students (PAWS), the state's standardized academic exam, indicate that 11th-grade CTE concentrators scored no differently from non-CTE students on each of the PAWS test areas in the 2005–06 school year (i.e., mathematics, reading, and writing). However, among students rated proficient across all three PAWS areas, career and technical concentrators were somewhat less likely than non-CTE students to be rated proficient. In the 2005–06 school year, roughly 39 percent of career and technical concentrators were rated proficient on all three tests, compared to 42 percent of non-CTE students (PRES Associates 2006b; PRES Associates, personal communication, 2006).

Wyoming has adopted the 16 career clusters identified by the U.S. Department of Education as the basis for organizing CTE programs, using the clusters as a platform for federal reporting purposes and for classifying student participation in CTE. The majority of students enrolled in career and technical education in Wyoming are focusing their studies in just five of the clusters. Data collected using the WyCTA state assessment indicate that almost two-thirds (62 percent) of Wyoming students chose to participate in coursework in Architecture & Construction; Agriculture, Food & Natural Resources; Business, Management & Administration; Manufacturing; and Information Technology (Table 1).

High levels of student involvement in these clusters may be due, in part, to the existence of affiliated CTE associations (e.g., National FFA Organization, Skills USA, DECA) that encourage student participation through organized activities and competitions. Other factors, including a historical focus on agriculture, construction, and manufacturing trades within Wyoming schools and the prevalence of veteran CTE instructors with endorsements in these areas, may also influence offerings and consequently student participation rates.

2 For those graduating in 2005. Data from U.S. Department of Education, National Center for Education Statistics, High School Transcript Study (HSTS), 2005.

3 For those graduating in 2000.

4 Wyoming Department of Education, Statewide Payment Model FY2006-Final, VocEd Worksheet.

5 Data taken from approximately 84 percent of all concentrators. Nothing is known about the quality of employment for these graduates.

TABLE 1. CTE participation by cluster area: 2005–06

Cluster Area	Number of Participants	Percent of All CTE Students Participating in Cluster	Cumulative Percent
Total	8,894	100.0	100.0
Architecture & Construction	1,545	17.4	17.4
Agriculture, Food & Natural Resources	1,137	12.8	30.2
Business, Management & Administration	1,038	11.7	41.8
Manufacturing	1,019	11.5	53.3
Information Technology	814	9.2	62.4
Arts, A/V Technology & Communications	772	8.7	71.1
Transportation, Distribution & Logistics	595	6.7	77.8
Hospitality & Tourism	587	6.6	84.4
Human Services	546	6.1	90.5
Retail & Wholesale Sales	412	4.6	95.2
Health Science	186	2.1	97.3
Education & Training	94	1.1	98.3
Finance	56	0.6	99.0
Government & Public Administration	45	0.5	99.5
Science, Technology, Engineering & Mathematics	27	0.3	99.8
Law, Public Safety, Corrections & Security	21	0.2	100.0

SOURCE: PRES Associates. (2006b). *Carl Perkins WyCTA State Report: Secondary Schools and Students 2005–06.*

Wyoming Economic Conditions

The mineral extraction industry currently is booming in Wyoming. Mining accounted for roughly one-third of the state's total earnings and job growth in 2005 and has contributed to an expansion in subsidiary industries, including professional and business services, transportation, and wholesale trade. Areas with high levels of mining production have also registered substantial increases in demand for construction, lodging, and retail trade to provide services for workers in these industries (Wyoming Department of Administration and Information 2005).

Energy production will continue to produce steady revenues for the state, with mining-related employment expected to increase over time. Specifically, the percentage of Wyoming workers employed in the mining industry is projected to increase by 11,219 workers between 2004 and 2014, translating to a 4.5 percent annual compounded rate of change. This would result in roughly 10 percent of all Wyoming workers (31,308 of 311,919) being employed in the mineral extraction field. Other industries, encompassing construction; wholesale trade, transportation, and utilities; professional and business services; and financial services are also expected to experience above-average growth (Table 2).[6]

However, even though opportunities in the natural resources and mining industry account for the state's largest projected employment growth, other industries in the state employ relatively larger percentages of individuals—with education and health care, leisure and hospitality, retail trade, and government accounting for the majority of current

6 Wyoming Statewide Long-Term Employment Projections, Industry Roll-Ups, 2004–2014. Wyoming Department of Employment. Retrieved March 21, 2007, from http://doe.state.wy.us/lmi/proj2005/long_emp2014rollups.htm.

jobs (Table 2). Enrollment in CTE clusters preparing students for these industries is relatively small, suggesting that these sectors may be good candidates for program expansion in the coming years.

The Organization of Career and Technical Services

Wyoming has established a strong foundation for providing quality CTE programs, as well as for improving student access to program services irrespective of district size and location. While much work remains to be done to improve the system, the state has already put in place several elements that set the stage for change—including establishing career clusters and pathways to organize programs, specifying content and performance standards to focus instruction, and instituting a statewide assessment to track student learning.

Career Clusters

As noted above, the state has adopted the 16 career clusters developed in the late 1990s by the U.S. Department of Education and the National Association of State Directors of CTE Consortium as an organizing framework for secondary education. Each cluster represents a broad industry area that includes a variety of career pathways. Each pathway in turn encompasses a number of occupations.

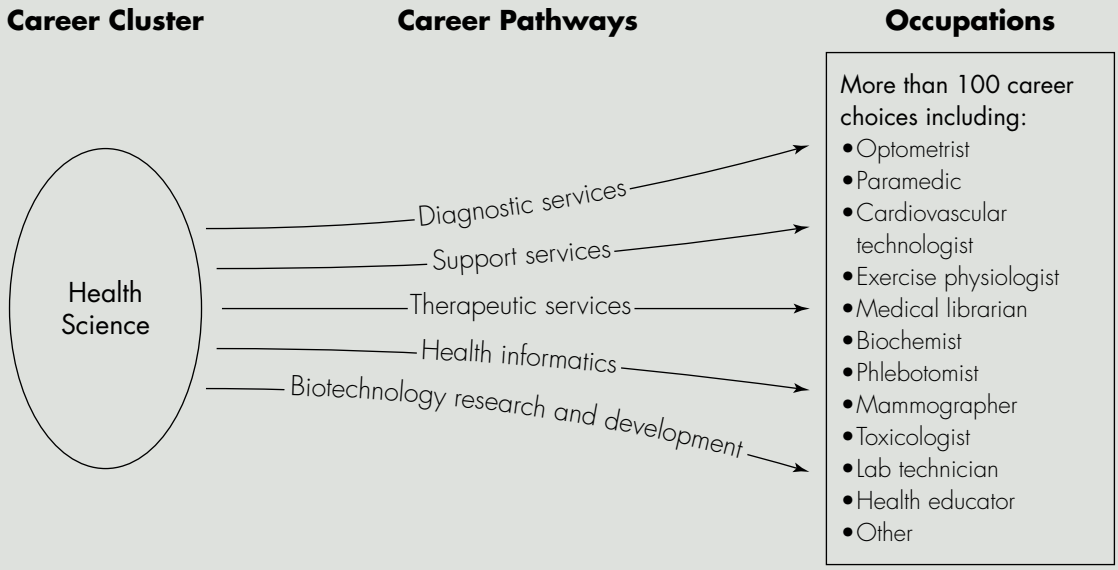
For example, Wyoming's Health Science career cluster includes pathways in five areas: Biotechnology Research and Development, Diagnostic Services, Health Informatics, Support Services, and Therapeutic Services (see Figure A). Each pathway encompasses a broad range of knowledge and skills spanning numerous occupational specialties. So students studying in the Therapeutic Services pathway would be learning a foundation set of skills that would prepare them

TABLE 2.
Wyoming statewide long-term employment projections, industry roll-ups, 2004–14

NAICS[1] Industry	2004 Employment	2014 Employment	Employment Change 2004–2014	Average Annual Compound Rate of Change 2004–2014
Agriculture, Forestry, Fishing & Hunting	2,440	2,909	469	1.8%
Mining	20,089	31,308	11,219	4.5%
Construction	19,177	27,904	8,727	3.8%
Manufacturing	9,536	11,326	1,790	1.7%
Wholesale Trade, Transportation, & Utilities	17,460	23,859	6,399	3.2%
Retail Trade	29,951	34,468	4,517	1.4%
Information	4,938	5,609	671	1.3%
Financial Activities	10,562	13,473	2,911	2.5%
Professional & Business Services	15,699	21,131	5,432	3.0%
Education & Health Care	53,861	65,296	11,435	1.9%
Leisure & Hospitality	32,601	38,655	6,054	1.7%
Other Services	7,970	9,447	1,477	1.7%
Government (Includes Postal Service)	23,748	26,534	2,786	1.1%
Total	**248,032**	**311,919**	**63,887**	**2.3%**

[1] North American Industry Classification System.
SOURCE: Wyoming Statewide Long-Term Employment Projections, Industry Roll-Ups, 2004–2014. Wyoming Department of Employment. Retrieved March 21, 2007, from http://doe.state.wy.us/lmi/proj2005/long_emp2014rollups.htm.

FIGURE A. Career pathways in the health science career cluster



SOURCE: Data from Wyoming Department of Education.

simultaneously for dozens of specific occupations, ranging from acupuncturist to dentist to paramedic or veterinarian. This structure helps students comprehend the range of jobs within a particular industry and, in turn, the preparation they need to enter the field at different levels.

To help students plan for their future using the career cluster framework, the Wyoming Department of Education, in cooperation with other state organizations, has developed a series of Career Cluster Guides. These materials help students see how technical coursework aligns with their postsecondary education and employment goals and offer examples of the type of high school coursework and college-level programs students must complete to realize their career aspirations.

Career and Technical Education Standards and Assessment

Wyoming has adopted career and technical content and performance standards specifying the workplace skills that students are expected to know and be able to demonstrate before they graduate. These standards draw heavily on recommendations contained in the report, *What Work Requires of Schools: A SCANS Report for America 2000*, published in 1991 by the Secretary's Commission on Achieving Necessary Skills, and the 1989 *National Career Development Guidelines*, produced by the National Occupational Information Coordinating Committee (NOICC).

Rather than defining specific skills for each career and technical program, the state has established a single set of standards that apply across all CTE program areas. Standards are identified for grades K–4, 5–8, and 9–12 with performance benchmarks specified at grades 4, 8, and 11. These standards are organized into six major strands:

1. *Resources:* Students effectively manage time, money, materials, facilities, and human resources.

2. *Interpersonal Skills:* Students acquire and demonstrate interpersonal skills necessary to be successful in the workplace.

3. *Information:* Students acquire and use workplace information.

4. *Systems*: Students demonstrate an understanding of how social, organizational, and technological systems work.

5. *Technology:* Students demonstrate the ability to use a variety of workplace technologies.

6. *Careers:* Students develop skills in career planning and workplace readiness.

While these standards provide a framework for organizing the academic and technical concepts that all career and technical instructors should address, they are *not* intended to tell teachers how to deliver the material to students, how to pace the curriculum, which hands-on activities or work-based elements might enhance student learning, or how to teach academic and technical concepts to students. Rather, the framework serves as a guideline—the overarching content that all students are expected to master.

To illustrate, all 11th-grade students participating in career and technical education programs are expected to demonstrate mastery of the Technology content, irrespective of the specific program in which they are enrolled (i.e., agriculture, health sciences, or manufacturing). Mastery is rated by how well students meet benchmarks, with students required to achieve the "proficient" level (see Table 3).

Wyoming educators currently monitor the skill proficiency of CTE concentrators using the Wyoming Career and Technical Assessment (WyCTA), a state-developed instrument designed to assess students' work readiness skills. Each district's CTE instructors rate student abilities based on their performance on a set of locally determined tasks. To standardize assessment, the state has developed a set of testing rubrics, instructions, and sample prompts that instructors may consult when administering exams. Skill judgments are made in the following areas: Applied Communica-

TABLE 3.
Example of Wyoming content standards for CTE

Technology Content Standards—Students demonstrate the ability to use a variety of workplace technologies.

Benchmark: Grade 11	**Performance standards level descriptors: Grade 11**
1. Students choose and utilize procedures, tools, or equipment, including computers and related technologies. 2. Students demonstrate proper procedure for set-up, operation, and routine maintenance of workplace equipment. 3. Students use workplace equipment to solve problems. 4. Students apply safe and ethical practices when using workplace technologies.	Advanced Performance Students at the advanced level independently and consistently demonstrate the safe and ethical use, as well as routine maintenance, of appropriate workplace technologies, as related to the benchmarks. Proficient Performance Students at the proficient level consistently, with limited assistance, demonstrate the safe and ethical use, as well as routine maintenance, of appropriate workplace technologies, as related to the benchmarks. Basic Performance Students at the basic level require frequent assistance to demonstrate the safe and ethical use of appropriate workplace technologies, as related to the benchmarks. Below Basic Performance Students at the below basic level require extensive support or provide little or no evidence in meeting the standard.

SOURCE: Wyoming Department of Education.

tion, Applied Math, Affective and Thinking Skills, Technology, Pre-Employability, and Employability. These areas have been determined to be valid and reliable in a crosswalk with the current state content standards in career and technical education.

As with state-established content standards, the state assessment does not require students to demonstrate program-specific knowledge—concentrators completing a welding program might be tested using the same criteria as those completing a business management sequence.

The Wyoming Department of Education is in the process of refining the content standards and performance benchmarks identified in the WyCTA, and the assessment instrument will be used for the last time in its current form during the 2006–07 school year. The state is also working to add a "Technical Skills" indicator to the existing list of six CTE content standards. The Department anticipates that the creation of this "Technical Skills" standard will allow school districts and the state to assess student performance in career and technical programs more effectively.

Unlike the existing state-established content standards, the proposed Technical Skills content standard will likely require students to demonstrate some level of program-specific knowledge. For example, concentrators completing a welding program might be expected to demonstrate technical knowledge and a set of skills associated with the metalworking profession. Student mastery will signal that students possess the requisite skills to successfully transition to postsecondary education, advanced training, and/or employment.

Career and Technical Education Finance

State financial support for career and technical education has undergone fundamental change since 2001, when the Wyoming Supreme Court directed the state to modify its school finance formula to adjust for the increased costs districts face in providing vocational education and to account for variation among schools in the intensity of services offered. Before this determination, state funding in Wyoming was allocated using a cost-based block grant model that provided districts with sufficient funding to deliver a legislatively specified "basket" of services. Although the basket accounted for all forms of instruction, the Court ruled that funding districts based on average statewide expenditures penalized schools with extensive vocational programs.

To comply with court directives, in March 2002 (Klein et al. 2002) the Wyoming legislature commissioned a study to modify the state's cost-based block grant model formula to account for the actual costs districts face in providing vocational services. To inform redesign efforts, the state contracted with MPR Associates, Inc. to quantify the costs Wyoming districts face in offering vocational services.

Noting that smaller class sizes and the costs of equipping and supplying classrooms can drive up the price of CTE instruction, MPR recommended that the state modify its resource allocation strategy to compensate districts for the increased costs of providing vocational services. The firm recommended basing funding on the number of full-time-equivalent (FTE) vocational students enrolled in state-approved district programs, weighted to account for the relatively higher cost of providing them with services. MPR also proposed that the state offer supplemental funding to permit districts to update instructional equipment and to purchase materials and supplies.

Acting on MPR's recommendation, in 2003 the Wyoming legislature approved a new approach

for allocating career and technical resources. Under the revised funding formula, local agencies are provided a 1.29 weight for each FTE student in career and technical studies, compared with a 1.0 weight for a student in regular education classes. This weight, established by analyzing statewide class size data for academic and career and technical instructors in 2001–02, ensures that districts are funded based on the actual number of students participating in CTE coursework, rather than a statewide average, as directed by the Court.

The legislature also approved additional funding for the purchase of career and technical equipment and supplies. The current formula provides districts with $7,731 per FTE career and technical education instructor, an amount roughly equivalent to the average district expenditure for these purposes in the 2001–02 school year, adjusted for inflation. Since formula adoption, some district administrators have suggested that the equipment adjustment does not adequately compensate them for their needs, in part because data on district equipment purchases were collected at a time when statewide spending for career and technical education was in decline.

The original formula also provided for a two-program minimum standard to ensure that all districts, irrespective of size, received sufficient resources to provide at least two comprehensive programs of technical study. This adjustment operated by attaching additional weighting to FTE CTE students attending schools with fewer than 131 students. This minimum program standard was dropped from the school finance formula in 2005 at the recommendation of Lawrence O. Picus and Associates, a firm contracted to recalibrate Wyoming's block grant model. This change was deemed appropriate due to changes in the high school prototype model, which provided more generous staffing to smaller schools, some of which could be redirected to support career and technical education.

Although the Wyoming Supreme Court acknowledged that the state made a good start in deriving its vocational funding formula, in January 2006 the Court described career and technical education as "a work in progress" due to incomplete data. Specifically, the Court determined that it lacked sufficient information to explain why district expenditures for career and technical education varied across districts, and, in particular, whether this difference was due to local preference for vocational instruction or to continuing concerns about more costly programs.

The Court's inability to make this determination may be due, in part, to a lack of specificity about what constitutes an adequate career and technical education program in the state. Although the Wyoming Department of Education has developed content and performance standards defining the knowledge and skills that students are expected to know and be able to do, along with a statewide assessment to test students' skill mastery, the generic nature of these materials allows educators considerable flexibility in structuring programs. For example, at some sites students may be able to meet standards using older equipment, while faculty at others may seek cutting-edge technology to provide instruction.

Indeed, it was the absence of clear guidelines on what constitutes career and technical education that led MPR researchers to observe, in their November 2001 report (Klein, Bugarin, and Hoachlander 2001), that:

> Ultimately, state support for vocational education should reflect the type and scope of instruction that it is willing to support. While the state is obligated to support districts incurring above-average costs in offering vocational

> education, it need not compensate districts that choose to spend more than is necessary to deliver a high-quality program due to local preferences (p. 23).

To help address this issue, the following section lays out a strategic plan to assist the state in establishing parameters for what constitutes an appropriate level for CTE in Wyoming and a strategy for linking this instruction to broader school improvement efforts.

CHAPTER 2

A Framework to Strengthen Career and Technical Education

This strategic plan calls for developing comprehensive multi-year programs of study—combining rigorous academics with challenging technical education—organized around major industry sectors or career clusters. It proposes a strategy for independently upgrading the quality of CTE instruction provided in Wyoming high schools, while at the same time improving its connection to both academic instruction and postsecondary programs. And it does so while preserving student options through

a wide range of offerings that lead to college *and* career—both goals and not one or the other.

The plan is intended to guide policy and implementation decisions affecting Wyoming secondary school districts over the next three to five years. Although elements of the plan may have potential applications in other settings (e.g., alternative high schools, juvenile detention centers), the plan is focused on services provided in comprehensive high schools, as well as in middle schools enrolling 9th-grade students.

The plan does not specifically address career and technical education provided at the middle and junior high school levels, although it recognizes that technical instruction can play an important role in helping focus student studies and provide a context for grounding academic instruction in all grades, elementary though postsecondary. Where appropriate, middle and junior high school teachers can use the career clusters model to help students undertake career exploration activities, such as conducting career research, compiling interest inventories, participating in job shadowing, and developing Individual Career Education Plans.

Theoretical and Empirical Underpinnings

Almost a century ago, John Dewey (1916) wrote in *Democracy and Education,* "Education through occupations … combines within itself more of the factors conducive to learning than any other method." Throughout the 20th century, national commissions on vocational education repeatedly urged stronger connections to the academic curriculum (Grubb 1995). Integrating academic and vocational/technical education has been one of the major policy objectives of the Carl D. Perkins Vocational Education Act, expressed first in 1985 and subsequently restated in the 1990, 1998, and 2006 reauthorizations. Additionally, the strategy has strong theoretical underpinnings in cognitive science and in a small but credible number of empirical studies on the effects of "learning in context" (Bjork and Richardson-Klavhen 1989; Bransford, Brown, and Cocking 1999; Caine and Caine 1991; Resnick 1991, 1996). "Project-based" and "problem-based" learning also embrace many of the same tenets as integration of academic and vocational education, and, of course, many efforts to strengthen education in mathematics, science, and reading depend on "application" and "context" to promote student mastery (Anderson et al. 1987; Maxwell, Bellisimo, and Mergendoller 1999; McLaughlin and Talbert 1993). A recent study (Stone et al. 2005), conducted by the National Research Center for Career and Technical Education (NRCCTE), focused on using CTE to enhance students' skills in mathematics. This study, employing randomized trials, found that CTE had positive effects on students' academic achievement in mathematics.

Nevertheless, integration of academics with CTE has yet to take hold in American high schools on any significant scale or with clear consistency and reliable evidence of effectiveness. The most recent National Assessment of Vocational Education (NAVE) concluded that despite the encouragement of federal policy for more than a decade, the practice of integration has been sporadic and idiosyncratic at best (Silverberg et al. 2004).

There are signs that this is changing. Today, the National Academy Foundation supports more than 600 career academies offering comprehensive integrated programs in finance, information technology, and hospitality and tourism. The National Career Academy Support Network estimates that, in addition to these NAF academies, there are some additional 1,500 to 2,000 career academies now operating in high schools throughout the country. Project Lead the Way

(PLTW) has developed eight rigorous courses in pre-engineering that integrate challenging academic content, particularly in mathematics and science, with demanding engineering content, and more than 1,000 high schools around the country today offer one or more of the PLTW courses. Ford Partnership Academies can be found in more than 150 high schools throughout the United States, and other integration initiatives, such as Talent Development, are also being more widely adopted.

Spurring these efforts is a growing recognition that the academic knowledge and skills students need to succeed in postsecondary education are similar to those needed to succeed in the workplace. For example, Achieve, through its support of the American Diploma Project and a growing consortium of states committed to raising academic standards, has documented the high levels of algebra, geometry, and other higher-level mathematics used by machinists, electricians, ironworkers, and draftsmen. And, more generally, an expanding body of research supports the premise that most young people will need at least some postsecondary education if they are to obtain jobs offering a living wage.

This work also aligns with efforts at the federal level to create seamless educational pathways connecting high schools, colleges, and the workplace. They incorporate evidence provided by the U.S. Department of Education's ongoing College and Career Transitions Initiative, intended to support the development of career-oriented course sequences that link the last two years of high school with the first two of college, as well as goals contained in the Carl D. Perkins Career and Technical Education Improvement Act of 2006. They also draw on principles identified in the States' Career Clusters Initiative, and build on strategies adopted by schools throughout the country to organize educational curriculum in a more meaningful way for students.

In short, there is substantial theoretical and empirical justification for promoting a system in Wyoming offering comprehensive programs of academic and technical study that prepare students for both postsecondary education and careers, not just one or the other. Therefore, this plan is organized around a set of guiding principles that defines the career pathways model and posits a series of strategic objectives to support achieving its intent. Concrete action steps to achieve these strategies are also presented.

Organizing Principles

The career pathways model is founded on the following fundamental principles:

1. Prepare students for the full range of postsecondary options—two- and four-year college, apprenticeship, the military, and formal employment training.

2. Provide students with a strong foundation of industry knowledge and technical skill that enables them to pursue a wide range of career options in many different fields.

3. Offer occupationally specific training in a broader program of academic and technical preparation.

4. Connect academic and technical curriculum grounded in academic and industry standards.

5. Promote joint planning and team teaching among academic and technical teachers.

6. Use data on student achievement, attendance, grade-to-grade transition, high school completion, postsecondary enrollment, and postsecondary attainment to assess success and improve programs.

Strategic Objectives

In keeping with these principles, this plan lays out 10 strategic objectives for improving career and technical education in Wyoming. Specific strategies and action steps to help the state meet these objectives are outlined in detail in the following section.

1. **Legislative Alignment:** Ensure that state legislative efforts promote school district involvement in the career pathways initiative and support student participation in career and technical education.

2. **Content Standards:** Enumerate the academic and industry-related standards that are the focus of each pathway.

3. **Plans of Study:** Develop curriculum framework models for each career cluster and career pathway that identify the relevant academic and technical courses needed for secondary completion and postsecondary enrollment and career entry.

4. **Curriculum:** Support development of a standards-based curriculum for core academic and technical courses in each of the major pathways.

5. **Delivery Systems:** Institute innovative strategies for ensuring that students have access to career pathways, as well as opportunities for work-based learning and dual enrollment in related postsecondary courses.

6. **Articulation:** Ensure that the program of study for each career pathway is aligned with a wide range of postsecondary options.

7. **Teacher Preparation:** Increase the number of teachers who are highly effective in teaching academic and technical courses in new pathways of integrated academic and technical study.

8. **Assessment:** Create assessments that evaluate students' mastery of both academic and technical knowledge and the core skills essential for career success.

9. **Finance:** As needed and appropriate, modify the state's school finance system to support development and implementation of the career clusters and pathways approach.

10. **Accountability:** Improve career and technical programs over time through ongoing monitoring and collection of student and program performance data.

Outcome Indicators

Career clusters and the pathways approach outlined in this strategic plan are intended as an organizing framework for secondary education. The purpose in adopting this framework is to improve the quality of career and technical education services provided across the state, and, perhaps as importantly, the overall quality of all students' educational experiences, irrespective of whether they concentrate in a CTE program area.

Ultimately, evidence of plan success would be indicated by increases in:

1. **Student Engagement** in school, as proxied by data on student:
   - Attendance
   - CTE concentration rates
   - Disciplinary infractions
   - Participation in CTE clubs and activities
   - Teacher/student interactions

2. **Student Achievement,** as proxied by data on student:
   - Graduation rates
   - Dropout rates
   - PAWS performance
   - WyCTA performance
   - Perkins performance
   - CTE certification exams

3. **Student Preparation for College and Career,** as proxied by data on student:
   - Postsecondary matriculation rates
   - Employment rates
   - Dual enrollment numbers
   - ACT and SAT test scores
   - Advanced Placement (AP) test scores
   - Job shadowing/work-based learning participation rates

CHAPTER 3

Essential Policy Considerations

This strategic plan presents a vision for strengthening secondary education in Wyoming. It is premised on the belief that high-quality career and technical education programs integrating rigorous academic content with high-level, industry-recognized technical skills can prepare Wyoming's youth for success in further education, career, and civic life. This approach assumes that core academics can be taught in many ways and that career education, broadly conceived and rigorously applied, can provide a unifying theme for organizing and providing a first-rate college-preparatory program of academic studies, as well as challenging technical education tailored to specific career goals. Realizing this vision requires that state legislators and educators address a number of essential policy issues that will influence effective implementation and development.

STRATEGIC OBJECTIVE 1

Legislative Alignment

Ensure that state legislative efforts promote school district involvement in the career pathways initiative and support student participation in career and technical education.

The Wyoming Department of Education has adopted the 16 Career Cluster areas identified by the U.S. Department of Education as an organizing framework for secondary education. These clusters include:

- Agriculture, Food & Natural Resources
- Architecture & Construction
- Arts, A/V Technology & Communications
- Business, Management & Administration
- Education & Training
- Finance
- Government & Public Administration
- Health Science
- Hospitality & Tourism
- Human Services
- Information Technology
- Law, Public Safety, Corrections & Security
- Manufacturing
- Marketing, Sales & Service
- Science, Technology, Engineering & Mathematics
- Transportation, Distribution & Logistics

School districts are encouraged to adopt or adapt these clusters voluntarily to help organize their secondary education programs. To support program adoption, the Wyoming Department of Education has developed materials to promote understanding of the clusters and their use in structuring educational programs.

STRATEGY 1.1
Recognize career clusters as the overarching framework for organizing the content and delivery of career and technical education, as well as more comprehensive programs of integrated academic and technical study.

Ideally, district administrators will choose clusters that reflect regional occupational needs, while balancing student interest across career areas. While size may limit a district's capacity to offer multiple career clusters, most districts should be able to offer at least two clusters and have the option of adapting two or more clusters into a single program area.

Action steps to achieve this goal

- Ensure that planned state legislation reinforces efforts by the Wyoming Department of Education to introduce career clusters.
- Provide incentives for districts to adopt or adapt career clusters.
- Ensure that state education policy supports the continued development and district adoption of the career clusters model and revise any policies that hinder it.

STRATEGY 1.2
Rename or eliminate the "career" category in the Hathaway Scholarship Program.

The Hathaway Scholarship Program provides deserving Wyoming students unprecedented assistance for pursuing postsecondary education within the state. Beginning with the class of 2006, Wyoming students may qualify for one of four merit scholarships for use at any community college in the state and/or the University of Wyoming (UW).

Scholarship opportunities fall into the four categories in Table 4.

TABLE 4. Hathaway Merit Scholarships

Career	Opportunity	Performance	Honors
Students earning: A minimum HS GPA of 2.5 or a minimum ACT score of 17 or a cumulative WorkKeys score of 12	Students earning: A minimum HS GPA of 2.5 or a minimum ACT score of 19	Students earning: A minimum HS GPA of 3.0 or a minimum ACT score of 21	Students earning: A minimum HS GPA of 3.5 or a minimum ACT score of 25
May receive: Up to $800/semester for up to 4 full-time semesters at a Wyoming community college. Students earning a certificate with a cumulative GPA of at least 2.25 or a degree may qualify for an additional 4 semesters of study at a community college.	May receive: Up to $800/semester for up to 8 full-time semesters of study. The initial 4 semesters can be at a Wyoming community college or the UW, but the last 4 semesters must be at the UW.	May receive: Up to $1,200/semester for up to 8 full-time semesters of study. The initial 4 semesters can be at a Wyoming community college or the UW, but the last 4 semesters must be at the UW.	May receive: Up to $1,600/semester for up to 8 full-time semesters of study. The initial 4 semesters can be at a Wyoming community college or the UW, but the last 4 semesters must be at the UW.

SOURCE: Wyoming Department of Education.

As the Wyoming legislature considers adopting new programs, care must be taken to ensure that state policies recognize and reinforce ongoing education initiatives.

All policies can have unintended consequences. As presently structured, the Hathaway Scholarship Program implies that students pursuing a career-focused curriculum in high school should only be eligible for the least demanding of the four scholarship opportunities. It also suggests that students pursuing career-focused studies are not expected to achieve the same level of academic knowledge as those taking other courses of study. Finally, it limits aid for those who have demonstrated they can succeed in college and may wish to pursue a baccalaureate degree.

This message reinforces outdated presumptions that CTE is intended primarily for students not intending to pursue a four-year college or advanced degree. Associating relatively lower levels of academic performance and alternative tests (i.e., WorkKeys) with the Hathaway "Career" scholarship category may also have the unintended consequence of deterring secondary schools from adopting, and students from pursuing, career-focused pathways of study. And because WorkKeys is not an accepted qualifying exam for the *Opportunity*, *Performance*, or *Honors* scholarships, students electing to take the WorkKeys exam may unwittingly close off academic opportunities for which they might otherwise have qualified.

Action steps to achieve this goal

- Rename the Hathaway *Career* scholarship as the *Achievement* or *Initiative* award to better capture the intent of this scholarship category, while removing any negative connotations associated with CTE.

OR

- Eliminate the *Career* scholarship and, if desired, modify the existing *Opportunity* scholarship to reflect the less restrictive eligibility requirements associated with the current *Career* scholarship.

- Allow recipients of the renamed or consolidated *Career* scholarship who achieve a minimum GPA requirement in community college to receive funding allowing them to enroll for four additional full-time semesters at the University of Wyoming.

- Eliminate the use of the WorkKeys exam for the *Career* scholarship and base scholarship eligibility on the ACT exam.[7]

STRATEGY 1.3
Recognize selected rigorous career and technical courses, as well as newly developed courses of integrated academic and technical content, as satisfying requirements for one or more of the academic courses in the *Success Curriculum*.

The Wyoming legislature is in the process of defining a *Success Curriculum* that all students must complete to participate in the Hathaway Scholarship Program. Currently, classes required for high school graduation are the same as those required for a Hathaway scholarship. Beginning with the high school class of 2011, scholarship eligibility will expand to include the study of a foreign language. This additional requirement may limit

7 WorkKeys can provide useful information on whether students are mastering work-based skills and may be a recommended approach for objectively measuring CTE skill attainment. However, using WorkKeys as a basis for awarding Hathaway scholarships is not a recommended approach for the reasons given.

students' ability to take career and technical education coursework given scheduling limitations.

While many school reform initiatives have focused on increasing the number of academic credits students must complete to graduate, simply requiring students to take more coursework may not be the solution to improving academic achievement—particularly for students who struggle to learn in traditional academic classes. Moreover, this additional coursework often comes at the expense of career and technical and other elective coursework that align with students' interests and, in some cases, keep them from dropping out of school.

Action steps to achieve this goal

- Change *Success Curriculum* requirements to allow students to apply technical course credits, from courses providing rigorous academic and technical content, toward meeting Hathaway Scholarship Program eligibility criteria.

STRATEGIC OBJECTIVE 2

Content Standards

Enumerate the academic and industry-related standards that are the focus of each pathway.

Wyoming has adopted content and performance standards that students participating in academic and technical coursework are expected to meet. Standards for academic subjects are subject-specific and relate to discrete topic areas (e.g., applying the Pythagorean Theorem in geometry), but these standards were not developed for use with the career pathways model and thus are neither associated with a given cluster area nor intended to provide examples of real-life applications.

In contrast, Wyoming's career and technical standards define a set of broad, crosscutting industry skills with a single set covering all career and technical program areas. Modeled on recommendations contained in the Secretary's Commission on Achieving Necessary Skills report, the standards can be taught in a variety of contexts at educators' discretion.

The absence of industry-specific standards means that the content and rigor of career and technical education programs vary statewide. Without clear direction regarding the technical knowledge needed for a program of study, local educators have flexibility in determining which skills should be taught and which types of equipment and supplies are appropriate for instruction. Recognizing that the structure of district programs should reflect statewide norms, the Wyoming Supreme Court called for additional work in career and technical education in its January 2006 ruling, and, in particular, cited MPR's recommendation that the state develop and adopt standards for vocational instruction.

STRATEGY 2.1
Identify the industry-related technical standards and academic standards that are the focus of pathway curricula.

Although Wyoming has made substantial progress in elaborating a set of generic technical standards expected of students completing CTE courses, the absence of industry-recognized standards corresponding to the career clusters and pathways adopted by the state poses a potential obstacle to the continued development of the pathways approach and to state efforts to quantify the cost of providing a high-quality CTE education.

Content standards, which define what a student should know and be able to do, are intended to serve as a resource that educators may consult when developing and strengthening curriculum, and in purchasing equipment and supplies to support instruction. While standards do not dictate how content is taught, they can help ensure that career and technical courses in Laramie will expose students to the same content as courses in Cody. Identifying specific industry-related standards can also help teachers to better prepare students for career entry or advanced technical training at the postsecondary level.

Industry-related technical content standards are needed within each of the 16 career clusters, encompassing each of the pathways associated with a cluster. For example, within the Architecture and Construction Career Cluster, technical standards should be specified for each of the three pathways associated with designing, planning, managing, building, and maintaining built environments: Design/Pre-Construction, Construction, and Maintenance/Operations.

Students pursuing the construction pathway might be held to the following types of standards:

Technical standards. Students must have the ability to:

- Convert scaled blueprint drawing measurements to full dimensions for a given construction project.

- Understand the processes and materials (e.g., structural, electrical, mechanical, finish) appropriate to the architectural design and residential construction.

Academic standards. Students should:

- Know how to use trigonometric functions to solve for an unknown length of a side of a right triangle, given an angle and a length of a side (mathematics).

- Understand the connections among natural resources, entrepreneurship, labor, and capital in an industrial economy (history/social-science).[8]

Ideally, standards within each cluster should align with those of industry to ensure that students are learning material that will enable them to excel within occupations associated with their career pathway, as well as to pass industry certification exams appropriate for their level of studies. For example, in the Manufacturing Career Cluster, standards in the Production Pathway, in which students prepare for careers in machining and metalworking, should align with those identified by the National Institute of Machining Skills, Inc.

8 From California's CTE standards: http://www.cde.ca.gov/re/pn/fd/documents/careertechstnd.pdf.

The good news is that Wyoming educators need not invent these standards from scratch. Many states, including California, Maryland, and North Dakota, have already specified technical and academic standards associated with career clusters and pathways. These standards can be readily adapted to fit Wyoming's unique industry and educational context. Once developed, the state will need to review standards on a periodic basis to ensure that they remain current with industry standards.

Wyoming may also want to incorporate its existing CTE content standards, such as "students use workplace equipment to solve problems" or "students demonstrate and/or teach a learned skill," into the new standards framework. General workforce development skills are useful in measuring whether students have obtained transferable skills that will help them succeed in various jobs, and many employers report that they seek individuals with these skills. Bolstering these generic standards with more specific academic and technical ones can encourage rigor and consistency in school curricula—ultimately helping to ensure that students in all schools master challenging material specific to a career pathway.

Action steps to achieve this goal

- Convene statewide teams of academic and technical instructors from secondary schools and postsecondary institutions, along with industry representatives, to begin developing technical standards and associating academic standards with each of the 16 career clusters identified by the state—starting with the three to five clusters that enroll the most students or are most critical to state economic development.
- Align academic and technical standards with current industry standards and needs, for example, by reviewing standards produced by national industry groups—such as the National Institute of Machining Skills, Inc. (NIMS) in the machining and metalworking areas and the National Automotive Technicians Education Foundation (NATEF) for automotive repair—to ensure that state standards align with, or take into account, those identified by industry.
- When disseminating completed standards, help school personnel to understand how to use them as guidelines in developing their course curricula.
- Review standards periodically to ensure that they have kept pace with industry innovations and trends.

Framing Instruction Using Industry Skill Standards

To help structure technical instruction in the food services industry, Wheatland High School (Platte School District #1) adopted the ProStart Program developed by the National Restaurant Association Educational Foundation (NAREF). As one of 20 high schools in Wyoming using ProStart Foodservice Management, Wheatland High School offers students the opportunity to blend classroom learning with work experience in a structured, standards-based educational program that culminates in the award of an industry-recognized National ProStart Certificate of Achievement accepted toward college credit at many university restaurant and foodservice programs.

Teachers at Wheatland follow the ProStart syllabi to organize coursework, use student textbooks, videos, and transparency masters to structure instruction, and may consult equipment checklists to identify the types of materials needed to teach the ProStart curriculum. Instructors may also use ProStart assessments, which are linked to classroom instructional materials, to assess student learning and award ProStart certificates.

STRATEGIC OBJECTIVE 3

Plans of Study

Develop curriculum framework models for each career cluster and career pathway that identify the relevant academic and technical courses needed for secondary completion and postsecondary enrollment and career entry.

Curriculum frameworks illustrate the types of academic and technical courses students must complete, and the order in which they must be taken, to specialize in a career cluster area. Mapping out coherent sequences of courses associated with particular pathways helps clarify what students should take to gain a foundation level of knowledge and skills to prepare them for a range of postsecondary options and careers. These plans can also help administrators to adapt school schedules to the cluster model and articulate program studies with industry and postsecondary institutions.

The Wyoming Department of Education has already started the process of developing model plans of study corresponding to each career cluster, specifying the type of academic coursework, beginning in the middle grades and continuing through high school, that students need to complete. These model frameworks provide a starting point for helping students understand the types of coursework required for success, but currently they do not demonstrate how students might link CTE coursework within a program sequence to prepare for occupations associated with a given career pathway, nor how coursework can articulate with programs at postsecondary institutions.

STRATEGY 3.1
Develop model program frameworks for each career pathway illustrating the academic and technical courses comprising a comprehensive four-year program of study.

Curriculum frameworks are a necessary precursor to the development of course curriculum. The Wyoming Department of Education therefore should continue to build on this preliminary work to illustrate how schools can help students construct coherent, focused programs of academic and technical courses. Within the state's 16 career clusters are 81 career pathways offering preparation for hundreds of occupations. Each pathway should offer a coherent sequence of courses aligned with high school academic courses, postsecondary courses, and various careers. A complete framework would consist of six essential components:

1. Core academics—essential courses in English, mathematics, science, and social studies needed for enrollment in postsecondary education.

2. Technical courses—industry-focused courses providing increasingly challenging knowledge and skills required for success in the career cluster.

3. Work-based learning—job shadowing, mentoring, internships, virtual apprenticeship, and school-based enterprises.

4. Supplemental services—as needed, additional instruction in mathematics and reading, counseling, transportation, or other areas.

5. Related student organizations—such as Future Business Leaders of America; Family, Career, and Community Leaders of America; National FFA Organization; or others.

6. Articulation with postsecondary education—majors in two- and four-year colleges, apprenticeship, the military, and formal employment training opportunities.

To illustrate a plan of study, consider the Agriculture, Food, and Natural Resources cluster. This cluster has six pathways that prepare students for a range of careers spanning the state's resource-based economy. While some pathways, such as Agribusiness Systems and Animal Systems, might encompass similar academic coursework, such as biology and agricultural science, the three or four technical courses of each pathway might differ substantially, with the Agribusiness Systems pathway focusing on marketing and business management, and the Animal Systems pathway requiring animal science and wildlife management courses. Providing students with more detailed programs of study will clarify which courses students should take within a particular pathway.

Table 5 presents one possible Agricultural Business plan of study.

In addition to specifying academic and technical courses, these plans must also incorporate youth clubs such as FFA or Skills USA, since these programs provide a helpful context in which students can apply their classroom learning. Work-based learning opportunities should also be incorporated into the latter stages of these plans, to help keep students engaged in their final year of high school and bridge their work to post-graduation plans.

TABLE 5. Possible program of study for agricultural business pathway in the agriculture, food, and natural resources cluster

	9th Grade	10th–11th Grade	12th Grade	Advanced Coursework/ Dual Enrollment
Academic				
English	English I	English II English III	English IV	
Mathematics	Algebra I	Algebra II Geometry	Statistics Pre-calculus	Accounting
Science	Biology	Chemistry Physics	Agricultural Science	AP Biology Insect Biology
Social Studies	American History	World History Geography	Government/Civics Economics	Agricultural Economics
Technical				
Sector Courses	Introduction to Agriculture	Agricultural Sales & Service Agricultural Marketing	Agricultural Business Management	Farm Management Farm Accounting
Work-Based Learning	Career Planning Job Shadowing	Career Days	Internship Senior Project	
Youth Groups such as FFA or Skills USA	Youth Groups	Youth Groups	Youth Groups	

To accommodate traditional academic as well as technical courses, schools may need to adapt their schedules, since a six-period day may make it difficult for students to complete the Success Curriculum and also finish a career and technical pathway. Block schedules, in which certain classes can be offered on alternating days, or seven- or eight-period days allowing students to take more classes within a day, can help address this issue.

Action steps to achieve this goal

- Convene sector-focused committees of industry representatives, postsecondary professors, and academic and CTE teachers, to model programs of study for each pathway, based on a review of state academic and CTE program offerings.

- Provide resources and/or technical assistance to support schools in developing curriculum frameworks and in modifying school schedules to support the pathways model.

- Disseminate plans of study to educators and communicate the benefits of adopting them, showcasing schools that have used them to improve student learning.

Transcript Evaluations: One Method for Monitoring Student Progress

One method for determining whether students are adopting plans of study for a career pathway is to evaluate student transcripts. Examining which courses students take, when they take them, and how well they do in them can help principals, counselors, and students—as well as state administrators—in various ways. The information gathered from transcripts can be formatted into reports to address specific goals.

- Student reports can help counselors and students see which courses students still need to take to complete a career pathway and determine when they might take those courses before graduation.
- School reports can help principals determine why students are struggling to complete a particular pathway and how to address the issue, for example, by adapting school scheduling, providing more supplemental support for students, or offering more targeted teacher professional development to improve courses.
- State level reports can help the Department of Education compare schools or programs and provide proper support where needed.

In California, a transcript evaluation pilot project of broader scope is currently underway—examining high school students' progress in meeting the course and grade point average required for acceptance to the University of California system.

STRATEGIC OBJECTIVE 4

Curriculum

Support development of a standards-based curriculum for core academic and technical courses in each of the major pathways.

Creating challenging, comprehensive pathways of academic and technical study will require substantial curriculum development, for both academic and technical courses. Although CTE instructors in Wyoming incorporate some academic instruction into their existing coursework, instruction often focuses on occupationally specific skills taught in isolation from academics or more generalizable industry-related technical knowledge. Without specific content standards for CTE, the type and rigor of technical skill instruction also varies across schools. Similarly, subject area offerings in English, mathematics, science, and social studies are often structured with little attention to authentic application of key academic concepts in industry. In short, students would benefit from infusing more academic content into CTE curriculum, as well as from including more attention to industry-related application of academic concepts in the core academic curriculum.

Integrating academic and technical curriculum into classroom instructional materials is a challenging, labor-intensive task. While academic and technical teachers should be free to adapt state-developed model curriculum to their particular needs and circumstances locally, it may be uneconomical to expect curriculum development to occur solely at the local level. Consequently, it will fall to the state to provide leadership in identifying exemplary curriculum materials and in drafting new materials aligned with career pathways within clusters.

STRATEGY 4.1
Develop model curriculum for the technical core courses in each of the career pathways.

The process of curriculum development typically begins once plans of study have been developed, content standards identified, and an assessment strategy formalized. Designing curriculum is a collaborative effort, involving teams of academic and technical instructors who review existing courses to determine whether identified academic or technical standards can be found within existing lesson plans or whether new learning objectives are required.

Rather than seeking to develop curriculum from scratch, Wyoming educators should review examples of curriculum materials developed by national industry or professional groups, with the goal of adopting or adapting examples for local use. For example, the National Center for Agriscience and Technology Education has a resource clearinghouse containing sample lesson plans, lab projects, and learning objectives to support educators in teaching courses in the Agriculture, Food and Natural Resources cluster.

State administrators should also consult with their counterparts in other states. For example, the Center for Occupational Research and Development (CORD) has recently worked with the Tennessee State Department of Education to develop curriculum materials to support instruction in the Manufacturing, Construction, and Transportation Service career clusters.

Action steps to achieve this goal

- Identify high-quality curricula currently available in Wyoming schools or through national organizations or industry groups.
- Convene committees of secondary and postsecondary academic and CTE instructors and business and industry representatives to develop model units guided by skill standards identified in each career cluster and pathway area.
- Offer stipends to teachers volunteering to participate on committees held during the summer months. Offer incentives for industry and postsecondary representatives as well.
- Offer ongoing technical assistance, including on-site visits throughout the school year to help teachers implement new curricula.
- Encourage schools to set aside joint planning time for academic and technical teachers working together to implement the curriculum themselves or in team-teaching situations.

Example of an Existing Curriculum: Pre-engineering Program Using Rigorous Math and Science

Project Lead the Way (PLTW) (www.pltw.org) is a pre-engineering program that provides a good example of emphasizing relevant and challenging academic content in applied courses. The program starts in middle school and continues throughout high school, preparing students for postsecondary study in engineering (in four-year colleges and universities) and engineering technology (generally taught in two-year associate's degree programs). Started in 1997–98, the program is now offered in more than 1,300 schools in 45 states.

The curriculum reinforces high-level math and science content (aligned with national standards) with engineering applications in electronics, robotics, and manufacturing processes. Participants are required to study college-prep math every year in grades 9–12, both to gain skills and knowledge useful in the PLTW courses and to prepare them for postsecondary study. Participants are given challenging problem-solving and analytical tasks they must complete—many of them in teams; computer work is also common. Some schools provide students access to summer internships.

The project provides complete curricula for five 9-week units for grades 6–8 and six high school courses, with two additional ones in development. Middle-grades units are Design and Modeling, The Magic of Electrons, The Science of Technology, Automation and Robotics, and Flight and Space. High school courses include Principles of Engineering, Introduction to Engineering Design, Digital Electronics, Computer Integrated Manufacturing, Civil Engineering and Architecture, and Engineering Design and Development, as well as Biotechnical Engineering and Aerospace Engineering courses, which are under development.

PLTW's articulation agreements with many colleges allow qualifying students to receive college credit for PLTW courses. Participating students must take end-of-course exams and have the option to take the "college credit" portion of the assessment, which can help facilitate transfer of college credit for those courses. The program also offers teacher training, information on equipment needed, and a career awareness program for school counselors and students.

STRATEGIC OBJECTIVE 5

Delivery Systems

Institute innovative strategies for ensuring that students have access to career pathways, as well as opportunities for work-based learning and dual enrollment in related postsecondary courses.

Ideally, students should be able to select from a range of career clusters offered in their school, with each cluster encompassing multiple career pathways and providing opportunities for work-based learning and/or opportunities for continued studies at a postsecondary institution. Unfortunately, fiscal constraints, school size and location, and teacher recruitment issues can limit these options.

Maximizing student access to challenging, in-depth programs of study will require instituting statewide policies that encourage districts to create innovative school programs, form regional partnerships, and make more efficient use of human resources in the state.

STRATEGY 5.1
Promote the development and use of school-based delivery approaches, such as career academies or career magnets to organize instruction.

Most high schools should be able to offer students access to studies in a minimum of two career clusters, with two or more career pathways in each cluster. In some cases, career clusters can be integrated into the existing school structure with relatively little effort, for example by reorganizing the educational program to incorporate cluster themes. In other cases, schools will need to make scheduling changes to allow time for student projects, labs, or other activities and budget time and resources for faculty planning and curriculum design.

Some schools may seek to create alternative structures, such as "career academies," "career magnets," or other forms of "schools-within-schools," that allow both students and teachers to participate in one particular pathway as a well-defined group. In these school organizations, academic and technical teachers plan jointly and often engage in team teaching. Students rotate through their academic and technical classes as a group and, in some instances, across grades with the same teachers, reinforcing intra-grade connections and enhancing opportunities for applying academic knowledge and skill to a pathway's industry focus.

Action steps to achieve this goal

- Develop materials and provide technical assistance to assist school administrators and teachers in shifting to a focus on career pathways.

- Offer fiscal resources to provide administrators and faculty with release time to plan programs and curriculum both within and across districts and regions, to visit model programs, and to attend professional development conferences and workshops.

STRATEGY 5.2
Encourage districts to adopt regional strategies that encourage collaboration among districts and educational institutions.

Most high schools will be unable to offer more than four or five comprehensive pathways with the full complement of academic and technical courses. In high schools with fewer than 150 to 200 students, it will be difficult to offer more than two. Districts can, however, take advantage of regional assets to expand the range of options for students by:

- Collaborating with one or more neighboring districts to organize complementary cluster and pathway offerings;

- Arranging for inter-district transfer for students, on either a shared-time or full-time basis;

- Making more effective use of BOCES to reduce staffing and equipment pressures within a single school;

- Coordinating with nearby postsecondary institutions to deliver specialized academic and technical courses that diversify and enrich the curriculum; and

- Strengthening dual enrollment (which allows high school students to enroll in college-level courses) to provide more course options for high school students.

The Wyoming Department of Education can play an important role in developing statewide articu-

lation agreements, which clarify when a student can receive college credit and the responsibilities of each institution.

As evident on the Wyoming map on the next page, though schools and higher education institutions are spread out across the state, many are tightly clustered within a region. Although there are some drawbacks to transporting students across districts for services, including logistical difficulties related to scheduling and weather, regional collaborations can provide cost-effective means for expanding student program options.

Action steps to achieve this goal

- Provide incentives for schools districts to adopt regional delivery models.
- Develop a statewide articulation agreement for dual enrollment.
- Provide instructors with contractual release time to support collaborative planning.
- Foster collaboration by encouraging superintendents to align professional development calendars within a region so middle schools, high schools, and schools in other districts have common planning time.
- Consider dedicating statewide professional development days to create common planning time in districts and regions in a format similar to the former two-day Wyoming Interdisciplinary Conferences.

STRATEGY 5.3
Remove obstacles to hiring effective teachers.

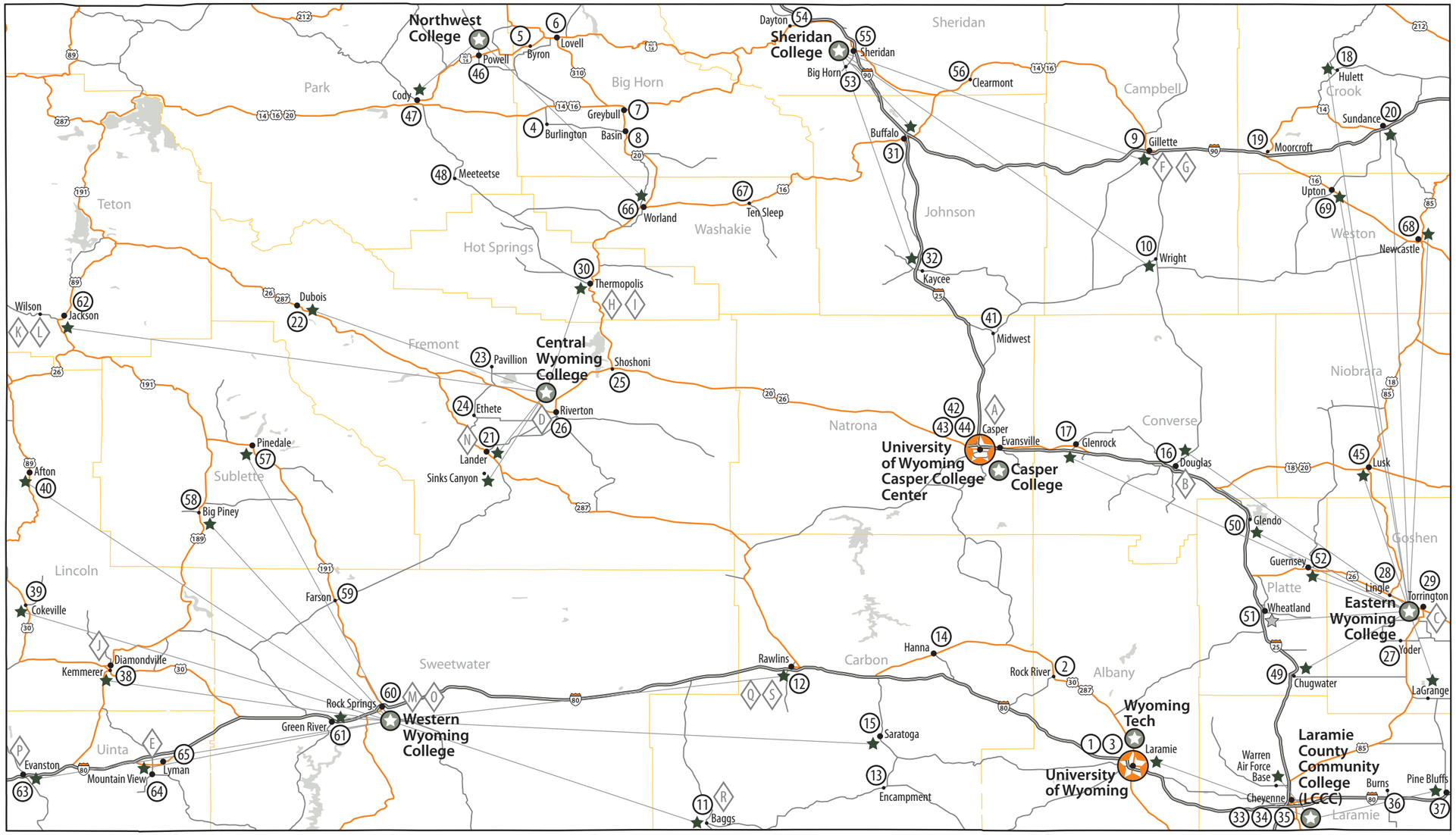
High school administrators face major challenges in hiring CTE instructors, in part because schools often cannot compete with the wages offered in the private sector. Finding qualified CTE teachers who are also capable of integrating rigorous academic skills into their technical coursework or who possess dual certification (i.e., who can teach both academic and career and technical courses) presents an even greater obstacle. These problems are compounded in small and rural high schools, which have difficulty attracting qualified instructors willing to live in an isolated community.

State teacher certification requirements complicate teacher recruitment efforts because individuals with specialized expertise, such as community college faculty or private sector employees, are prohibited from teaching in secondary classrooms unless they complete a state certification program. Expanding the pool of eligible teachers requires that the state undertake a critical review of its credentialing process to reduce district obstacles to hiring competent, highly trained instructors who lack formal certification.

As a starting point, the Wyoming Professional Teaching Standards Board should identify policies that hinder school districts from hiring higher education professionals who, other than lacking a secondary teaching credential, are highly qualified to teach at the secondary level. Providing allowances for industry experts who possess advanced degrees or who can provide evidence of instructional competency could also help reduce teacher recruitment barriers.

The Wyoming Department of Education should also take the lead in coordinating instruction across school districts that might otherwise be unable to hire a full-time instructor. For example, with appropriate legislative authority and funding, the Department should establish a Regional Teacher Corps of itinerant teachers, both academic and CTE, who would travel among two or more

Wyoming's Career and Technical Education (CTE) Institutions



Legend

- University
- College
- College Outreach Center
- (69) School serving any of grades 9–12 with CTE
- (A) BOCES/BOCHES
- City/town
- Interstate highway
- Highway
- Road
- County line
- Body of water

Universities

	City
University of Wyoming	Laramie
University of Wyoming—Casper College Center	Casper

Colleges & Outreach Centers

	City
Casper College	Casper
Central Wyoming College	Riverton
Outreach centers: Dubois, Jackson, Lander, Sinks Canyon, Thermopolis	
Eastern Wyoming College	Torrington
Outreach centers: Chugwater, Douglas, Glendo, Glenrock, Guernsey, Hulett, LaGrange Lusk, Newcastle, Sundance, Upton, Wheatland	
Laramie County Community College (LCCC)	Cheyenne
Outreach centers: Laramie, Pine Bluffs, Warren Air Force Base	
Northwest College	Powell
Outreach centers: Cody, Worland	

Colleges & Outreach Centers

	City
Sheridan College	Sheridan
Outreach centers: Buffalo, Gillette, Kaycee, Wright	
Western Wyoming College	Rock Springs
Outreach centers: Afton, Baggs, Big Piney, Cokeville, Evanston, Green River, Kemmerer, Mountain View/Lyman, Pinedale, Rawlins, Saratoga/Encampment	
Wyoming Tech (private for-profit)	Laramie

Boards of Cooperative Educational Services (BOCES)

	City
A Central Wyoming BOCES	Casper
B Douglas BOCES	Douglas
C Douglas BOCES/Eastern Wyoming College	Torrington
D Fremont County BOCES	Riverton
E Mountain View and Lyman BOCES	Mountain View
F Northeast Wyoming BOCES	Gillette
G Northeast Wyoming BOCES/Powder River Basin Children's Center	Gillette
H Northwest Wyoming BOCES	Thermopolis
I Northwest Wyoming BOCES/Big Horn Basin Children's Center	Thermopolis
J Oyster Ridge BOCES	Kemmerer
K Region V BOCES	Wilson
L Region V BOCES/C-Bar-V Ranch	Wilson
M Region V BOCES/Roosevelt Learning Center	Rock Springs
N Region V BOCES/Sunrise School	Lander

Boards of Cooperative Educational Services (BOCES)

	City
O Sweetwater BOCES	Rock Springs
P Uinta BOCES #1 Education Center	Evanston

Boards of Cooperative Higher Educational Services (BOCHES)

	City
Q Carbon County Higher Education Center	Rawlins
R Little Snake River Valley Education Center/ Carbon County BOCHES	Baggs
S Vocational Campus/Carbon County BOCHES	Rawlins

NOT PLOTTED

Alternative and charter schools not offering CTE at their sites in 2004–05 (may send students to another HS for CTE)

District	School Name	City
Campbell 1	Westwood High School	Gillette
Carbon 1	Cooperative High	Rawlins
Crook 1	Bear Lodge High School	Sundance
Fremont 1	Pathfinder High School	Lander
Fremont 21	Ft. Washakie Charter High Schl	Ft. Washakie
Fremont 38	Arapaho Charter High School	Arapaho
Lincoln 1	Kemmerer Alternative School	Diamondville
Lincoln 2	Swift Creek Learning Center	Afton
Sheridan 2	Fort Mackenzie	Sheridan
Sweetwater 1	Independence High School	Rock Springs
Sweetwater 2	Expedition Academy	Green River
Teton 1	Summit High School	Jackson
Teton 1	Western Wyoming High School	Jackson
Unita 1	Horizon Alternative School	Evanston

Schools serving any of grades 9–12 with CTE

No	District	School Name	City
1	Albany 1	Laramie High School	Laramie
2	Albany 1	Rock River High School	Rock River
3	Albany 1	Whiting High School	Laramie
4	Big Horn 1	Burlington High School	Burlington
5	Big Horn 1	Rocky Mountain High Schl	Byron
6	Big Horn 2	Lovell High School	Lovell
7	Big Horn 3	Greybull High School	Greybull
8	Big Horn 4	Riverside High School	Basin
9	Campbell 1	Campbell Cnty High School	Gillette
10	Campbell 1	Wright Jr/Sr High School	Wright
11	Carbon 1	Little Snake River Valley Schl	Baggs
12	Carbon 1	Rawlins High School	Rawlins
13	Carbon 2	Encampment High School	Encampment
14	Carbon 2	HEM Senior High	Hanna
15	Carbon 2	Saratoga High School	Saratoga
16	Converse 1	Douglas High School	Douglas
17	Converse 2	Glenrock High School	Glenrock
18	Crook 1	Hulett High School	Hulett
19	Crook 1	Moorcroft High School	Moorcroft
20	Crook 1	Sundance High School	Sundance
21	Fremont 1	Lander Valley High School	Lander
22	Fremont 2	Dubois High School	Dubois
23	Fremont 6	Wind River Secondary Schl	Pavillion
24	Fremont 14	Wyoming Indian High Schl	Ethete
25	Fremont 24	Shoshoni High School	Shoshoni
26	Fremont 25	Riverton High School	Riverton
27	Goshen 1	Southeast High School	Yoder
28	Goshen 1	Lingle-Ft Laramie High Schl	Lingle
29	Goshen 1	Torrington High School	Torrington
30	Hot Springs 1	Hot Springs County High Schl	Thermopolis
31	Johnson 1	Buffalo High School	Buffalo
32	Johnson 1	Kaycee High School	Kaycee
33	Laramie 1	Central High School	Cheyenne
34	Laramie 1	East High School	Cheyenne
35	Laramie 1	Triumph High School	Cheyenne
36	Laramie 2	Burns Jr/Sr High School	Burns
37	Laramie 2	Pine Bluffs Jr/Sr High School	Pine Bluffs
38	Lincoln 1	Kemmerer High School	Diamondville
39	Lincoln 2	Cokeville High School	Cokeville
40	Lincoln 2	Star Valley High School	Afton
41	Natrona 1	Midwest School	Midwest
42	Natrona 1	Kelly Walsh High School	Casper
43	Natrona 1	Natrona County High School	Casper
44	Natrona 1	Roosevelt High School	Casper
45	Niobrara 1	Niobrara County High School	Lusk
46	Park 1	Powell High School	Powell
47	Park 6	Cody High School	Cody
48	Park 16	Meeteetse School	Meeteetse
49	Platte 1	Chugwater High School	Chugwater
50	Platte 1	Glendo High School	Glendo
51	Platte 1	Wheatland High School	Wheatland
52	Platte 2	Guernsey-Sunrise High Schl	Guernsey
53	Sheridan 1	Big Horn High School	Big Horn
54	Sheridan 1	Tongue River High School	Dayton
55	Sheridan 2	Sheridan Jr High School	Sheridan
56	Sheridan 3	Arvada-Clearmont High Schl	Clearmont
57	Sublette 1	Pinedale High School	Pinedale
58	Sublette 9	Big Piney High School	Big Piney
59	Sweetwater 1	Farson-Eden High School	Farson
60	Sweetwater 1	Rock Springs High School	Rock Springs
61	Sweetwater 2	Green River High School	Green River
62	Teton 1	Jackson Hole High School	Jackson
63	Uinta 1	Evanston High School	Evanston
64	Uinta 4	Mountain View High School	Mountain View
65	Uinta 6	Lyman High School	Lyman
66	Washakie 1	Worland High School	Worland
67	Washakie 2	Ten Sleep High School	Ten Sleep
68	Weston 1	Newcastle High School	Newcastle
69	Weston 7	Upton High School	Upton

DATA SOURCE: Wyoming Department of Education, Statewide Payment Model FY2006-Final, VocEd Worksheet. Wyoming Department of Education, *2006–2007 Wyoming Education Directory*. Retrieved March 23, 2007, from http://www.k12.wy.us/A/directory/06_07directory.pdf. Additional data provided by the Wyoming Community College Commission.

districts. Any one high school would employ teachers on a part-time basis, for example, hiring an academic teacher to teach a Calculus class or a CTE teacher to offer a Principles of Engineering class. State funding would be provided to cover costs of transportation and the administration of the Regional Teacher Corps. With attention to the credentialing issues noted above, the Corps could include community college faculty and industry experts in addition to traditional secondary faculty.

A third strategy would be for the state to adapt its distance learning courses offered through the Wyoming Equality Video Network (WEN), or collaborate with other providers to design distance learning programs tailored to career pathways.

Action steps to achieve this goal

- Encourage the Professional Teaching Standards Board to provide more flexibility in CTE credentialing to help more qualified individuals become CTE instructors—particularly in technical areas with a shortage of teachers.
- Develop a Regional Teacher Corps of "itinerant" or shared instructors who can travel among school districts within a region to provide specialized instruction in both CTE and academic subjects.
- Tailor distance-learning capabilities within the state to address the career pathways approach.
- Develop oversight and accountability measures for the WEN to ensure that participating students are making sufficient progress and meeting performance benchmarks.

One Post-Graduation Option: The Apprenticeship

While many high school students head to two- or four-year colleges after graduation, still others pursue a somewhat lesser-known, yet well-established, option to prepare for the future: they enroll in an apprenticeship. Apprenticeships offer students an opportunity to learn a trade with careful supervision in a structured program while simultaneously finishing related coursework at an apprenticeship training center or community college. Through apprenticeships, students can become electricians, plumbers, plasterers, ironworkers, or tradespeople in various occupations. When they finish their programs, apprentices are awarded status as journeyworkers and are offered completion certificates, which allow them to work in a particular trade anywhere in the country. As they work side-by-side with master tradespeople, apprentices also earn wages, which increase as more instruction and work hours are completed.

To participate in an apprenticeship program, students must be at least 16 years of age and in many cases at least 18 due to hazardous occupations involved. Apprenticeship programs must submit and receive approval from the U.S. Department of Labor, Bureau of Apprenticeship Training for additional requirements specific to their program. In Wyoming, the carpenter's union requires that apprenticeship applicants hold a high school diploma or GED and pass the union's math test with a score of 70 percent or more. Once enrolled, participants are required to train in all phases of carpentry, working for a contractor during the day and completing 80 hours of related classroom work per semester. When they have completed the program, they receive their journeyman's card that they can use in the 50 states and Canada. Both men and women are admitted to the program (Wyoming Building Trades, personal communication, 2006).

Apprenticeships offer many advantages. Students earn while they learn a trade, learn academics and technical skills in a hands-on setting, and—upon completion of the apprenticeship—can have a skilled decent-paying career for the long term or, should they choose, a job for the short term that can help put them through college. High school students should be made more aware of this opportunity by their counselors, teachers, principals, parents, and community members.

STRATEGIC OBJECTIVE 6

Articulation

Ensure that the program of study for each career pathway is aligned with a wide range of postsecondary options.

Career pathways should be designed so that they are appropriate for any student, regardless of postsecondary education aspirations. A program in Health Science, for example, should be as appropriate for a student intent on becoming a cardiothoracic surgeon or social worker, as for one seeking an associate's degree in radiology or a certificate in nursing assisting. It is neither desirable nor necessary to design separate pathways that "track" high school students into particular postsecondary opportunities.

Articulation should occur at many levels. Middle and junior high schools should align their programs to career pathways in nearby high schools so that students enter high school with an understanding of their career options and the coursework needed to realize them. In middle school, studies should focus on career exploration activities that expose students to the range of occupations available in the workforce and help students better understand the academic and technical knowledge needed to succeed in high school pathways and future careers.

High schools should articulate their programs so that students completing a career pathway may easily transition to postsecondary studies—in two-year and four-year colleges, the military, apprenticeships, and public and private institutions offering subbaccalaureate certification. Ideally, students should not only understand the types of studies they will need at the postsecondary level, but also be able to identify specific institutions offering the program that matches their interests. They should also be able to apply their secondary credits toward a postsecondary certificate or degree.

To illustrate, a high school program might specify how students who have completed the Restaurants and Food/Beverage Services pathway in the Hospitality and Tourism career cluster might apply their credits at a Wyoming community college. In some instances, a school might develop a formal articulation agreement with a neighboring college or community college, so that students can move directly from high school to a program that has already indicated a willingness to accept the student.

STRATEGY 6.1
Develop articulation models and pursue statewide articulation agreements to align secondary career pathways with their associated postsecondary programs of study.

Each school district will need to align its own cluster and pathway options with those of postsecondary education, other institutions within the state, and specific agencies. To do so, secondary educators will require models that will help them identify possible linkages with University of Wyoming and community college programs, as well as regional BOCES programs.

Providing this information will help students to focus their studies while in high school, as well as offer the assurance that they are being prepared for postsecondary entry without the need for remediation. Articulating secondary and postsecondary programs can also lead to instructional efficiencies, because it helps school administrators invest in equipment and facilities appropriate for their programs.

Action steps to achieve this goal

- Map clearly how programs of study in high school lead directly, through statewide articulation agreements and other policies, to related majors in two-year and four-year colleges, apprenticeship, and other forms of subbaccalaureate certification, military training, and formal employment training opportunities in related industries.

- Develop model articulation agreements that school districts and community colleges can use to align coursework.

Statewide Articulation Agreements Help Student Transitions

Articulation agreements between secondary and postsecondary institutions serve as informal contracts that guide decision-making within each level and coordination between the levels. Agreements can detail which courses and content are covered at each level, helping both systems to maximize the use of resources and avoid duplication of courses and content. Agreements also can detail dual enrollment guidelines—such as which courses qualify for college credit, who can teach them, and at which sites.

Wyoming currently allows local agreements in which various institutions in a region enter into agreements with each other. While this helps secondary and postsecondary institutions to tailor agreements to their local needs, it can inadvertently cause confusion for students who transfer to another district or decide to attend a community college not near their local school district. For example, a Cody student completing a Therapeutic Services pathway in the Health Sciences cluster during high school and hoping to pursue an A.S. degree in physical therapy should be equally prepared to start a program at both Northwest College and Laramie County Community College.

States such as Texas, Florida, and North Carolina have statewide articulation agreements, which attempt to address this issue. North Carolina's agreement outlines:

- procedures to follow to identify and align courses (e.g., read course descriptions, determine if competencies are similar).
- criteria used to award college credit for high school courses (e.g., grade of B or higher in the course, specific score on the CTE post-assessment).
- process for documenting college credit for high school courses (e.g., obtain high school transcripts to verify acceptable grade, determine how to reflect the course on the high school and college transcripts).
- measures for evaluating the articulation agreement (e.g., do criteria for awarding credit ensure student success in college courses; do articulated course lists reflect current curricula; how many students are receiving articulation credit).

Texas offers an Articulated Course Crosswalk by cluster area. The crosswalk chart lists a college level course in one column and corresponding high school courses in another column, including how many college credits the high school course is worth, any enhancements needed to bring the course to college level, or a combination of courses that would equal a college-level course. Each course name links to a course description; learning outcomes; expected competencies; and textbook, hardware/software, and tool recommendations.

STRATEGIC OBJECTIVE 7

Teacher Preparation

Increase the number of teachers who are highly effective in teaching academic and technical courses in new pathways of integrated academic and technical study.

Adapting existing curriculum and instructional practices to offer challenging, integrated career pathways based on both academic and technical courses will require significant attention to teacher preparation and professional development for existing teachers. While CTE teachers are more likely to be experienced in project-based or cross-disciplinary learning, they usually lack advanced academic subject area knowledge and have received little, if any, formal training in integrating academics into their technical coursework. Academic teachers, on the other hand, usually have limited experience in technical fields and in helping students understand the industry applications of the academic knowledge they teach. Implementing coordinated academic and technical programs on any scale will require attention to well-designed professional development of existing teachers, both academic and technical, as well as changes in the recruitment and preparation of new teachers. Building a cadre of teachers who understand the benefits of integrating curriculum and instruction and have the tools and methods needed to implement changes can help lead change in schools, facilitating a smoother and faster transition to integrated programs.

STRATEGY 7.1
Strengthen teacher preparation programs.

To help guide professional development and teacher preparation, the Wyoming Department of Education should undertake, in collaboration with industry representatives and faculty in postsecondary professional departments, a thorough and systematic determination of what secondary academic and technical teachers need to know and be able to do to teach their respective subjects in comprehensive, industry-focused pathways of academic and technical study.

This will likely require identifying the training that technical instructors need to teach academic concepts associated with their particular industry or profession and academic teachers need to connect their particular discipline (e.g., algebra, biology, or world history) to the context and authentic applications of industry. When these requirements have been clearly identified, state procedures for teacher certification should be modified accordingly.

Additionally, the state should encourage major providers of teacher education to develop programs explicitly designed to prepare academic and technical teachers who will instruct in comprehensive pathways, with attention to such considerations as curriculum integration, joint planning, project- or problem-based learning, contextualized learning, work-based learning, authentic assessment, and other essential aspects of instructional practice directly related to effective delivery of career pathways. When appropriately prepared, these teachers will be able to help schools implement instruction and curriculum focused on both academic and technical content.

Programs should also encourage candidates to pursue dual certification in academic and technical subject areas. Conversations with state educators suggest that CTE teacher candidates often lack only a few credits to obtain credentials in a second area—such as consumer science candidates needing only a few courses to obtain a science certification. With some modest financial incentives, the number of candidates completing dual certification could be increased significantly.

Action steps to achieve this goal

- Engage industry and postsecondary educators in identifying what teachers/administrators should know and be able to do to provide integrated instruction.

- Identify instructional strategies that can be used in teacher preparation programs and, if necessary, modify state credentialing procedures to prepare beginning teachers to provide instruction using the pathways model.

- Work with higher education institutions to modify teacher preparation programs to emphasize agreed-upon elements that teachers should know and be able to do.

- Ramp up existing higher education teacher preparation programs to increase the number of teachers entering the Wyoming workforce who have the necessary skills to integrate technical and academic content. Encourage this cadre of teachers to help schools make the transition to integrated curriculum and instruction.

- Provide financial incentives to encourage students enrolled in teacher preparation programs to complete dual certification in CTE and an academic discipline.

STRATEGY 7.2
Provide professional development to assist existing teachers in understanding and transitioning to using career clusters and pathways to organize instruction.

Ultimately, the success of the career clusters and pathways initiative will depend on convincing the existing workforce of the benefits of the approach. While some instructors will likely resist change, others will be receptive, particularly if they experiment and find success with new curriculum approaches. To date, academic and CTE instructors have tended to work in isolation from one another, and the existing physical layout and administrative organization of schools reinforce this separation.

Changing faculty attitudes will require providing intensive training to teachers, to help them understand both why the pathways approach offers benefits and how to institute classroom changes, including collaborating to develop strategies to ensure their success. Doing so will require technical assistance, in the form of curriculum materials illustrating integrated instruction and opportunities for teachers to share experiences and practices demonstrated to work.

The Wyoming Department of Education should lead this endeavor, sponsoring efforts to develop an instructional infrastructure that includes examples of exemplary programs, courses, curriculum materials, lesson plans, and assessments that can be adopted or adapted by local educators. The state should also take the lead in providing statewide or regional professional development conferences to assist district staff in adopting the pathways approach. Teachers receptive to the changes should be encouraged to help lead the transition in their schools.

Action steps to achieve this goal

- Distribute examples of exemplary curriculum materials and suggested instructional strategies to encourage academic and technical teachers to collaborate in developing integrated coursework.

- Provide start-up resources to support the initial development of integrated curricula including:

    - incentives for schools to offer release time or in-school preparation time for teachers to adopt (or adapt) academically and technically integrated curriculum materials.

    - incentives to encourage neighboring districts of all sizes to work together. For example, the state might offer additional professional development funds to regional collaboratives consisting of districts with small, moderate, and large enrollments.

    - resources to enable Wyoming instructors to visit exemplary programs and network with other schools that have successfully instituted the pathways approach.

- Conduct statewide or regional professional development workshops focused specifically on training teachers to incorporate technical material into their academic coursework and vice versa. Encourage the exchange of ideas across districts and regions.

- Create communication networks among academic and technical instructors, for example, by developing a listserv and/or moderated web blog.

- Work with employers to create summer placements to allow academic teachers to see how academic knowledge is applied in the workplace.

STRATEGY 7.3
Strengthen preparation and support for administrators.

Administrators will play a critical role in facilitating the implementation of career pathways. Besides recognizing the benefits of the approach, administrators will need to understand the key programmatic elements necessary for its adoption. For example, principals will need to understand the scheduling requirements, staffing needs, and planning time necessary to introduce effective CTE programs, as well as the criteria for evaluating teachers who have adopted the approach.

Action steps to achieve this goal

- Identify key elements that principals may need assistance with to successfully operate a school that integrates academic and technical programs.
- Develop and offer ongoing professional development that incorporates identified key elements and helps principals learn how to support the comprehensive approach.
- Encourage higher education institutions to modify their administrator preparation programs to incorporate key elements that principals need to know and be able to do.

How Other States Help Teachers Integrate Academic and Technical Material

Depending on their training and work experience before entering the profession, teachers may lack adequate preparation in pedagogy, academic content, or even CTE content. States are attempting to improve teachers' abilities to offer courses with integrated academic and technical material.

Idaho has developed a course to teach integration methods to both prospective and current teachers. Teachers develop lesson plans integrating reading, writing, and mathematics content aligned with the state's academic standards into their CTE classes. Some models are maintained in an online library. While the course is aimed primarily at CTE teachers, academic teachers working with them are also encouraged to enroll. Teachers can enroll for graduate or undergraduate academic credit or in-service credit. Stipends are offered to offset some of teachers' costs.

Kentucky has developed 10 high school courses that integrate academic and technical material. The state outlines key technical components and aligns them with academic standards, which helps teachers design lessons integrating both elements. In some cases, the state has also provided sample activities and sample extensions for diverse learners—giving teachers even more information as they develop lesson plans.

The Construction Geometry course covers all 23 state content standards for geometry while providing the technical knowledge relevant to the construction industry. The state's outline pairs learning to "calculate the amount of concrete needed for footing and foundation wall" with learning about perimeter, area, and circumference, as well as the volume for a prism, sphere, cone, cylinder, and other figures. To lay out and install stairs, students must "connect geographic diagrams with algebraic representations."

While Kentucky's 10 interdisciplinary courses cover the state's standards for geometry, life science, or economics—and can be substituted for those academic courses' graduation requirements—teachers still have freedom to choose how to teach the material.

STRATEGIC OBJECTIVE 8

Assessment

Create assessments that evaluate students' mastery of both academic and technical knowledge, as well as the core skills essential for career success.

State assessment policies and practices strongly influence local curriculum and instruction, as well as students' expectations about what they must learn. Wyoming has already made considerable progress in developing assessments of technical knowledge and skills that supplement more conventional academic tests. The state should continue to build on this foundation, adapting it as necessary to reflect the industry sectors and related content standards.

STRATEGY 8.1
Adapt the Wyoming Career and Technical Assessment (WyCTA) to provide standards-based assessment of both academic and technical knowledge in each of the career clusters adopted by the state.

Wyoming currently monitors the skill attainment of CTE concentrators—students completing three or more courses in a CTE sequence—using the WyCTA, an electronic, state-developed testing instrument that assesses a broad set of work-readiness skills common to all CTE programs. Assessment areas within the WyCTA directly align with the state's broadly defined performance standards and benchmarks for CTE. Because performance standards such as interpersonal skills or technology are common across CTE program areas, the current assessment does not measure students' mastery of technical skills unique to a cluster area or the associated academic content.

One approach to test development would be for Wyoming to contract with a private vendor to design or adapt an existing assessment to meet state needs. Examination of vendor-driven systems suggests that states using them may face somewhat lower start-up costs than states developing their own exams. Savings occur because state administrators do not need to convene task forces to create and validate the assessments for each occupational area. States do, however, face ongoing costs for test licensing and administration that should be considered in any benefit-cost analysis.

While adopting other existing exams might be another option, to date, no comprehensive national assessment has been developed to address specific cluster areas, although the national States' Career Clusters Initiative is working to develop such assessments. As an alternative to contracting out, Wyoming could opt, as many other states have, to create its own cluster-based assessments or to adopt certification exams used by industry to assess worker competency. Aligning assessments with placement exams at community colleges and the University of Wyoming can also help let students know if they will need to take remedial courses if they want to enroll in postsecondary education after high school.

The WorkKeys assessment system, which measures mastery of skills used in the work world, can play an important role in assessing student knowledge and skills. It tests the ability of students to apply what they have learned in school to work situations. This test can continue to play an important role as one in a range of assessment tools used by state or local entitites.

Action steps to achieve this goal

- Convene a working group—comprised of academic and CTE instructors, postsecondary educators, and representatives of business and industry—to adapt the WyCTA to students' technical skills in career pathways associated with a cluster area, by:
    - Contracting with a private vendor to develop an assessment aligned with the state's new technical and academic standards for CTE; or
    - Identifying industry certification exams that align with or can be adapted to align with state standards; or
    - Reviewing existing state cluster assessments to determine the potential for adapting them for state use.

STRATEGY 8.2
Provide incentives for students to take and pass appropriate certification exams in sectors or clusters with occupations requiring formal certification (e.g., nursing and other health-related occupations, information technology, etc.).

Students completing studies in a career area may qualify to take technical certification exams as part of their educational program. To encourage districts to offer, and students to participate in, career pathways that include formal certification, the state could provide incentives to reward students who take and pass industry-recognized certification exams.

For example, the Virginia State Board of Education offers students a CTE seal on their high school diploma if they fulfill requirements for a standard or advanced studies high school diploma, complete a prescribed sequence of courses in a CTE program, and either maintain a B or better average in CTE courses, acquire a professional license in a CTE field, or pass an exam for certification from a recognized industry or professional association. As part of this requirement, the state has compiled a list of acceptable national industry certification exams (e.g., ASE), as well as endorsed 48 occupational competency exams developed by NOCTI. Other states, such as New York, have adopted similar approaches.

Action steps to achieve this goal

- Consider developing criteria for and adopting a career-cluster or technical endorsement for the Wyoming high school diploma.

- Identify national or industry certification exams that align with pathways within each of the 16 cluster areas and offer incentives to students for passing them.

STRATEGIC OBJECTIVE 9

Finance

As needed and appropriate, modify the state's school finance system to support development and implementation of the career clusters and pathways approach.

Wyoming has invested considerable resources in designing and implementing a system of school finance that supports the provision of high-quality public education for all youth. Although various parties continue to challenge the legality of the state's new school finance system, in January 2006 the Wyoming Superior Court ruled that the legislature has largely satisfied its mandate to make constitutionally required changes. The Court implied, however, that the work of improving educational instruction is subject to ongoing review, and that work in some areas, including career and technical education, is not yet complete.

STRATEGY 9.1
Specify pathway courses eligible for weighted funding and, if needed, adjust the current career and technical education weight of 1.29 to reflect new class size requirements, program minima, and special requirements of very small schools.

Under the current funding formula, local agencies are provided a 1.29 weight for each full-time-equivalent CTE student, compared with a 1.0 weight for a student in regular education classes. This weight was established by analyzing statewide class size data for academic and career and technical instructors in 2001–02. The 1.29 weight for CTE students was premised on the provision of coursework categorized as either academic or vocational in content. Consequently, only students participating in courses that are part of a state-recognized career and technical education sequence, typically taught by an instructor with a vocational endorsement, qualify for additional weighting. Although funding is allocated to districts based on CTE enrollments, districts retain flexibility in how they spend these funds. This means that district administrators who receive funds generated by CTE enrollments may choose to allocate those resources for other, non-program-related purposes.

As districts move to adopt the career pathways model, the distinction between academic and technical coursework may begin to blur as academic and technical instructors collaborate to integrate instruction within cluster pathways. Whether these new contextualized instructional programs will cost more to provide than traditional academic coursework is an open question.

While the manner in which instruction is offered will certainly affect cost, the development of curriculum standards and assessments within cluster areas should help indicate a reasonable amount of funding needed for equipment, supplies, and instruction. Moreover, a number of districts have already adopted the pathways model using their current funding system to maintain program offerings, suggesting that it is possible to institute the clusters model without introducing additional resources into the system.

Action steps to achieve this goal

- Quantify the cost of providing pathways instruction compared with regular coursework. Based on these findings, the state could choose to:
    - Develop a pathways weight to compensate districts for any additional cost associated with using the career clusters model and fund all full-time-equivalent students in districts adopting career pathways at this differentiated weight; or
    - Attach no additional weight to academic courses within the pathways sequence, but apply the 1.29 weight for sequences of CTE courses associated with a cluster pathway, as the current formula provides.
- Consider recalibrating the career and technical education weight to reflect demographic changes since the original weight was specified.

STRATEGY 9.2
Provide fiscal resources to support the development of content standards, curricula, and assessments.

It is anticipated that the Wyoming Department of Education will provide leadership and direction in drafting the instructional materials needed to introduce career clusters. While it is beyond the scope of this plan to quantify the cost of development, the state may need to add additional staff to lead development teams and to train local educators in the use of the standards, curriculum, and assessments. Additional funding will also be needed to convene development teams and to compensate members for their travel and lodging costs.

To help estimate costs, the state should start by consulting with standards developers in other states and considering the potential for adapting existing standards for state use. The state should also fund pilot projects within a limited number of clusters to help determine development costs and to create a model for use in other clusters.

Action steps to achieve this goal

- Fund the development of standards, model curriculum, and assessments for three to five clusters to determine development costs required to complete this process for the remaining clusters.

- Use findings from pilot efforts to quantify the actual cost of development and the process for guiding further development work.

- Provide funding to support pilot demonstrations and evaluations of career pathways in selected schools and school districts.

STRATEGY 9.3
Provide fiscal or other incentives to support educators in implementing the pathways approach and for local schools and districts in coordinating with other school districts, BOCES, and postsecondary systems to deliver instruction.

Although much of the front-end development of curriculum standards and assessments will be borne by the state, local educators will need to invest resources in adapting state materials for local use. Administrators will also need time to plan and implement career pathways models. To support educators in developing career pathways models, the state should offer fiscal or other incentives to promote district adoption of this approach.

To determine the type and amount of resources needed to support cluster design, the legislature should consult with the Wyoming Department of Education to identify the number of districts likely to pursue funding in a given year and the estimated cost of carrying out planning activities. To ensure that resources are distributed fairly, the department also should develop priorities for awarding incentives, for example, by allocating resources to ensure that large and small districts and those with different investments in career and technical education can participate in the development effort.

Action steps to achieve this goal

- Establish a statewide grant program, administered by the Wyoming Department of Education, to offset start-up costs associated with the development of integrated curriculum.

- Consider prioritizing funding for proposals that promote inter-district or regional collaboration in implementing pathways programs—particularly proposals in which three or more districts participate and small, medium, and large districts are represented.

STRATEGY 9.4
Provide appropriate categorical or formula-based support for equipment and supplies based on newly developed content standards, curriculum, and assessments.

In the absence of clear content and performance standards defining what students are expected to know and be able to do, MPR was unable to determine what constituted a reasonable expenditure for equipment and supplies in its November 2002 study. Since material requirements for a given class can range from cutting-edge technology to older equipment, MPR researchers reasoned that basing expenditures and supplies on average statewide spending provided some assurance of increased equity among districts, since schools emphasizing capital-intensive programs were balanced out by those emphasizing more general skill instruction.

According to district administrators, the $7,731 distributed for equipment and supplies, based on the number of full-time-equivalent CTE instructors employed in a district, is inadequate in part because this amount is based on district expenditures at a time when statewide spending for career education was in decline. However, the introduction of the new state funding formula in 2005 infused additional resources into the educational system, which may have helped alleviate some of the pent-up demand for equipment replacement.

Action steps to achieve this goal

- Identify the types of equipment and supplies educators require to teach to the academic and technical content standards identified for each cluster and career pathway.

- Conduct an audit of district CTE equipment to quantify the cost of bringing all districts to a minimum level of program quality, as determined by the state content standards.

- Conduct an audit of school facilities to assess whether existing infrastructure can accommodate instruction organized around the career clusters and pathways approach.

STRATEGIC OBJECTIVE 10

Accountability

Improve career and technical programs over time through ongoing monitoring and collection of student and program performance data.

Career clusters and pathways are intended to improve student outcomes within Wyoming. To ensure that program changes are producing their desired effect, state administrators will need to collect data on both student and program outcomes, as well as district efforts to adopt the clusters initiative. In particular, strategies outlined in this plan aim to increase rates of student engagement in school, student achievement in both academic and CTE subject areas, and student preparation for college and career. By monitoring whether those aims are being met and other unintended benefits are emerging, the state can continue with its current pathways adoption or adjust its course as necessary.

STRATEGY 10.1
Develop an accountability system to assess the effect of the career clusters and pathways model.

To quantify the effect of the clusters model, the state should identify and collect valid and reliable data on district efforts to implement career pathways and their effect on student performance and program outcomes. Data collection may include existing state data or new measures developed by the state. Examples of these types of measures are provided in Chapter 2 of this report.

Action steps to achieve this goal

- Determine process and outcome indicators that can be used to gauge the success of the clusters model approach.
- Collect annual data on program performance.

STRATEGY 10.2
Use performance outcomes to identify promising program strategies, to reward school districts making exemplary progress, and to target technical assistance to underperforming schools.

Once collected, data must be interpreted and used. One obvious use is to identify programs that appear to be having above-average success in using career clusters and pathways to deliver instruction. Another is to provide incentives based on school performance, irrespective of whether districts adopt the clusters model.

Action steps to achieve this goal

- Review district performance on an annual basis and publish information about district performance to allow administrators to compare their performance with other programs.
- Determine if additional staffing is needed to collect and monitor data and provide necessary funds.
- Adopt incentives to reward districts that show outstanding progress and offer technical assistance to those in need of improvement.

CHAPTER 4

Implementation Considerations

In some respects, developing a system of comprehensive pathways of challenging academic and technical study, organized around the major industries that will be the mainstay of the Wyoming economy over the next half century, sets a bold and demanding goal for the state. Without a doubt, anchoring high school academic and technical studies within broad industry contexts—creating integrated programs that prepare students for *both* college and career—is not business as usual for either academic or career and

technical education, as currently designed and offered in most high schools in Wyoming.

In other respects, however, Wyoming is well on its way to realizing this goal. The state has already adopted a program framework for CTE using broad career clusters to expand the traditionally narrow occupational focus of vocational education. Important work has already been done on developing educational content standards and assessments. The current finance system now provides districts with significantly more support for developing and expanding high-quality CTE offerings and recognizes differences among school districts in the intensity of services they seek to offer.

Moreover, a number of schools and school districts have already implemented comprehensive programs of both academic and CTE instruction that use career pathways to frame educational programs and have introduced career academies or other innovations to provide services in a focused, efficient manner. There is, therefore, a solid foundation on which to build toward a new system.

Achieving proposed objectives will, by necessity, occur in stages, recognizing that individual schools and school districts vary in their readiness to move toward a fully integrated system. Although this strategic plan lays out a wide-ranging set of recommendations to support the state in making systematic change, several constraints make it unlikely that the state will be able to move forward simultaneously on all fronts. And some work, such as the development of statewide assessments, cannot occur until preliminary work, including the development of content standards within pathways, has occurred.

At least five steps are essential to move incrementally but steadily toward achieving longer-range statewide objectives:

1. *Establish a statewide steering committee to guide pathways adoption.*

   Although the strategic goals and action steps outlined in this report offer a starting point for structuring statewide development activities, ultimately it will fall on the state legislature or its designee to organize and implement recommendations presented here. To guide system development, the legislature should establish a steering committee to coordinate statewide activities and oversee system design and adoption. Ideally, this committee would be composed of policymakers, state department of education and BOCES staff, representatives of business and labor, and leaders from the community college and university systems. The legislature may also wish to consider providing supplemental resources to enable the Wyoming Department of Education to hire additional staff and obtain additional assistance to implement steering committee recommendations.

2. *Strengthen core CTE programs and curriculum.*

   Wyoming Department of Education staff must continue to provide leadership in refining the overarching career cluster frameworks, which includes enumerating the specific academic and technical content standards within cluster areas; improving the existing WyCTA assessment to measure student attainment of industry-based skills; and developing standards for equipment and supplies appropriate for cluster-oriented programs of study. Over time, as content standards are identified, state staff will also need to take a lead role in identifying and disseminating curriculum products that local educators can adapt for classroom use.

3. *Conduct pilot demonstrations of comprehensive career pathways.*

   Statewide support will hinge on the ability of Wyoming educators to demonstrate conclusively—in Wyoming schools with Wyoming students—the contribution that a pathways approach can make to school improvement. To showcase system benefits, the state will likely need to pilot a series of demonstration models in a small number of school districts (say, three to five) strongly committed to developing integrated programs of study. Ideally, sites selected for demonstration purposes would already have implemented some of the action steps contained in this plan, and staff should be willing to work with education experts to review their existing programs and, where necessary, make changes to improve instructional services.

   Demonstrations should provide information on how schools can 1) undertake systematic program planning, 2) select among clusters to identify two or more industry sectors for program delivery, and 3) provide technical assistance for curriculum planning and professional development. Selected sites must also be willing to collect data on a set of student and school performance indicators common across demonstration sites.

4. *Strengthen professional development and teacher preparation programs.*

   Restructuring high school programs will require outfitting instructors with the knowledge and skills necessary to implement the career pathways model. This will entail enhancing the existing workforce's skills as well as instituting procedures for preparing new instructors to enter the field. This will likely require Wyoming Department of Education staff to provide statewide and individualized technical assistance to support local school district and postsecondary institutional educators in planning the adoption of pathways. Simultaneously, department staff will need to coordinate with teacher education professionals at the University of Wyoming to ensure that induction programs prepare teacher candidates to integrate academic and technical education into the type of challenging programs of study called for in this report.

5. *Evaluate improvements to career and technical education instruction and delivery.*

   Wyoming state administrators must be able to demonstrate conclusively the contribution that the pathways approach makes to education in general and career and technical education in particular. To do so, the state will need to derive a set of outcome and process indicators for data on student achievement (academic and well as technical), attendance, on-time grade-to-grade transition, high school completion, postsecondary transition, and state progress in developing content standards, curriculum, and assessments. The state will also need to undertake systematic formative evaluations of its career and technical programs to support continuous improvement and, as appropriate, expansion and replication of the pathways model throughout the state.

The proposals put forward in this report lay out a challenging scope of work for Wyoming educators. As demanding as this task may seem, Wyoming has instituted a solid foundation for financing a career and technical education system and continues to make progress in improving the delivery of instructional services.

The recommendations contained in this strategic plan will help the state to more clearly identify the purposes of CTE instruction in Wyoming, and in particular, the academic and technical content within programs and the equipment and supplies needed to teach that content. This plan is intended to serve as a foundation for preparing all youth for postsecondary success and career entry, providing them with the knowledge and skills that will allow them to make more informed decisions about their education and their future.

Appendix

Interviews Completed

Rollin Abernethy
University of Wyoming

Rocky Anderson
Wyoming Electric JATC

Sandy Barton
Wyoming State Board of Education

Tex Boggs
Western Wyoming Community College/
Wyoming State Senate

Kathy Emmons
Department of Workforce Services

Matt Grant
Wyoming Mining Association

Mary Kay Hill
Wyoming Department of Education

Audrey Kleinsasser
University of Wyoming

Dave LePlant
School Facilities Commission

Jim McBride
Wyoming Department of Education

Tom Martin
Wyoming Department of Education

Donna Murray
School Facilities Commission

Dave Nelson
Legislative Services Office

Mike O'Donnell
Office of the Attorney General

Kay Post
Wyoming Department of Education

Jim Rose
Community Colleges Commission

Joe Simpson
Wyoming Department of Education

Adele VanPatten-Gorny
Wyoming Professional Teaching Standards Board

Charlie Ware
Wyoming Contractor's Association/
State Workforce Investment Board of Wyoming

Tim Wells
Wyoming Building Trades

Teri Wigert
Wyoming Department of Education

Site Visits Conducted

Campbell County School District #1
Gillette, WY
Conducted with assistance from:
Lyn Velle, *Board of Cooperative Higher Education Services Consultant*

Platte County School District #1
Wheatland, WY
Conducted with assistance from:
Katie Carmin, *Special Education Director*

Laramie County School District #1
Cheyenne, WY
Conducted with assistance from:
Jeff Stone, *Career/Technical Education Coordinator*

Sweetwater County School District #1
Rock Springs, WY
Conducted with assistance from:
Randall Wendling, *Principal*
Jamie Christiansen, *Associate Principal*
Jason Fuss, *Activities Director*
Ron Kalicki, *Curriculum Director*
Ted Schroeder, *Career Technical Education Instructor*

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