The Report of the

Commission for a College Ready Texas

November 2007

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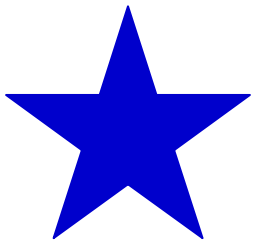


Executive Summary

The Commission for a College Ready Texas (the Commission) was appointed in April 2007 by Texas Governor Rick Perry and is composed of 21 individuals and a chair who have distinguished themselves in business, education, and community service. Also serving on the Commission are eight Vertical Team co-chairs. They are aided by four ex-officio members, including the Commissioner of Education and the Commissioner of Higher Education.

The Commission was created to engage all Texans in a discussion of what skills and knowledge a student must possess to be college ready and to provide expert resources and general support to the Vertical Teams and the State Board of Education (SBOE). House Bill 1 (79th Texas Legislature, 3rd Called Session, 2006) requires the SBOE, the body holding the statutory authority for public school curriculum, to incorporate college readiness standards into Texas' foundation curriculum—the Texas Essential Knowledge and Skills (TEKS). To assist the SBOE with its charge, HB1 directs the Commissioners of Education and Higher Education to appoint high school and college faculty to Vertical Teams to develop college readiness standards for English language arts, mathematics, science, and social studies. After a period of public comment, college readiness standards will be submitted for approval by the Commissioner of Education and the Texas Higher Education Coordinating Board (THECB) and submitted to the SBOE for its consideration. Final authority to incorporate these standards into the TEKS rests with the SBOE.

The Commission addressed several key questions in its effort to provide resources and support to the Vertical Teams as they drafted college readiness standards and to the SBOE in aligning high school curriculum with college standards:

- How is college readiness defined?
- Is college readiness the same as workforce readiness?
- What do data say about the college readiness of students nationally and in Texas?
- What are the costs of students not being ready?
- What is the evidence supporting the calls for increased rigor in K–12 courses?
- How well do existing TEKS standards for English language arts align to exemplary standards?
- How well do existing TEKS standards for mathematics align to exemplary standards?

- How do nationally recognized college readiness standards define knowledge and skills and what evidence supports the validity of the standards?
- What does college readiness mean to Texans—parents, students, teachers, college faculty, employers?

This report answers these questions using research and opinion from a variety of recognized experts in Texas and throughout the nation as well as from testimony the Commission received from a broad spectrum of citizens throughout Texas. It provides data and analysis that suggest the level of proficiency required to ensure that students are prepared for success in entry-level college courses or the skilled workplace. It compares the required level of proficiency with the standards offered by the Vertical Teams in English language arts, mathematics, and science. It compares Texas' current English language arts standards (TEKS) to other standards. This report provides research on the role that postsecondary developmental education plays in college success or failure. The information presented herein is intended to serve as guidance for policymakers and key stakeholders and should not to be confused with state curriculum standards, which consist of much more specific statements of skills and concepts necessary at each grade level.

It also is important to note that the information presented in this report represents the first step in a long process. The next steps include the contemplation of these findings and recommendations by the SBOE as it determines how to best write specific grade-level curriculum standards that will put students on track to be college ready when they graduate. Additionally, policymakers will need to address the development of instructional materials, teacher professional development, and student end-of-course assessments to ensure that each is aligned with college readiness standards.

The Commission provides the following findings and recommendations to state and local policymakers including the Governor, Texas Legislature, SBOE, THECB, and the Commissioners of Education and Higher Education; public schools; higher education institutions; education, community, and business leaders; parents; students; and all Texans on how to improve the postsecondary readiness of every Texas high school graduate.

Findings of the Commission

Understanding and Redefining College Readiness

- Definitions of college readiness vary, but most concur that readiness is the attainment of the core knowledge and skills necessary to succeed in the first year of education after high school without the need for remedial/developmental education.

- Today's knowledge-based, global economy requires all youth to acquire education after high school to be competitive, successful, and earn an adequate income.
- Today the options for education after high school are vast and include technical training, the military, and 2-year college and 4-year university programs.
- The essential knowledge and skills required for post-secondary readiness, no matter what option is chosen, are the same, although many students may want to consider even more rigorous coursework.
- The K–12 public school curriculum must be made more challenging to ensure that all students graduate with the prerequisite knowledge and skills to succeed after high school. Students, faculty, counselors, and administrators can no longer view the senior year in high school as a let-down or "marking-time" interval. Academic intensity must continue through the 12th grade if students are to obtain the knowledge and skills necessary for college and workplace success.
- Preparation for college readiness must begin in kindergarten and progress through 12th grade.
- Texas high school graduates today are unprepared for the rigor of college courses, and there is a disconnect between the current exit-level Texas Assessment of Knowledge and Skills (TAKS) passing standards—the requirement for high school graduation—and the level of performance needed to be college ready.

Need for College and Career Readiness

- Educational attainment, such as receiving a high school diploma or completing an associate's or bachelor's degree, significantly influences an individual's expected earning potential.
- The majority of high school graduates in the United States intend to complete some form of post-secondary education but do not complete their education after high school.
- The vast majority of Texas public school graduates who intend to acquire post-secondary certification or a degree are less prepared to succeed than most of their peers throughout the nation.
- The business community in Texas supports the development of more rigorous standards for high school graduation.
- Lack of rigor in curriculum standards leads to poor educational attainment. This puts Texas and our students at a competitive disadvantage in the global economy in which they are required to compete. Although higher education enrollment is growing slowly

toward achieving the goals established by THECB (2000) in *Closing the Gaps by 2015,* the state's higher education plan, post-secondary education completion in Texas is behind other states and other countries.

- Standards alone cannot address the problems identified in this report. Rather they provide goals to be reached. Reaching these goals requires a substantial effort in K–12 education to support curriculum and teacher development, which are delineated in House Bill 1, 79th Legislature, 3rd Called Session.
- In today's knowledge-based economy, an overwhelming majority of jobs require some form of post-secondary education.
- Students in the public education system today must be prepared to solve problems and work in careers that do not yet exist in an increasingly competitive, global workplace.
- The most frequent concern expressed by employers is the shortage of qualified and trainable workers who possess solid academic knowledge and workplace skills such as persistence, a strong work ethic, good attendance and punctuality, and the ability to work in teams. This difficulty results in remedial training and employee turnover.

What Research Says About College and Career Readiness Standards

- Standards for college and career readiness have been established by several national organizations and are being used increasingly throughout the United States.
- Research suggests that these standards are associated with college and career success and therefore more prosperous citizens.
- When compared, nationally recognized standards describe the knowledge and skills necessary for college and career readiness.
- Sets of nationally recognized standards offer different levels of specificity. Specificity increases the likelihood that a standard is clearly understood by educators, parents, students, test-makers, and textbook publishers.
- ACT college readiness standards in mathematics, English, reading, and science are empirically derived. They have been mapped to specific ACT score ranges and test questions, and they indicate a certain probability of performance in first-year college classes. The relationship between test questions, test scores, and academic standards provides invaluable information about the level of proficiency that students need to demonstrate to be successful after high school.
- The College Board Standards for College Success are grade-specific, 6–12 curriculum standards based on extensive surveys of college and high school faculties and analysis of course content from exemplary college

preparatory courses. The College Board standards provide specific guidelines for how the state may develop a sequence of courses and end-of-course assessments building to research-based definitions of college readiness.

- Individually, none of the nationally recognized college readiness standards examined includes everything that business and higher education faculty believe are essential for college readiness. When the standards are combined, however, all of the essential standards are present.
- There are few, if any, distinctions made in nationally recognized and exemplary state standards between college readiness and workforce readiness. This is supported by testimony from the business community and general public.
- Both research and feedback from the business and higher education communities indicate that the high school courses required for students to succeed after high school are much the same across the nationally recognized standards. They include, but are not limited to, Algebra II, Physics, and Statistics.

Comparison of College Readiness Standards

- Significant gaps exist in current Texas standards when they are compared to nationally recognized standards of college readiness.
- Current Texas standards do not always reflect the specificity and focus to clearly communicate the intent of the standard.
- Upon initial review, the Vertical Team standards in mathematics and science appear to align with the knowledge and skills required for college readiness that were identified in the comparison of nationally recognized standards.
- The amended draft of the English language arts standards, presented by the Vertical Team co-chairs, represents a consensus about the knowledge and skills required for college readiness. The amended draft, which covers writing, reading, speaking, and listening, replaces those sections of the Draft Texas College Readiness Standards posted on the THECB web site. Appendix H presents the amended draft standards.
- Although a nationally recognized standards comparison was not conducted in social studies, the Commission believes that K–12 social studies standards will need clear, rigorous, and explicit expectations with respect to core knowledge and skills to meet college ready expectations.
- As the Vertical Teams, Texas Education Agency (TEA), THECB, and SBOE continue working on the state's college readiness standards, the

inclusion of grade-specific classroom lessons, illustrative texts, and appropriate assessments will ensure that teachers and students clearly understand the level of rigor required to be college ready.

Recommendations of the Commission

Policies to Support New College Readiness Standards

- As policymakers and educators implement college readiness strategies and curriculum, they should also address issues of high school dropouts and stress the importance of obtaining a high school diploma. Engaging and rigorous course options should be provided to all students, with additional attention paid to students at-risk of dropping out of school.
- For all Texas students to be successful after high school, the TEA, THECB, and SBOE should better align their infrastructures to ensure consistency in policies and programs essential to every student's academic success. This includes aligning data systems and coordinating the expenditure of applicable state and federal funds. This also includes determining standards of performance on the Texas Higher Education Assessment (THEA) and the Higher Education Readiness Certification (HERC). It is also imperative that consensus is reached in determining the standards associated with postsecondary readiness and passing scores for end-of-course exams and any other high school assessments that the SBOE may approve for use in Texas public schools, such as the ACT, Scholastic Aptitude Test (SAT), and THEA.
- A statewide strategic plan for introducing college readiness standards should be developed. The plan should specify the processes to be followed, systems to be created, and steps to be taken with consideration of the responsibility that the State Board of Education has to adopt college readiness standards and include them in the K–12 curriculum. It should include, but not be limited to: instructional materials that align to the new curriculum and college readiness standards; an assessment system that aligns to the new curriculum standards with high school end-of-course exams that reflect the college readiness standards; and a new information system that provides data about a student's school career from kindergarten through post-secondary education. It also should include clear metrics that define the terms *college readiness* and/or *on-track to be college ready* so that student progress toward college readiness can be identified at the district level starting as early as sixth grade; meaningful professional development and teacher preparation programs to ensure teachers are adequately prepared and supported to increase college readiness among Texas students; and new teacher certification tests that align to the more rigorous curriculum standards.

- The K–12 public school curriculum must be designed and implemented to expand and improve students' abilities to gather, analyze, evaluate, and use information in real situations to ensure that all students graduate with the prerequisite knowledge and skills to succeed after high school. Thinking and reasoning skills, based in appropriate content-specific knowledge, are of primary importance.
- Policies regarding the selection of instructional materials, test development, determinations of proficiency and other levels of achievement, professional development for educators, and general accountability should be made or aligned with the goal of students progressing each year toward college readiness upon graduation from high school. Preparation for college readiness must begin in kindergarten and continue through grade 12.
- The new classroom expectations should focus first on the systematic acquisition of broad factual knowledge associated with core academic subjects and on developing a rigorous level of abstract thinking and applied knowledge and skills. This approach to teaching and learning should be reflected in every aspect of public education, including but not limited to instructional practices, textbooks, assessments, teacher preparation, professional development, teacher certification, information systems, and accountability.
- As standards for college readiness are introduced into Texas public schools, vigorous steps must be taken to ensure high expectations for all students. Additionally, education leaders should identify mechanisms and strategies to help students bridge the gap between current standards and standards for college readiness, including better utilization of the High School Allotment and other state grants and programs.
- Career and technical education provides students with engaging course options. This curriculum must constantly challenge and guide students to improve and expand their thinking and reasoning skills, to make use of content information in rigorous ways, and to recognize real-world applications of these skills. The standards must reflect expectations for college readiness, including the ability to succeed academically in post-secondary education.
- All institutions of higher education should use the standards for college readiness adopted by the THECB and the SBOE to determine entry-level credit-bearing courses.
- All institutions of higher education that are responsible for aspects of teacher preparation, including alternative certification, should incorporate these standards into their preparation practices.

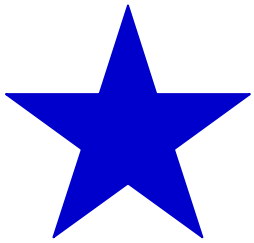
- Institutions of higher education should be rewarded for increasing the number of students who successfully complete degree programs. Additionally, systems of accountability should be put in place to assess student learning in each institution's general academic program to ensure that institutional standards remain high while completion rates increase. Such measures of accountability should align closely with standards and expectations established by nationally recognized professional organizations, licensing boards, and other independent standard-setting agencies.
- All Texans should be informed about the importance of education after high school and its impact on individual success. P–16 reform should remain the top priority for state and local policymakers to better serve the needs of the communities, schools, and families they represent.
- Policymakers, teachers, and high school guidance counselors should help parents and students become better informed of the value of education after high school as well as the knowledge, skills, and specific courses required to be successful after high school. College readiness standards should be accessible and understandable to parents and students.
- Academic learning must be the priority for classroom instruction. Skills such as punctuality, reliability, persistence, strong work ethic, effective study habits, time management, and the ability to work in teams are sometimes dismissed as "soft skills" but they are critical to college and workplace success. Effective instruction can foster these habits, but development of these skills should not be the focus of classroom instruction.

Requirements for New College Readiness Standards

- College readiness standards should be written with specificity and articulate a clear understanding of the complexity level expected within each standard.
- K–12 standards must offer a pathway to graduating college-ready Texans. They must be specific, giving teachers a clear indication of the level at which they need to teach and at which they should expect their students to perform to be prepared for college and/or a meaningful career.
- Texas college readiness standards should be consistent with the knowledge and skills identified from the comparison of nationally recognized college readiness standards.
- K–12 curriculum standards, including standards for college readiness, should include core skills for each grade level. These standards should call for steady and sustained increases in content knowledge, reasoning skills, communication skills (oral and written), and ability to use these

skills effectively in real settings through each grade until graduation. They should be focused, specific, and measurable.

- Expectations in the classroom should align with expectations in college and the workforce. This effort should include a focus on progressively more challenging and academically intensive levels of abstract, conceptual, analytical, and applied knowledge and skills. These increasingly intense challenges must extend through the senior year of high school so that students do not experience a let-down or falling-off of knowledge and skills just before beginning their college or workplace careers.
- Expectations for all graduates of Texas public schools should reflect a composite of available college readiness standards, including ACT, American Diploma Project, Standards 4 Success, and The College Board.
- Requirements for acquiring a high school diploma from Texas public schools should include successful completion of courses that indicate college readiness. These include, but are not limited to, Algebra II, Physics, and Statistics.



The Report of the Commission for a College Ready Texas

Introduction

The Commission for a College Ready Texas (the Commission) was appointed in April 2007 by Texas Governor Rick Perry and is composed of 21 individuals and a chair who have distinguished themselves in business, education, and community service. Also on the Commission are the eight Vertical Team co-chairs. They are aided by four ex-officio members, including the Commissioner of Education and the Commissioner of Higher Education. The members are:

- Sandy Kress, Chair of the Commission, Partner, Akin, Gump, Strauss, Hauer & Feld, L.L.P.
- Albert Black, President, On-Target Supplies and Logistics of Dallas
- Barbara Cargill, Member, State Board of Education
- Jose Cuevas Jr., Founder and CEO, JumBurrito
- Dr. Robert Duron, Superintendent, San Antonio Independent School District
- Linda Evans, President of Grants and Planning, The Meadows Foundation of Dallas
- Bruce Esterline, Vice President of Grants and Planning, The Meadows Foundation of Dallas
- Larry Faulkner, President, The Houston Endowment; and former President, The University of Texas at Austin
- David Garcia, CEO, CEDRA Corporation of Austin
- Bill Hammond, President and CEO, Texas Association of Business
- Dr. Eric Hanushek, Paul and Jan Hanna Senior Fellow, Hoover Institution of Stanford University
- Woody L. Hunt, former Vice Chairman of the Board of Regents, The University of Texas System
- Jodie Jiles, Managing Director, RBC Capital Markets of Houston
- Charles E. McMahen, Chairman, Governor's Business Council
- George McShan, former President and President-elect, Texas Association of School Boards
- Sonya Medina, Executive Director, AT&T Foundation
- Elaine Mendoza, Member, Texas Higher Education Coordinating Board
- David Merrill, Vice President-Investments, AG Edwards & Sons, Inc.
- Dean Nafziger, Ph.D., CEO , Edvance Research, Inc.
- Dr. Richard M. Rhodes, President, El Paso Community College

- Dr. Ricardo Romo, President, The University of Texas at San Antonio
- Zeynep Young, Michael and Susan Dell Foundation

The eight co-chairs who oversee the four subject-specific Vertical Teams are:

- Dr. Linda Ferreira-Buckley, Chair, Department of Rhetoric and Composition English, The University of Texas at Austin
- Selina Jackson, English Teacher, Wall Independent School District
- Linda Gann, Mathematics Instructional Specialist, Northside Independent School District
- Dr. Selina Vasquez-Mireles, Associate Professor of Mathematics, Texas State University
- Mercedes Guzman, High School Science Facilitator, El Paso Independent School District
- Dr. C. O. Patterson, Professor of Biology, Texas A&M University, College Station
- Larry Garibaldi, Instructional Team Leader, Houston Independent School District
- Dr. Jonathan Lee, Associate Professor of History, San Antonio College

Ex-officio members of the commission include:

- Commissioner Robert Scott, Texas Education Agency
- Commissioner Raymund Parades, Texas Higher Education Coordinating Board
- Susan Combs, Texas State Comptroller
- John Fitzpatrick, Executive Director, Texas High School Project– Communities Foundation of Texas

Once appointed, the Commission established the following goals:

- Provide a public forum for policy discussions about college readiness.
- Engage stakeholder groups (including business, education, government, and philanthropy) and provide a forum for groups to express their views and contribute to the work of college readiness.
- Gather public and expert views on the development of college ready standards and other issues related to college readiness, including professional development, instructional resources, teacher quality, and teacher preparation.
- Provide feedback and support to the vertical teams.
- Enhance awareness and facilitate a discussion of college readiness and produce a report on findings regarding college readiness.

Purpose of the Commission

The Commission was created to engage all Texans in a discussion of what skills and knowledge a student must possess to be college ready and to provide expert resources and general support to the Vertical Teams and the State Board of Education (SBOE). House Bill 1 (79th Texas Legislature, 3rd Called Session, 2006) requires the SBOE, the body holding the statutory authority for public school curriculum, to incorporate college readiness standards into Texas' foundation curriculum—the Texas Essential Knowledge and Skills (TEKS). To assist the SBOE with its charge, HB1 directs the Commissioners of Education and Higher Education to appoint high school and college faculty to Vertical Teams to develop college readiness standards for English language arts, mathematics, science, and social studies. After a period of public comment, college readiness standards will be submitted for approval by the Commissioner of Education and the Texas Higher Education Coordinating Board (THECB) and submitted to the SBOE for its consideration. Final authority to incorporate these standards into the TEKS rests with the SBOE.

It is important to note that the information presented in this report represents the first step in a long process. The next steps include the contemplation of these findings and recommendations by the SBOE as it determines how to best write specific grade-level curriculum standards that will put students on track to be college ready when they graduate. Additionally, policymakers will need to address the development of instructional materials, teacher professional development, and student end-of-course assessments to ensure that each is aligned with college readiness standards.

Several key questions emerged as the Commission began addressing its charge to provide resources and support to the Vertical Teams and the SBOE in aligning high school curriculum with college standards. These key questions have guided the Commission's discussions with recognized experts in Texas and across the country on college readiness standards. They have directed the Commission's research, including a comparative examination of several sets of nationally recognized college readiness standards in the core subject areas of English, mathematics, and science. They also have directed research toward the identification of gaps between exemplary college readiness standards and the current TEKS standards—the required standards for student learning in Texas public schools—in English and mathematics. The questions have guided dialogue at statewide and regional meetings and in focus groups on what college readiness means to parents, teachers, the business community, and college faculty.

These key questions are:

- How is college readiness defined?
- Is college readiness the same as workforce readiness?
- What do data say about the college readiness of students nationally and in Texas?
- What are the costs of students not being ready?

- What is the evidence supporting the calls for increased rigor in K–12 courses?
- How well do existing TEKS standards for English language arts align to exemplary standards?
- How well do existing TEKS standards for mathematics align to exemplary standards?
- How do nationally recognized college readiness standards define knowledge and skills, and what evidence supports the validity of the standards?
- What does college readiness mean to Texans—parents, teachers, college faculty, and employers?

This report answers these questions using research and opinion from a variety of recognized experts in Texas and throughout the nation as well as from testimony received from a broad spectrum of citizens throughout Texas. The information presented should not be confused with state curriculum standards, which consist of much more specific statements of skills and concepts necessary at each grade level. This report provides a wealth of data and analysis that suggest the level of proficiency required for success in entry-level college courses or the skilled workplace. It compares the required level of proficiency with the standards offered by the Vertical Teams in English language arts, mathematics, and science. It provides research on the role that postsecondary developmental education plays in college success or failure.

The report also includes a summary of findings based on the expert and public testimony and a review of data, analyses, and research. Finally, the report provides recommendations to state and local policymakers, including the Governor, Texas Legislature, SBOE, THECB, and the Commissioners of Education and Higher Education; public schools; higher education institutions; education, community, and business leaders; parents; students; and all Texans on how to improve the postsecondary readiness of every Texas high school graduate.

Part One

Addressing Key Questions About College Readiness

The Commission began its work by addressing key questions about defining and measuring college readiness and whether the state has compelling reasons to support increased rigor in the high school curriculum.

How Is College Readiness Defined?

The Commission was presented with several definitions of college readiness from national organizations that have studied this issue extensively. Commission members also reviewed the definition used by the Texas Education Agency (TEA) and THECB and corresponding assessment standards established to ensure that Texas students are either college ready or receiving developmental assistance.

There is concurrence among these organizations that college readiness means the acquisition of the knowledge and skills necessary to succeed in entry-level college courses without the need for remedial or developmental education services.

Texas Higher Education Coordinating Board

The THECB defines a *college-ready student* as "one who has the knowledge and skills necessary to begin entry-level college courses with a reasonable likelihood of success and does not require developmental education" (Tex. Admin. Code, 2007). The Texas Success Initiative is a statewide program that requires all students to be assessed in reading, writing, and mathematics before enrolling in college to determine if students are ready for credit-bearing college courses or in need of remedial or developmental education. This initiative sets minimum passing standards on approved assessments such as the Texas Higher Education Assessment (THEA), ASSET and COMPASS offered by ACT, and ACCUPLACER offered by The College Board. Texas students are also deemed to be college ready if they achieve a composite score of 23 with a minimum of 19 on the English and mathematics portions on the ACT, a combined verbal and mathematics score of 1070 with a minimum of 500 on the verbal and mathematics sections on the Scholastic Aptitude Test (SAT), or a 2200 on the English and mathematics tests and at least a 3 on the writing test of the exit-level Texas Assessment of Knowledge and Skills (TAKS). The exit-level TAKS are state-developed, state-required tests that all high school students, beginning in the 11th grade, must take and pass to graduate. The exit-level TAKS assesses the standards defined by the TEKS.

ACT

ACT (2007a), an independent, not-for-profit organization that provides assessments, research, and program information in the areas of education and workforce development, defines *college readiness* as "the level of achievement a student needs to be ready to enroll and succeed—without remediation—in a credit-bearing course at a two-

year or four-year institution, trade school, or technical school." It further characterizes success as a 75% chance of earning a grade of C or better or a 50% chance of earning a grade of B or better (percentages approximate) in selected courses commonly taken by first-year college students in the areas of English (English composition), mathematics (College Algebra), social sciences (History, Psychology, Sociology, Political Science, or Economics), and natural sciences (Biology). These success rates are tied to ACT college readiness benchmark scores of 18 in English, 22 in mathematics, 21 in reading, and 24 in science.

The College Board

The College Board (2007), a non-profit association that administers the SAT, Preliminary SAT, and Advanced Placement program, simply states that "students are college ready when they have the knowledge, skills and behaviors to successfully complete a college course of study without remediation." College Board research has established that a score of 1020 in critical reading and mathematical reasoning corresponds to a 90% probability of a freshman grade point average of C or higher and a 50% probability of a B or higher.

Achieve Inc., American Diploma Project

Achieve Inc., which was established by governors and business leaders across the United States to help states raise academic standards and achievement so that all students graduate ready for college and work, launched the American Diploma Project (ADP) to establish standards or benchmarks that apply to college and workforce readiness. Those benchmarks define the needed knowledge and skills for high school students that ensure success in college or the workplace when they graduate. Several Texas businesses and 2- and 4-year colleges and universities were involved in the development of the ADP benchmarks (see Appendix A).

Is College Readiness the Same as Workforce Readiness?

The question of whether college readiness is the same as workforce readiness was critical to the work of the Commission because not all students in Texas high schools enroll in a college or university immediately upon graduation. If college readiness is not the same as workforce readiness, the Commission would need to explore establishing different knowledge and skill expectations for students entering the workforce.

The Commission was presented with research findings from ACT and Achieve's ADP, along with a study by the U. S. Department of Education's Regional Educational Laboratory (REL) Southwest to address this question. ACT and Achieve's ADP concur that the knowledge and skills required for success in first-year college classes are also necessary skills for success in the workforce. In addition, the REL Southwest's Lexile analysis supports that argument, showing that workplace reading requirements are comparable to those in the first year of college.

ACT

Research findings from ACT provide empirical evidence that all high school graduates need the same level of knowledge and skills in reading and mathematics regardless of whether they enter college or the workforce. This research found that the knowledge and skills required for jobs that produce a self-sufficient wage for a family of four ($39,066 annually) and measured on the ACT WorkKeys tests, which assess the skills needed for workforce readiness in nine areas, are similar to the ACT college readiness benchmark skills in reading and mathematics. This high degree of comparability between college readiness and workforce readiness supports the conclusion that all students should be required to take rigorous core courses in high school regardless of whether college or work is their next step after graduation (ACT, 2006).

Achieve Inc., American Diploma Project

Achieve offered testimony on the ADP's multi-year study to create college and workplace standards, which concluded that all high school graduates need the same knowledge and skills whether they go to college or directly to a career. In the workplace study phase of the project, ADP identified *good jobs* in the workforce—those that pay more than $25,000 annually and provide some benefits—and tracked the high school course-taking practices of people employed in those jobs. From that, a set of workplace expectations in English and mathematics were developed and subsequently vetted and refined with business managers in several types of industries.

Another process of defining higher education expectations took place with focus groups of community college and university faculty that produced a set of English and mathematics competencies necessary for success in freshman credit-bearing courses. Because of the overlap in expectations from both sectors—higher education and business—a single set of benchmarks was created outlining the knowledge and skills required for success in both college and the workforce (Slover, 2007).

Regional Education Laboratory Southwest

REL Southwest presented to the Commission an analysis of the level of reading ability required for workers to comprehend a variety of manuals, brochures, tutorials, forms, and applications commonly used in the workplace. Reading difficulty was assessed using Lexiles, a widely used measure of text demand for textbooks, as well as curriculum and workplace materials. That analysis showed the mid-point of these technical texts to be at a reading level just slightly below that required by texts in a community college. The following table shows the Lexile requirements for some job-related texts compared to texts used in high school and the first year of college (Rolfhus, 2007).

Table 1
Workplace Lexiles

Texts	Lexile level
Forklift Operations Manual	890
11th and 12th Grade Texts	1,123
Attendance Policy for Hourly Employees	1,210
Aetna U.S. Healthcare – Open Choice PPO	1,280
U. S. Dept. of Justice Employment Eligibility Verification	1,340
1st Year College Texts	1,355

Source: REL Southwest

National job outlook projections from the U.S. Bureau of Labor Statistics (2005) indicate that the fastest growing occupations through 2014 will require higher levels of education and training (see Appendix B). In addition, a study by Barton (2006) counters findings that the knowledge and skills required for success in the workforce are the same as those needed for college (see Appendix C).

What Do Data Say About the College Readiness of Students Nationally and in Texas?

A variety of data confirm that high school graduates across the United States are ill-prepared for the rigors of college coursework, and Texas students fare even worse than their counterparts nationally.

The Commission was presented with several ways to look at the current status of student college readiness in Texas. A method used by ACT establishes empirically based college readiness benchmark scores on the ACT college admission tests that indicate the probability of a student's success in certain first-year college courses, such as English Composition, Algebra, History, Political Science, and Biology. A similar method used by The College Board establishes empirically based college readiness benchmark scores on the SAT college admission exam that indicate the probability of success in the first year of college. An approach used by the THECB looks at the percentage of students enrolled in college non-credit-bearing remedial or developmental courses that attempt to prepare students for typical freshman classes.

The Commission also heard testimony about the findings of an ADP survey to determine whether higher education faculty believe high school graduates are academically prepared for college courses.

The Commission learned that the lack of college readiness of high school graduates is a problem nationally, but according to ACT, worse in Texas. Supporting ACT's findings are data from the THECB show that 50% of college freshmen in Texas are enrolled in remedial or developmental education as compared to 28% across the United States. Research by the National Center for Educational Accountability (NCEA), an ACT-owned non-profit organization that provides *Just for the Kids* school improvement

products and data-driven best practices research, demonstrates that Texas high school graduates are unprepared for the rigor of college courses and highlights the disconnect between the current exit-level TAKS Passing standard and the level of performance needed to be college ready, which is closer to the Commended standard.

National Results

The Commission learned that large numbers of students across the United States graduate from high school without the knowledge and skills to be successful in credit-bearing college classes.

- Only 21% of students nationally taking the ACT tests meet college readiness benchmarks in English, reading, mathematics, and science (Schmeiser, 2007).
- In the 2000–2001 academic year, 28% of college freshmen across the county enrolled in remedial courses in reading, writing, and/or mathematics. The percentage was even higher at 2-year community colleges, with 42% of entering students taking one or more remedial courses (NCES, 2003).
- Higher education faculty surveyed by ADP estimated that 42% of first-year students are academically unprepared for the rigor of college classes (Slover, 2007).

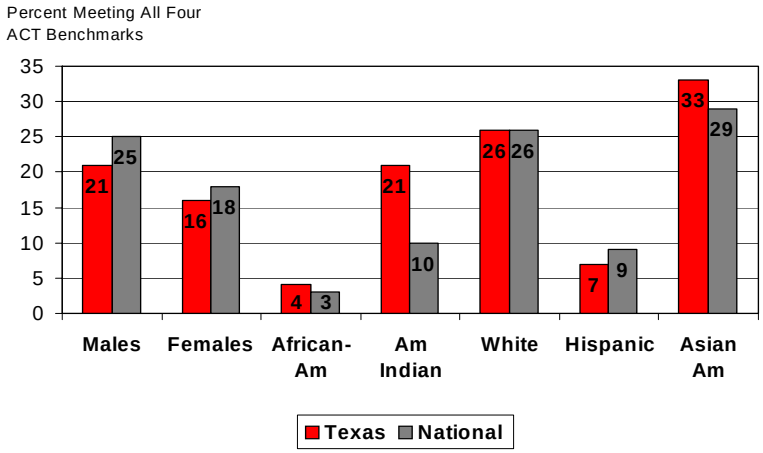
Texas Results

Evidence received from ACT, THECB, and NCEA indicate that Texas high school graduates are more poorly prepared to succeed in college coursework than most of their peers in other states.

Information from ACT indicates that only:

- 18% of Texas students who took the ACT met the college readiness benchmarks in all four subjects; the percentages are even smaller for African American and Hispanic students.
- 17% of current 10th graders are on target to be college ready and an astoundingly low 8% of eighth graders are on course to meet the college readiness benchmarks by high school graduation.

Figure 1 shows how Texas students compare currently with students across the United States in meeting ACT's college readiness benchmarks (Schmeiser, 2007).



Source: ACT

Figure 1. Percent meeting all four ACT benchmarks.

Based on evidence presented to the Commission by the THECB, Texas colleges and universities have a large percentage of first-year students qualifying for remedial or developmental programs. According to Gardner (2007):

- 50% of entering students do not meet state standards in mathematics, reading, and writing, and are eligible for remedial education courses.
- 61% of students at 2-year community colleges are not academically prepared to succeed in postsecondary education.
- 63% of first-time-in-college Hispanic students qualify for remedial programs.
- 71% African Americans require remedial services.

National Center for Educational Accountability

The NCEA presented research demonstrating the lack of college preparedness of Texas high school students, substantiating findings of ACT and the THECB. NCEA created TAKS college readiness benchmarks by linking exit-level TAKS scores to ACT and SAT college readiness benchmarks and passing scores on the THEA, an instrument used to determine if Texas college students need remediation.

The NCEA found that Texas students need to score a 2300 on the exit-level TAKS in English, mathematics, and science to be college ready. Data from the 2006 administration of the exit-level TAKS show that only 10% of students in 11th grade scored at least a 2300 in all three subjects (Dougherty, 2007).

This analysis indicates that the current exit-level TAKS Passing standard provides no assurance that Texas high school graduates are ready for college. In fact, it signifies that the Commended performance score in English, mathematics, and science is more closely

aligned with established college readiness benchmarks. Table 2 compares the various performance standards for the exit-level TAKS.

Table 2
Exit-Level TAKS Standards

Subject	TAKS standard/ passing score	THECB/SBOE Higher Education Readiness Certification (HERC) standard	NCEA TAKS college readiness benchmark	TAKS commended performance score
English	2100	2200	2300	2400
Mathematics	2100	2200	2300	2400
Science	2100	n/a	2300	2400

REL Southwest analyzed the reading demand of textbooks at the high school, community college, and university levels, and then compared the results to the Commended, Higher Education Readiness Certification (HERC) standards, and the Standard/Passing scores adopted by the SBOE and the THECB for the exit-level English TAKS. Appendix D contains the results of this analysis.

What Are the Costs of Students not Being Ready?

The Commission asked Dr. Eric Hanushek, a Commission member and economist at Stanford University, to examine the relationship between education and the economy. Hanushek found that the rate of economic growth of a country is highly correlated with the quality of its education system—higher performance on international tests equates to faster economic growth. His analysis showed that even a moderately strong improvement in the U.S. education system over the next 20 years would boost the gross domestic product by about 30%, an increase that substantially exceeds what this country currently spends on education (4.5% of gross domestic product). He also examined the differences in lifetime earnings of men and women by educational attainment (see Table 3). A man with a bachelor's degree is expected to earn $1.4 million more over his lifetime than a man with less than a high school diploma (Hanushek, 2007).

Table 3
Individual Earnings by Education Attainment

Education attainment	Women	Men
Less than high school	$0.7 million	$1.1 million
High school	$1.0 million	$1.4 million
Some college	$1.2 million	$1.7 million
Associate's degree	$1.3 million	$1.8 million
Bachelor's degree	$1.6 million	$2.5 million

Source: Eric Hanushek

Appendix E contains the results of a study by The Perryman Group (2007) quantifying the economic benefits of meeting the goals established by the THECB (2000) in its *Closing the Gaps by 2015* plan.

What Is the Evidence Supporting the Calls for Increased Rigor in K–12 Courses?

Input the Commission received from experts and stakeholders across Texas supports an increase in the rigor of high school courses. It was pointed out repeatedly, however, that college readiness begins in kindergarten, and the skills learned in elementary and middle school should be vertically aligned to ensure that all ninth graders are fully prepared for the challenge of higher-quality high school classes. In other words, college readiness must begin in kindergarten and continue as an unbroken ramp of increasingly challenging expectations that culminate in college readiness by grade 12.

The Commission examined comprehensive studies from Adelman and ACT that provided either empirical or survey data to substantiate the need for more rigorous courses. The large-scale, longitudinal study by Adelman (1999) analyzed a number of key factors that are often cited as contributing to a student's ability (or inability) to earn a bachelor's degree at a 4-year university. Adelman found that a student's high school curriculum had the strongest influence on degree attainment. In other words, this research indicated that college degree completion has a strong statistical relationship to the academic rigor of high school courses. It also showed that a strong high school curriculum can close the achievement gap in postsecondary education that is commonly seen between racial and ethnic groups.

Researchers examined high school and college transcripts, test scores, and results of surveys of a national cohort of students from 10th grade to almost age 30 (1980–1993) to determine which single variable had the largest statistical influence on the ability to obtain bachelor's degrees. Of the 11 variables analyzed, the rigor—intensity and quality—of a student's high school curriculum had the strongest influence on whether that individual received a bachelor's degree from a university. That impact was even more significant for African-American and Hispanic students than for white students. In addition, the combination of factors—a rigorous high school curriculum, high test scores, and high class rank—significantly reduced the influence a student's socioeconomic status had on bachelor's degree completion. Students from the lowest two socioeconomic status quintiles who were also in the highest quintile of receiving quality academic resources in high school earned bachelor's degrees at a higher rate than a majority of students from the top socioeconomic status quintile.

Adelman's study also found that among all courses in the high school curriculum, mathematics has the strongest influence on earning a bachelor's degree. In fact, researchers found the influence to be so powerful that just completing one course beyond Algebra II, such as Trigonometry or Pre-calculus, corresponded to the doubling of the chances that an entering college student would complete a bachelor's degree.

In a subsequent study, Adelman (2006) found that academic intensity at this highest level translated to:

- 4 credits of English
- 4 credits of mathematics
- 3 credits of laboratory science
- 3 credits of foreign language
- 4 credits of history and social studies
- 1 credit computer science
- 1 Advanced Placement (AP) course

This follow-up study also showed that the amount of mathematics taken in high school continues to be a key correlate for college degree attainment, with courses beyond Algebra II playing a big role in eventual college success. More than 96% of students in the highest quintile of academic intensity took mathematics beyond Algebra II (Adelman, 2006).

Both empirical studies and testimony of business and academic leaders emphasized a need for increased rigor. It is therefore important that planners, curriculum designers, and standards-setting boards have a clear understanding of what *rigor* means. Rigor does not mean reading assignments of 50 pages rather than 25 pages; it does not mean working 30 arithmetic problems rather than 15. It does not mean memorizing longer and longer lists of definitions without context. Instead, rigor can be characterized more explicitly as:

- Expanding students' vocabularies, especially their ability to use technical terms and phrases to make precise, succinct statements.
- Enlarging students' ability to think in abstract terms, using symbolic representations of real-world situations to carry out formal operations of analysis, comparison, and evaluation.
- Increasing students' skills in analyzing and comparing alternative explanatory models to account for past events and outcomes and predict future events.
- Improving students' abilities to gather and evaluate data that form the basis for evaluation.
- Enhancing students' skills in translating among narrative, numeric, graphical, pictorial, symbolic, and kinesthetic descriptions of things, processes, and events, and using any of these modes of expression to produce equivalent descriptions.
- Developing students' capacity to apply their knowledge to real-world problems, generalizing from previously learned principles and explanatory models to account for or anticipate new situations and events.

Findings of Adelman's research are supported by research conducted by ACT (2007b) that analyzed the impact academic rigor has on a high school student's ability to meet all

four of the ACT college benchmark standards. This study looked at the course-taking patterns of students in nearly 400 "rigorous" high schools across the country and compared that to students' ACT results. The analysis showed that:

- 50% of students attending the rigorous mathematics high schools who had taken Algebra I, Algebra II, and Geometry met the ACT mathematics benchmarks compared to 26% who had taken the same courses nationally.
- When Trigonometry was added to the sequence, 84% of students at the rigorous schools met the ACT mathematics benchmarks compared to 56% across the United States.
- Students attending the rigorous science high schools who took Biology and Chemistry met the ACT science benchmarks at a rate of 36% compared to 26% of ACT-tested students across the country.
- By adding Physics to the sequence, the percentage jumped to 64% meeting the ACT science benchmarks in the rigorous science high schools compared to 42% in the national group.

Additionally, ACT tracked these students once they graduated from high school and enrolled in college to see if taking more rigorous courses in high school had an impact on college enrollment and retention. The data showed that students in the rigorous high schools who took Algebra II and Chemistry were more likely to enroll in college after graduation and return to college the following year than other ACT-tested students nationally who took the same courses.

At the request of the Commission, researcher Darwin Miller (2007) at Stanford University examined data on cohorts of graduates of Texas public high schools from 1998 to 2005 who entered Texas public higher education (a total of 1.1 million students). Data included demographic characteristics, high school course-taking patterns, Texas Academic Skills Program/Texas Higher Education Assessment (TASP/THEA) scores, SAT scores, and a large number of academic outcomes in college. The study, which included a correlation of the courses taken during the senior year of high school and their degree of association with college completion, found that several courses taken during the senior year showed a positive correlation with college completion. These courses include, in order of size of relationship (strongest to weakest):

- AP Math
- Pre-calculus
- Physics
- AP English
- Fourth year of a foreign language
- Other AP courses
- Third year of a foreign language
- Biology

The study also found that several courses, when taken during the senior year of high school, show a negative correlation with college completion. These courses include, in order of size of relationship (strongest to weakest):

- Geometry
- Algebra II
- Algebra I
- Second year of a foreign language
- AP foreign language
- First year of a foreign language
- Chemistry

These findings clearly indicate that a high school course load that includes the full sequence of mathematics, science, and to some extent foreign language courses, is a strong indicator of college success. They also suggest that students who have not taken sequential courses earlier in their high school careers (such as Geometry, Algebra I, Algebra II) and who do not complete the full sequence of courses suffer negatively in terms of college readiness.

In addition, the study showed that although test scores (e.g., TASP/THEA, SAT, college placement tests) and demographic factors are important correlates of college success, there is strong evidence that the impact of high test scores can be replicated by taking strong mathematics, science, and Advanced Placement courses during the senior year of high school (Miller, 2007). Appendix F contains a summary of the Miller report. The full report may be accessed at http://www.collegereadytexas.org.

As part of the ADP work to develop college and workplace readiness standards, Achieve, Inc. surveyed college faculty, employers, and recent high school graduates who are in college or working to determine if high schools are adequately preparing students for college and jobs. The summary of the survey results are included in Appendix G.

How Well Do Existing TEKS Standards for English Language Arts Align to Exemplary Standards?

The Commission asked REL Southwest to conduct research to fill in the gaps in knowledge about how the alignment of the Texas curriculum standards (the TEKS) in English language arts compares with the alignment of selected exemplary college readiness and state standards. This was a critical question to answer because the Texas SBOE is currently reviewing the English language arts TEKS for kindergarten through 12th grade. The purpose of this analysis was two-fold: one, determine on a more detailed level whether the current state standards for Texas high schools match the best college readiness standards available, and two, conclude whether the Texas standards for kindergarten through eighth grade prepare students entering high school to succeed in rigorous, college preparatory courses.

English Language Arts/Reading Gap Analysis

The English Language Arts/Reading (ELAR) gap analysis is based on a highly objective, replicable process that compares the ELAR TEKS with state and national benchmark standards that have earned national recognition for academic rigor and specificity that facilitates high-level understanding of the expectations for grade levels and courses. Researchers rated the level of agreement between the ELAR TEKS and the benchmarks.

This analysis found that the current ELAR TEKS are not of sufficient rigor and specificity to prepare Texas students for post-high school success.

Benchmarks selected for the analysis were:

- Massachusetts English Language Arts Curriculum Framework
- Principles of reading founded on scientific research that are identified by the National Reading Panel report, *Teaching Children to Read* (2000)
- ACT's College Readiness Standards for English
- Achieve's ADP English Benchmarks

Comparisons between the ELAR TEKS and benchmarks were produced by four independent teams of experts that used similar but slightly different methods. National experts recognized for their work with literacy, standards, and curriculum produced summary analyses of the comparisons, which then were subjected to peer review.

Findings of ELAR Gap Analysis

The findings of the ELAR TEKS gap analysis showed remarkable similarity across the teams' findings. This convergence across research teams suggests a high degree of confidence should be placed in the findings. There was general agreement that the ELAR TEKS:

- Do not always exhibit the specificity and focus to clearly communicate the intent of the standard (i.e., content coverage, level of conceptual demand) and facilitate instruction.
- Do not always provide a clear developmental sequence (i.e., a progression of increasing cognitive demand) across the grades when it is needed.
- Repeat standards across grade levels, instead of relying on the commonly used statement "Continue to address earlier standards as needed," and do not clearly identify grade-level specific standards.
- Show significant gaps in college readiness when compared with ADP and ACT standards.

Recommendations from ELAR Gap Analysis

- Increase the specificity and rigor of grade-level standards. (One of the ways to do this is through clear and elaborated examples of standards.)

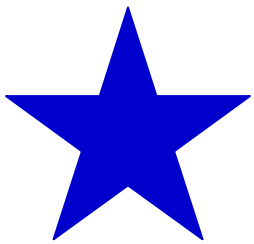
- Develop an explicit developmental sequence, with increasing cognitive demand, throughout the grades where knowledge and skills should be sequenced (such as with vocabulary).
- Revise ELAR TEKS to reflect findings of the National Reading Panel and ensure each area identified by the panel is covered thoroughly.
- Reorganize the ELAR TEKS strands to simplify standards and reflect the elements identified by the National Reading Panel.
- Address gaps in the ELAR TEKS to ensure all students are college ready.
- Recognize the limitations of this analysis as a result of interpreting wording differences between the ELAR TEKS and the benchmark standards.

The summary reports and related documents from the ELAR gap analysis may be accessed at http://www.collegereadytexas.org.

How Well Do Existing TEKS Standards for Mathematics Align to Exemplary Standards?

The Commission is sponsoring research to identify gaps between state expectations for mathematics in grades 6–12 and benchmarks for proficiency and college readiness set by national entities. Researchers will establish crosswalks between the mathematics TEKS, standards for proficiency set by the National Council of Teachers of Mathematics, and state standards established by California and Indiana, which are widely considered to be the nation's best state standards for mathematics. Crosswalks also will be established between the mathematics TEKS and standards for college readiness set by ADP and ACT.

In addition, this research will identify how Texas can close these gaps and enhance the TEKS to establish proficiency and college readiness as the standard for performance in mathematics in Texas public schools. The work will be conducted by REL Southwest and the RG Research Group. RG Research Group is the home for the mathematics strand of the Center on Instruction, which provides resources and expertise to the U.S. Department of Education's Regional Comprehensive Centers. These centers serve state education leaders in helping schools and districts meet the goals of No Child Left Behind. RG Research Group will engage nationally recognized experts to conduct this research, including Hung Hsi Wu at Stanford University, David Chard at SMU, and Janie Schielack at Texas A&M University. This research will not be completed until Dec. 1, 2007 and will be released by the TEA.



Part Two

Nationally Recognized College Readiness Standards: Overview of Research, Findings, and Recommendations

General Overview

The Commission's most important task was to determine whether nationally recognized college readiness standards already exist in the four major subject areas, and, if so, to determine if they truly are valid measures of what high school graduates need to know to succeed in higher education. Through testimony and extensive discussion with national experts, the Commission identified several sets of nationally recognized college readiness standards, and in some cases exemplary K–12 state standards, that clearly categorize the content and skills essential for college readiness and effectively communicate the intent of the standards with supplemental materials, such as sample test questions, classroom lessons, and lists of texts expected for particular grades.

These relevant standards were examined to determine what knowledge and skills were common across all the standards, revealing a consensus of certain standards required for college readiness in English language arts, mathematics, and science. The Commission was able to identify only one set of widely accepted national standards in social studies so no comparison was done in that area.

The Commission carefully studied and compared nationally recognized college readiness standards. Following is a general comparison between these standards and the college readiness standards produced by the Vertical Teams. Further work with respect to these comparisons will be conducted by REL Southwest and funded by the Institute for Education Sciences. The results will be published upon completion of the study and may be accessed at that time at http://www.edvanceresearch.com.

General Findings

A number of general findings emerged from this initial examination of college readiness standards.

- When compared, nationally recognized standards describe the knowledge and skills necessary for college and career readiness.
- There are few, if any, distinctions made in nationally recognized and exemplary state standards between college readiness and workforce readiness. This is supported by testimony from the business community and general public.
- Sets of nationally recognized standards offer different levels of specificity. Specificity increases the likelihood that a standard is clearly understood by educators, parents, students, test-makers, and textbook publishers.
- Upon initial review, the Vertical Teams' standards in mathematics and science appear to align with the knowledge and skills required for college readiness that were identified in the nationally recognized standards comparison.

- The amended draft of the English language arts standards, presented by the Vertical Team co-chairs, represents a consensus about the knowledge and skills required for college readiness. The amended draft, which covers writing, reading, speaking, and listening, replaces those sections of the Draft Texas College Readiness Standards posted on the THECB web site. Appendix H presents the amended draft standards.
- As the Vertical Teams, TEA, THECB, and SBOE continue working on the state's college readiness standards, the inclusion of grade-specific classroom lessons, illustrative texts, and appropriate assessments will ensure that teachers and students clearly understand the level of rigor required to be college ready.
- Although a nationally recognized standards comparison was not conducted in social studies, in the following sections the Commission will address certain issues that arise from the Vertical Team report in this area.

General Recommendations

- College readiness standards should be written with specificity and articulate a clear understanding of the complexity level expected within each standard.
- K–12 standards must offer a pathway to graduating college-ready Texans. They must be specific, giving teachers a clear indication of the level at which they need to teach and at which they should expect their students to perform to be prepared for college and/or a meaningful career.
- Texas college readiness standards should be consistent with the knowledge and skills identified from the comparison of nationally recognized college readiness standards.
- Policies regarding the selection of instructional materials, test development, determinations of proficiency and other levels of achievement, professional development for educators, and general accountability should be made or aligned with the goal of students progressing each year toward college readiness upon graduation from high school. Preparation for college readiness must begin in kindergarten and continue through grade 12.

Standards Research Conducted

Activity

The Commission conducted a benchmarking activity to determine what content was agreed upon through multiple independent efforts to define college readiness. In the benchmarking activity, multiple sets of standards were compared against a single set of standards that was selected as the benchmark or point of reference. Each comparison set was then searched for content that matched each benchmark statement. This is a substantially different activity from a content alignment process (or gap analysis) in which the goal is to validate whether content statements are perfectly aligned or to identify the precise nature of mismatched content. In most gap analysis activities,

multiple raters are used with a formal scoring rubric and consensus process, and the alignment is often assessed along multiple criteria. Because of the Commission's short timeframe, the large number of standards documents under consideration, and the nature of the research question, the examination of standards for this report were through the creation of a crosswalk table using a single-rater, expert-review approach.

For each subject area, a benchmark was identified—Achieve's ADP Benchmarks in the case of English language arts and mathematics, and Project 2061 (AAAS, 1993) and California standards in science. For each benchmark statement, the remaining standards were read and searched for appropriate content statements. These matches represent the best fit from a particular standards document, but there is variability in the quality of the matches. The matching process was done to determine whether a particular set of content appearing in the benchmark statement was also nominated by the particular comparison standard. One content expert performed the alignment, which was then reviewed by another content expert. Discrepancies were resolved through discussion.

It is important to note that the information presented in this report is intended to serve as guidance for parents, teachers, students, and school administrators. The information is not to be confused with state standards, which consist of much more specific statements of skills and concepts necessary at each grade level. State standards also require a high degree of precision and must guide schools and families as to which are the most crucial topics, concepts, and operations for any given grade level.

Standards Examined

English Language Arts and Mathematics

Four sources of nationally recognized college readiness standards were identified that address both of these domains:

- ACT's College Readiness Standards
- Achieve's ADP Benchmarks
- The College Board Standards for College Success
- Standards 4 Success—College Knowledge by David Conley (Conley, 2003, 2005)

In addition, California's mathematics standards and Massachusetts' standards for English language arts were included as being representative of nationally recognized and highly rated K–12 standards (Klein et al., 2005; Stotsky, 2005).

Science

Because ACT, ADP, and The College Board college readiness standards did not address science (or did not do so with enough specificity), the following standards were reviewed:

- Standards 4 Success—College Knowledge by David Conley
- K–12 science standards from Project 2061 (AAAS, 1993)

- K–12 state standards for California
- K–12 state standards for Virginia

Social Studies

A broad search for nationally recognized college readiness standards in social studies yielded only one source, Standards 4 Success—College Knowledge by David Conley. One national set of K–12 standards was identified (National Council for the Social Studies, 1994). State K–12 standards are, of course, available. National experts in curriculum and assessment were informally queried for the existence of nationally known college readiness standards for social studies. Given the identification of only one set of college readiness standards in this domain, no comparison activities were undertaken.

Sample Row of Crosswalk Content

A sample row of crosswalk content is provided in Table 4 to help illustrate features of the matrix and several important aspects of the crosswalk table, most notably:

- There can be a wide range in specificity of content statements that map to the benchmark statement.
- Multiple matches in cases were found from two of the standards.
- Sometimes a statement may strongly imply but not actually mention specific content.

Reviewing specific rows of the matrix also can be informative in evaluating the role that specificity plays in standards. The matrix was developed, however, to answer more general questions, including:

- What content is in common across most or all of the standards?
- What content is not agreed upon by all of the documents but has been nominated by at least one standard and should be evaluated?

Table 4
College Readiness Standards Crosswalk—Mathematics

ADP	ACT	S4S	College Board content statement	College Board objective
I1.2. Calculate and apply ratios, proportions, rates, and percentages to solve problems.	Mathematics College Readiness Standards [Basic Operations & Applications] (401) Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average. (201) Perform one-operation computation with whole numbers and decimals. (202) Solve problems in one or two steps using whole numbers. (203) Perform common conversions (e.g., inches to feet or hours to minutes). (301)	Mathematical Reasoning D.1. Can convert between decimal approximations and fractions.	MI.2.2 Student develops computational fluency in working with ratios, percents, and proportional situations, and applies this fluency to estimate the solution to and solve a variety of real-world problems.	MI.2.2.1 Uses unit rates and equivalent ratios to represent and make quantitative comparisons in solving problems in real-world contexts (e.g., equivalent measures, discounts, interest, taxes, tips). MI.2.2.2 Represents and models ratios associated with whole-number percents that are less than or equal to 100%. MI.2.2.3 Mentally estimates and finds solutions to percent problems. MI.2.2.4 Translates fluently among the various representations for fractions, decimals, and percents in appropriate ways.

ADP	ACT	S4S	College Board content statement	College Board objective
	Solve routine one step arithmetic problems using whole numbers, fractions, and decimals) such as single-step percent. (302) Solve some routine two-step arithmetic problems.			

Core English Language Arts Content

Four sources of nationally recognized college readiness standards were examined to generate the following summary statements: ACT's College Readiness Standards, Achieve's ADP Benchmarks, The College Board Standards for College Success, and the Standards 4 Success—College Knowledge standards. In addition, the Massachusetts English language arts standards for grades 9–12 were reviewed.

The following content was nominated by most or all of the reviewed standards as important for college and workforce readiness.

- The underlying assumption not always explicit in the standards is that students can read and comprehend efficiently and successfully.
- Students use grammar, punctuation, and mechanics of English properly.
- Students can construct proper sentences and paragraphs linked together appropriately to support a thesis.
- Students use note-taking, prewriting, and planning activities.
- Students exhibit strong research skills and can gather relevant information with proper reference and citation of sources. Students also can critically evaluate evidence, credibility, and validity.
- Students can analyze arguments and the quality of supporting evidence, and can recognize logical fallacies in arguments.
- Students can organize writing and speech around a thesis, showing strong argumentation with supporting evidence.

- Students have the tools to infer meaning of unfamiliar words: (a) can use dictionaries, (b) have knowledge of roots/affixes/cognates, and (c) can use context.
- Students can understand subtle differences in word meaning, allusions, idioms, and figurative language. Students also can carefully select words for proper meaning and for the particular audience.
- Students can account for the needs and nature of the audience when writing or speaking.
- Students can revise drafts based on self and other feedback.
- Students can write an expository, persuasive, and research essay.
- Students know a range of works of American, British, and World Literature. (Specific works are not mentioned as examples in college readiness standards but are present in some states such as Massachusetts.)
- Students have knowledge of elements of poetry (e.g., rhyme, meter), prose (e.g., setting, foreshadowing), and drama.
- Students demonstrate oral comprehension and presentation skills, effectively engaging different audiences.
- Students understand the conventions of informational text and can generate and successfully engage informational text.

Core Mathematics Content

Four sources of nationally recognized college readiness standards were examined to generate the following summary statements: ACT's College Readiness Standards, Achieve's ADP Benchmarks, The College Board Standards for College Success, and the Standards 4 Success—College Knowledge standards. In addition the California mathematics standards for grades 6—12 were reviewed.

The following content was included in most or all of the reviewed standards as important for college or workforce readiness.

- Students have a solid working knowledge of Algebra I, Geometry, Algebra II.
- Students are fluent in basic computations: addition, subtraction, multiplication, and division of integers, fractions, decimals, and rational expressions; and students can apply order of operations.
- Students can translate between graphical, geometric, algebraic, and verbal representations of problems.
- Students are fluent in operations on polynomials (addition, subtraction, multiplication, and factoring of polynomials) and can divide a polynomial by a low-degree polynomial.
- Students work fluently with real-world measurement (e.g., perimeter, area, volume, surface area).

- Students can create and interpret various types of data representations (e.g., charts, graphs, plots).
- Students can plot points in Cartesian plane, fit functions of linear and parabolic equations to observed data, and in real world problems draw conclusions using the slopes, x and y intercept, and/or zeros of a function.
- Students can use the core trigonometry functions of sine, cosine, and tangent; relate trigonometry functions to triangles; and understand the Pythagorean theorem.
- Students are fluent with fractions, ratios, decimals, percents, and proportions, and can apply this knowledge to real-world problems.
- Students can evaluate functions at a specific point.
- Students are fluent with rules of exponents/roots (e.g., integer and rational exponents).
- Students understand statistical concepts of central tendency and variability (variance, standard deviation, and the normal distribution were not covered by all).
- Students understand basic data analysis and experimental design issues (e.g., random assignment)
- Students can apply or have experience with several distributions (e.g., normal, exponential, logarithmic).
- Students understand inverse trigonometric functions.
- Students can solve systems of equations in applied problems.

Core Science Content

Two separate benchmarking activities, the first using Project 2061 as the benchmark, and a second using California state standards as the benchmark, were conducted to triangulate agreement on the core science content across the relevant standards. The science content that was nominated by most or all of the examined standards was aggregated into a smaller number of descriptors listed below. At the most general level, the content would be contained within the typical high school course domains of Chemistry, Physics, Biology, and Earth and Space Science, and an additional (non-course) domain of Scientific Methods and Inquiry. Standards documents often differ on whether they treat scientific method as embedded within content or as a separate strand.

The following list represents content nominated at some level of specificity by most or all of the science standards examined as essential for college or workforce readiness.

- Students can formulate logic- and evidence-based explanations.
- Students rely on reproducible observations of natural events and phenomena, and recognize that such observations, when repeatedly confirmed, are regarded as the highest-quality data.

- Students are skilled at recognizing inappropriate or illogical arguments and conclusions and know that such mistakes lead to fraudulent or pseudo-scientific claims and theories.
- Students use a variety of mathematical and statistical procedures and techniques to analyze, evaluate, and interpret data and explanatory models.
- Students understand plate tectonics and the Earth's geological processes and geological history.
- Students are aware of solar radiation as Earth's energy source and the contribution of solar energy to Earth systems and processes.
- Students understand cell biology (e.g., cellular processes, cellular specialization, and cell structure/function).
- Students grasp the importance of genetics as well as the implications of gene expression and replication at the cellular, individual, and population levels.
- Students know organ and body systems and the physiological roles of the respective organism system components.
- Students understand acids, bases, and salts and their chemistry and properties in solutions.
- Students understand facets of the kinetic molecular theory and properties of gases.
- Students understand chemical bonds.
- Students understand atomic and molecular structure.
- Students understand the Periodic Table and periodicity as it relates to element physical and chemical properties and trends.
- Students understand properties and characteristics of waves.
- Students understand the Law of Conservation of Energy and Momentum and its relationship to movement of objects.
- Students understand Newton's Laws of Motion.
- Students understand the structure of the solar system and nature of various astronomical objects such as black holes and galaxies.

Specific Findings in Each Subject Area

In addition to the general findings, the comparison revealed findings that were specific to the content area.

English Language Arts

- There was broad agreement on the importance of English grammar and mechanics, effective writing, developing a large vocabulary and the ability to

infer meanings of new words, and an emphasis in particular on skills for engaging with informational text.

- The nature of the English domain makes it more difficult (than for mathematics or science) for standards statements to anchor or communicate the level of conceptual difficulty or rigor required for the college level.
- Standards that appear to communicate rigor well incorporate specific examples of work products and types of content that students are expected to engage successfully.
- The amended draft of the English language arts standards covers this content comprehensively. However, work should be done during the next phases of standards development as set out in House Bill 1 to include grade-specific sample classroom lessons, illustrative texts, and appropriate assessments to communicate the level of rigor required to meet the standard. (See Appendix H for the amended draft of English language arts standards.)

The English language arts Vertical Team developed this amended draft of standards, which represents the consensus knowledge and skills required for college readiness that were identified in the English standards comparison. The revised document meets the four requirements identified by the Commission as necessary for good college readiness standards. These include:

- A sophisticated set of skills and knowledge that is expected in colleges and universities.
- An emphasis on outcome standards.
- More specificity, which will provide teachers with more clarity on planning instruction.
- Content that is clearly aligned with what will be the expectations for grades 11 and 12 under the new state curriculum standards based on the English language arts gap analysis.

Mathematics

- Students should know the content of rigorous high school courses in Algebra I, Geometry, and Algebra II, and should have a background in the basic statistical concepts of central tendency, variability, and probability.
- The Vertical Team document covers this content comprehensively. (The Vertical Team standards for mathematics can be accessed at http://www.thecb.state.tx.us/collegereadiness/Draft_CRS.pdf.)
- When the state begins to review mathematics standards, it will need to build on the recommendations of the Vertical Team to include specific statements of skills and concepts necessary at each grade level. The Commission is conducting an expert review of the current state standards to ensure alignment with the knowledge and skills necessary to be ready for college level work in courses in

mathematics and/or courses that require use of mathematics such as Physics, Biology, Engineering, Business, and Accounting.

Science

- Students should know the content of rigorous high school courses in Biology, Chemistry, and Physics.
- Additional content typically covered under Earth and Space Science courses is considered important as well; students should understand plate tectonics, atmospheric processes, and climate.
- A clear understanding of scientific method, measurement and scientific inquiry is critical. This can be represented very differently in different standards, either embedded within each content domain or as a separate strand.
- The Vertical Team document covers this content comprehensively and in great detail. (The Vertical Team standards for science can be accessed at http://www.thecb.state.tx.us/collegereadiness/Draft_CRS.pdf.)

Social Studies

The Commission found only one set of nationally recognized college readiness standards in social studies—the Standards 4 Success—College Knowledge standards—so no formal examination across standards was done. In addition, there is little agreement nationwide on how to define college readiness in this subject.

The Social Studies Vertical Team was charged with creating college ready standards that encompass the broad disciplines within the social studies spectrum (e.g., history, government, geography, sociology, psychology), which made its task distinctly different from those of the other Vertical Teams. Although the state will not review social studies standards for some time, the Commission and Vertical Team believe that K–12 standards will require clear, rigorous, and explicit expectations with respect to both cognitive skills and knowledge of content. The Vertical Team made a deliberate decision not to identify lists of facts that students must master to be ready for college; however, this should not be interpreted to mean that students should not be mastering a range of foundational knowledge about social systems and phenomena.

The Commission and Vertical Team believe that significant work will be required in the next phases of activity regarding the appropriate definition of content knowledge expectations if the SBOE is to be given helpful guidance when the time comes for review of standards. Further, the Commission believes that in addition to emphasizing the need for global analysis and an ability to function in a globally competitive economy, knowledge about the founding of our nation, the ideas and principles in the U.S. Constitution, and the crucial bearing of this period of history on our role as citizens is essential for all Texas high school graduates. While recognizing the interdisciplinary nature of the Vertical Team's charge, a more thorough treatment of these objectives would be a constructive addition immediately to the Vertical Team report. (The Vertical

Team standards for social science can be accessed at http://www.thecb.state.tx.us/collegereadiness/Draft_CRS.pdf).

Part Three

College Readiness Definitions From Texans—Parents, Students, Teachers, College Faculty, and Employers

The Commission held a series of statewide and regional meetings to gain input from Texans on what knowledge, skills, and traits a person must possess to be equipped to succeed in college courses. They also organized a focus group of business leaders and faculty who teach college freshmen so that they could share their views on the knowledge and skills associated with college and career readiness. In addition, the Commission surveyed the directors of the state's Workforce Development Boards to have them identify the most important skills required for employment.

The Commission met five times from April through September with a portion of the meetings dedicated to receiving testimony and comment from diverse stakeholders. Regional meetings also were held in Midland/Odessa, Harlingen, and Lubbock with one or more Commission members joining local business, education, political, and civic leaders to discuss the college readiness challenges and successes of the particular area.

Additionally, the Commission convened a focus group of business leaders and higher education faculty in Austin to provide feedback on the nationally recognized college readiness standards comparison in English, mathematics, and science conducted by REL Southwest at the request of the Commission. This focus group was asked to answer the following questions:

- Do the standards that are common to all or most of the sources compared in the crosswalk match faculty expectations for entering college students and employer expectations for high school graduates entering the workforce?
- Are skills and knowledge needed that are not included in the standards?
- Which skills and knowledge, if any, are particularly important?
- Are there specific needs in Texas that are not reflected in the standards?
- Are the skills and knowledge needed for college different from those needed to enter the workforce?

Summary of Stakeholder Input From Statewide Meetings

Testimony about introducing college career readiness standards in Texas was collected from a broad cross-section of groups throughout the state, including public school teachers, school board trustees, higher education faculty, public policy groups, and business leaders. The majority of individuals speaking to the Commission agreed that current graduates are inadequately prepared to succeed after high school and that all students should be prepared for postsecondary education and training. They offered the following recommendations, none of which are necessarily endorsed by the Commission.

Input from Testimony for K–12 Standards

- Start standards for college and career readiness in kindergarten.
- Prepare all students to be college and career ready.
- Include scientifically based principles, particularly in English language arts.
- Develop specific, measurable grade-level standards that increase in cognitive complexity as grades progress.
- Enhance the relevance of academic standards and meaningfulness for students.
- Create vertical alignment between expectations for high school graduates and entry-level requirements of postsecondary education.

Input From Testimony for Assessment and Accountability

- Develop and educate teachers in a range of appropriate formative assessments
- Refine state assessments to measure high level cognitive skills and conceptual connections.
- Create growth and value-added measures to assessments and accountability.
- Base assessments and accountability on expectations for college and career readiness.
- Administer national pre-college readiness tests, such as the Preliminary SAT, ACT Plan, and Explore.
- Require all students to demonstrate college and career readiness before receiving a high school diploma.
- Establish standards that are comparable to the best in the world and equip graduates of Texas public schools to be globally competitive.
- Introduce school choice as a part of school accountability.

Other Input From Testimony

- Provide students and parents with information about the importance of preparing for and succeeding in college and careers.
- Offer supplemental instruction—extended day programs, Saturday programs, and summer academic camps—to help students who fall behind.
- Offer first-rate preschool programs.
- Establish collaborative curricular efforts between higher education institutions and public schools.
- Develop articulation agreements between high schools and local colleges and universities.
- Encourage students to enroll in college courses through Advanced Placement, dual enrollment, and Early College programs.

- Create a P–16 information system.
- Provide training for teachers currently in Texas public schools, particularly mathematics and science teachers, so they can teach to higher level expectations.
- Strengthen teacher preparation programs to equip teachers with the knowledge and skills needed to prepare students for college and career.
- Increase public awareness that all students need to be prepared for college and career, and showcase the many postsecondary options available to students, including vocational programs.
- Create a coherent, comprehensive plan for improving college and career readiness and postsecondary success, with a state cabinet-level position of Secretary of Education and alignment of curriculum from K–16.
- Designate community colleges to be the primary provider of remedial/developmental education.
- Introduce college and career readiness immediately to meet the needs of both students and businesses.

Appendix I includes a summary of individual stakeholder input from the Commission's statewide meetings.

Summary of Input From Regional Meetings

The regional meetings held in Midland/Odessa, Harlingen, and Lubbock gave Commission members the opportunity to receive input on the college readiness challenges faced by each of these three regions. Testimony was provided by a State Representative, higher education leaders, school board trustees, public school administrators, and local business executives. Much of the input mirrored the recommendations received by the Commission at statewide meetings, and there was agreement that current high school graduates do not possess the knowledge and skills required for success in postsecondary education and training. Participants offered the following recommendations.

Input From Regional Testimony for K-12 Standards

- Start standards for college and career readiness in pre-school and kindergarten.
- Prepare all students to be college and career ready.
- Include scientifically based principles in the curriculum.
- Enhance the relevance of academic standards and meaningfulness for students.
- Create vertical alignment between expectations for high school graduates and entry-level requirements of postsecondary education.
- Ensure that students have abstract reasoning skills.

Input From Regional Testimony for Assessment and Accountability

- Align the state and federal accountability systems to avoid confusion.
- Create an accountability system for colleges.

Other Input From Regional Testimony

- Provide students and parents with information about the importance of preparing for and succeeding in college and careers.
- Offer supplemental instruction—extended day programs, Saturday programs, and summer academic camps—to help students who fall behind.
- Establish collaborative curricular efforts between higher education and public schools, particularly dual credit programs.
- Develop articulation agreements between high schools and local postsecondary institutions.
- Encourage students to enroll in postsecondary courses through dual enrollment.
- Create and support Regional P–16 Councils.
- Provide training for teachers currently in Texas public schools, particularly mathematics and science teachers, so they can learn to teach to higher level expectations.
- Provide professional development training in how to teach critical reading and writing to middle and high school teachers
- Strengthen teacher preparation programs to equip teachers with the knowledge and skills needed to prepare students for college and career. This charge includes a command of subject expertise as well as cross disciplinary skills.
- Increase public awareness that all students need to be prepared for college and career, and showcase the many postsecondary options available to students, including vocational programs.
- Increase funding and support for education.
- Introduce college and career readiness immediately to meet the needs of both students and businesses.
- Promote stronger technology instruction and application in high school.
- Encourage partnerships between school districts.
- Support more college and career counseling in middle and high schools.

Appendix J presents a summary of individual stakeholder input from the Commission's regional meetings.

Summary of Input From College Faculty and Business Leaders at Focus Group Meeting

The Commission Chair convened a meeting of business leaders from across the state and higher education faculty representing each core curriculum area to discuss what knowledge and skills are necessary to ensure high school graduates are ready for college and the workplace. The meeting also was designed to provide feedback on what researchers have found from examining the best college readiness standards in English, mathematics, and science from across the country. All of the participants expressed concern about students who are unprepared for postsecondary education and the workforce, particularly in mathematics and science. They also were concerned about the competitiveness of our workforce. The group made some general observations about required knowledge and skills that cut across subject areas.

Observations on K–12 Standards

- Students should be prepared for both college and the workplace, and the same knowledge and skills are generally required for both.
- Students need rigorous standards, knowledgeable teachers, high intensity in their high school courses, quality high school counseling all of 4 years of high school, motivation to learn, independence in learning, and persistence in studying.
- Reading is a fundamental skill. Reading deficits represent the leading cause of academic problems across the disciplines. If students cannot read, they cannot acquire the knowledge and skills necessary for college and work.
- Problem solving is particularly critical to college readiness in mathematics, but it crosses all core subjects. We must do a better job of developing problem-solving competencies across the curriculum and demonstrating how knowledge is applied in the real world.
- Higher education and high schools must begin a dialogue so that standards, when adopted, are interpreted correctly. The Commission must address the disconnect between what high schools perceive college readiness to be and what skills and knowledge faculty in higher education say are really needed for college success. If education is to be seamless and integrated, we must make sure that what is taught in K–12 education truly prepares students for higher education.
- Technology is a vital skill for every high school graduate. Students need to be able to use the computer, and digital fluency must be integrated into the classroom.

Observations on Assessment and Accountability

- It is important to consider the international/global market when looking at standards, knowledge, and skills. The new college readiness standards adopted

by the state must ensure that students are prepared for the global marketplace. Unless we do so, their ability to earn a living is diminished, and the Texas economy will not be competitive.

Other Observations

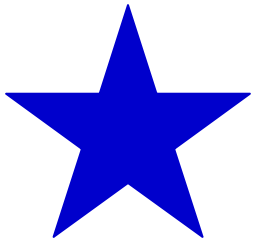
- The number one concern expressed by business leaders is the impossibility of finding qualified or trainable workers. Businesses are looking for applicants who are reliable, punctual, and persistent in accomplishing tasks. Businesses need people who show a strong work ethic, who can work well in teams, and who can meet effectively with clients, customers, and the public. In addition, workers are needed who can master new skills, adapt to new demands of technology and the marketplace, and continually contribute to the success of their industry or employer. These characteristics are sometimes dismissed as "soft skills" that have little importance. Surveys confirm, however, that workers are terminated primarily because of poor attendance, tardiness, insubordination, and the inability to work in teams, so workers with strong soft skills are in high demand.
- It was suggested that the Commission consider the possibility of multiple levels of standards for college readiness—a first level for students seeking a technical and vocational degree or certificate and a second level for students planning to attend a university. It may be necessary to think about a range of readiness or different tiers of college and career readiness, but we need to be very careful to avoid the possibility that students would be tracked into career paths.
- Teacher education in mathematics and science must be aligned with college readiness expectations. Concern was expressed that the current teacher corps is not prepared to teach mathematics and science courses with the high intensity and rigor that is needed to prepare all students for college. Decisions about teacher preparation and recruitment will have to be addressed with the introduction of college readiness standards.

Appendix K includes a summary of the specific recommendations and comments provided by the focus group participants in each of the four core curriculum areas.

In addition to obtaining feedback from business leaders participating in the Commission's focus group on college and workplace readiness, the heads of the Workforce Development Boards across Texas were surveyed to identify the most important knowledge and skills needed by workers today. Appendix L includes the results of this survey.

A similar survey was conducted at the 2007 Texas Association of School Boards (TASB) and Texas Association of School Administrators (TASA) Convention. Twenty respondents rated the necessity of specific content in English, mathematics, and science for college readiness. Appendix M presents the results of this survey.

Neither of these small surveys of Workforce Development Board directors and TASB/TASA participants was intended to be representative. These findings simply provide a snapshot of the opinions of the respondents.



Part Four
Findings of the Commission

After listening to expert and public testimony, and reviewing the research, the Commission found persuasive evidence for the following findings.

Understanding and Redefining College Readiness

- Definitions of college readiness vary, but most concur that readiness is the attainment of the core knowledge and skills required to succeed in the first year of education after high school without the need for remedial/developmental education.
- Today's knowledge-based, global economy requires all youth to acquire education after high school to be competitive, successful, and earn an adequate income.
- Today the options for education after high school are vast and include technical training, the military, and 2-year college and 4-year university programs.
- The essential knowledge and skills required for post-secondary readiness, no matter what option is chosen, are the same, although many students may want to consider even more rigorous coursework.
- The K–12 public school curriculum must be made more challenging to ensure that all students graduate with the prerequisite knowledge and skills to succeed after high school. Students, faculty, counselors, and administrators can no longer view the senior year in high school as a let-down or "marking-time" interval. Academic intensity must continue through 12th grade if students are to obtain the knowledge and skills necessary for college and workplace success.
- Preparation for college readiness must begin in kindergarten and progress through 12th grade.
- Texas high school graduates today are unprepared for the rigor of college courses and there is a disconnect between the current exit-level Texas Assessment of Knowledge and Skills (TAKS) passing standards—the requirement for high school graduation—and the level of performance needed to be college ready.

Need for College and Career Readiness

- Educational attainment, such as receiving a high school diploma or completing an associate's or bachelor's degree, significantly influences an individual's expected earning potential.
- The majority of high school graduates in the United States intend to complete some form of post-secondary education but do not complete their education after high school.

- The vast majority of Texas public school graduates who intend to acquire post-secondary certification or a degree are less prepared to succeed than most of their peers throughout the nation.
- The business community in Texas supports the development of more rigorous standards for high school graduation.
- Lack of rigor in curriculum standards leads to poor educational attainment. This puts Texas and our students at a competitive disadvantage in the global economy in which they are required to compete. Although higher education enrollment is growing slowly toward achieving the goals established by THECB (2000) in *Closing the Gaps by 2015,* the state's higher education plan, post-secondary education completion in Texas is behind other states and other countries.
- Standards alone cannot address the problems identified in this report. Rather they provide goals to be reached. Reaching these goals requires a substantial effort in K–12 education to support curriculum and teacher development, which are delineated in House Bill 1, 79th Legislature, 3rd Called Session.
- In today's knowledge-based economy, an overwhelming majority of jobs require some form of post-secondary education.
- Students in the public education system today must be prepared to solve problems and to work in careers that do not yet exist in an increasingly competitive, global workplace.
- The most frequent concern expressed by employers is the shortage of qualified and trainable workers who posses solid academic knowledge and workplace skills such as persistence, a strong work ethic, good attendance and punctuality, and the ability to work in teams. This difficulty results in remedial training and employee turnover.

What Research Says About College and Career Readiness Standards

- Standards for college and career readiness have been established by several national organizations and are being used increasingly throughout the United States.
- Research suggests that these standards are associated with college and career success and therefore more prosperous citizens.
- When compared, nationally recognized standards describe the knowledge and skills necessary for college and career readiness.
- Sets of nationally recognized standards offer different levels of specificity. Specificity increases the likelihood that a standard is clearly understood by educators, parents, students, test-makers, and textbook publishers.
- ACT college readiness standards in mathematics, English, reading, and science are empirically derived. These standards have been mapped to specific ACT

score ranges and test questions, and indicate a certain probability of performance in first-year college classes. The relationship between test questions, test scores, and academic standards provides invaluable information about the level of proficiency that students need to demonstrate to be successful after high school.

- The College Board Standards for College Success are grade-specific, 6–12 curriculum standards based on extensive surveys of college and high school faculties and analysis of course content from exemplary college preparatory courses. The College Board standards provide specific guidelines for how the state may develop a sequence of courses and end-of-course assessments building to research-based definitions of college readiness.
- Individually, none of the nationally recognized college readiness standards examined includes everything that business and higher education faculty believe are essential for college readiness. When the standards are combined, however, all of the essential standards are present.
- There are few, if any, distinctions made in nationally recognized and exemplary state standards between college readiness and workforce readiness. This is supported by testimony from the business community and general public.
- Both research and feedback from the business and higher education communities indicate that the high school courses required for students to succeed after high school are much the same across the nationally recognized standards. They include, but are not limited to, Algebra II, Physics, and Statistics.

Comparison of College Readiness Standards

- Significant gaps exist in current Texas standards when they are compared to nationally recognized standards of college readiness.
- Current Texas standards do not always reflect the specificity and focus to clearly communicate the intent of the standard.
- Upon initial review, the Vertical Team standards in mathematics and science appear to align with the knowledge and skills required for college readiness that were identified in the nationally recognized standards comparison.
- The amended draft of the English language arts standards, presented by the Vertical Team co-chairs, represents a consensus about college-ready knowledge and skills. The amended draft, which covers writing, reading, speaking, and listening, replaces those sections of the Draft Texas College Readiness Standards posted on the THECB website. Appendix H presents the amended draft standards.
- Although a nationally recognized standards comparison was not conducted in social studies, the Commission believes that K–12 social studies standards will need clear, rigorous, and explicit expectations with respect to core knowledge and skills to meet college ready expectations.

- As the Vertical Teams, TEA, THECB, and SBOE continue working on the state's college readiness standards, the inclusion of grade-specific classroom lessons, illustrative texts, and appropriate assessments will ensure that teachers and students clearly understand the level of rigor required to be college ready.

Recommendations of the Commission

Policies to Support New Post-High School Readiness Standards

- As policymakers and educators implement college readiness strategies and curriculum, they should also address issues of high school dropouts and stress the importance of obtaining a high school diploma. Engaging and rigorous course options should be provided to all students with additional attention paid to students at risk of dropping out of school.
- For all Texas students to be successful after high school, the TEA and the THECB should better align their infrastructures to ensure consistency in policies and programs essential to every student's academic success. This includes aligning data systems, coordinating the expenditure of applicable state and federal funds. This also includes determining standards of performance on the THEA and the HERC. It is also imperative that consensus is reached in determining the standards associated with postsecondary readiness and passing scores for end-of-course exams and any other high school assessments the SBOE approves for use in Texas public schools, such as the ACT, Scholastic Aptitude Test (SAT), and THEA.
- A statewide strategic plan for introducing college readiness standards should be developed. The plan should specify the processes to be followed, systems to be created, and steps to be taken with consideration to the responsibility of the SBOE to adopt college readiness standards and include them in the K–12 curriculum. It should include, but not be limited to: instructional materials that align to the new curriculum and college readiness standards; an assessment system that aligns to the new curriculum standards with high school end-of-course exams that reflect the college readiness standards; and a new information system that provides data about a student's school career from kindergarten through their post-secondary education. It also should include clear metrics that define the terms *college readiness* and/or *on-track to be college ready* so that student progress toward college readiness can be identified at the district level starting as early as sixth grade; meaningful professional development and teacher preparation programs to ensure teachers are adequately prepared and supported to increase college readiness among Texas students; and new teacher certification tests that align to the more rigorous curriculum standards.
- The K–12 public school curriculum must be designed and implemented to expand and improve students' abilities to gather, analyze, evaluate, and use information in real situations to ensure that all students graduate with the prerequisite knowledge and skills to succeed after high school. Thinking and

reasoning skills, based in appropriate content-specific knowledge, are of primary importance.

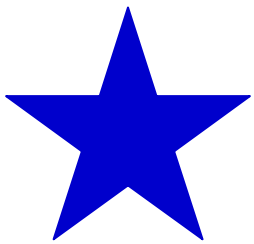
- Policies regarding the selection of instructional materials, test development, determinations of proficiency and other levels of achievement, professional development for educators, and general accountability should be made or aligned with the goal of students progressing each year toward college readiness upon graduation from high school. Preparation for college readiness must begin in kindergarten and continue through grade 12.
- The new classroom expectations should focus first on the systematic acquisition of broad factual knowledge associated with core academic subjects and on developing a rigorous level of abstract thinking and applied knowledge and skills. This different approach to teaching and learning should be reflected in every aspect of public education, including but not limited to instructional practices, textbooks, assessments, teacher preparation, professional development, teacher certification, information systems, and accountability.
- As standards for college readiness are introduced into Texas public schools, vigorous steps must be taken to ensure there are high expectations for all students. Additionally, education leaders should identify mechanisms and strategies to help students bridge the gap between current standards and standards for college readiness, including better utilization of the High School Allotment and other state grants and programs.
- Career and technical education provides students with engaging course options. This curriculum must constantly challenge and guide students to improve and expand their thinking and reasoning skills, to make use of content information in rigorous ways, and to recognize real-world applications of these skills. The standards must reflect expectations for college readiness, including the ability to succeed academically in postsecondary education.
- All institutions of higher education should use the standards for college readiness adopted by the THECB and the SBOE to determine entry-level credit bearing courses.
- All institutions of higher education that are responsible for aspects of teacher preparation, including alternative certification, should incorporate these standards into their preparation practices.
- Institutions of higher education should be rewarded for increasing the number of students who successfully complete degree programs. Additionally, systems of accountability should be put in place to assess student learning in each institution's general academic program to ensure that institutional standards remain high while completion rates increase. Such measures of accountability should align closely with standards and expectations established by nationally recognized professional organizations, licensing boards, and other independent standard-setting agencies.

- All Texans should be informed about the importance of education after high school and its impact on individual success. P–16 reform should remain the top priority for state and local policymakers to better serve the needs of the communities, schools, and families they represent.
- Policymakers, teachers, and high school guidance counselors should help parents and students become better informed of the value of education after high school as well as the knowledge, skills, and specific courses required to be successful after high school. College readiness standards should be accessible and understandable to parents and students.
- Academic learning must be the priority for classroom instruction. Skills such as punctuality, reliability, persistence, strong work ethic, effective study habits, time management, and the ability to work in teams are sometimes dismissed as soft skills but are critical to college and workplace success. Effective instruction can foster these habits, but development of these skills should not be the focus of classroom instruction.

Requirements for New College Readiness Standards

- College readiness standards should be written with specificity and articulate a clear understanding of the complexity level expected within each standard.
- K–12 standards must offer a pathway to graduating college-ready Texans. They must be specific, giving teachers a clear indication of the level at which they need to teach and at which they should expect their students to perform to be prepared for college and/or a meaningful career.
- Texas college readiness standards should be consistent with the knowledge and skills identified from the comparison of nationally recognized college readiness standards.
- K–12 curriculum standards, including standards for college readiness, should include core skills for each grade level. These standards should call for steady and sustained increases in content knowledge, reasoning skills, communication skills (oral and written), and ability to use these skills effectively in real settings through each grade until graduation. They should be focused, specific, and measurable.
- Expectations in the classroom should align with expectations in college and the workforce. This should include a focus on progressively more challenging and academically intensive levels of abstract, conceptual, analytical, and applied knowledge and skills. These increasingly intense challenges must extend through the senior year of high school so that students do not experience a let-down or falling-off of knowledge and skills just before beginning their college or workplace careers.

- Expectations for all graduates of Texas public schools should reflect a composite of available college readiness standards, including those from the ACT, American Diploma Project, Standards 4 Success, and The College Board.
- Requirements for acquiring a high school diploma from Texas public schools should include successful completion of courses that indicate college readiness. These include, but are not limited to, Algebra II, Physics, and Statistics.



Appendix A

Achieve's ADP Mathematics and English Benchmarks

(retrieved from http://www.achieve.org/node/175)

English Benchmarks

A. Language

The high school graduate can:

A1. Demonstrate control of standard English through the correct use of grammar, punctuation, capitalization and spelling. (Associated Workplace Tasks: #2, 3, 4, 5 and 6) (Associated Postsecondary Assignments: #4, 5 and 6)

A2. Use general and specialized dictionaries, thesauruses and glossaries (print and electronic) to determine the definition, pronunciation, etymology, spelling and usage of words. (Associated Postsecondary Assignment: #4)

A3. Use roots, affixes and cognates to determine the meaning of unfamiliar words.

A4. Use context to determine the meaning of unfamiliar words.

A5. Identify the meaning of common idioms, as well as literary, classical and biblical allusions; use them in oral and written communication.

A6. Recognize nuances in the meanings of words; choose words precisely to enhance communication. (Associated Workplace Tasks: #2, 3, 4, 5 and 6) (Associated Postsecondary Assignments: #4, 5 and 6)

A7. Comprehend and communicate quantitative, technical and mathematics information. (Associated Workplace Tasks: #1 and 2) (Associated Postsecondary Assignments: #2 and 3)

B. Communication

The high school graduate can:

B1. Give and follow spoken instructions to perform specific tasks, to answer questions or to solve problems. (Associated Workplace Tasks: #1 and 2)

B2. Summarize information presented orally by others.

B3. Paraphrase information presented orally by others.

B4. Identify the thesis of a speech and determine the essential elements that elaborate it.

B5. Analyze the ways in which the style and structure of a speech support or confound its meaning or purpose.

B6. Make oral presentations that:

- exhibit a logical structure appropriate to the audience, context and purpose;
- group related ideas and maintain a consistent focus;
- include smooth transitions;
- support judgments with sound evidence and well-chosen details;

- make skillful use of rhetorical devices;
- provide a coherent conclusion; and
- employ proper eye contact, speaking rate, volume, enunciation, inflection and gestures to communicate ideas effectively.

See Workplace Task #3: Actuary

B7. Participate productively in self-directed work teams for a particular purpose (for example, to interpret literature, write or critique a proposal, solve a problem, make a decision), including:

- posing relevant questions;
- listening with civility to the ideas of others;
- extracting essential information from others' input;
- building on the ideas of others and contributing relevant information or ideas in group discussions;
- consulting texts as a source of ideas;
- gaining the floor in respectful ways;
- defining individuals' roles and responsibilities and setting clear goals;
- acknowledging the ideas and contributions of individuals in the group;
- understanding the purpose of the team project and the ground rules for decision-making;
- maintaining independence of judgment, offering dissent courteously, ensuring a hearing for the range of positions on an issue, and avoiding premature consensus;
- tolerating ambiguity and a lack of consensus; and
- selecting leader/spokesperson when necessary.

See Postsecondary Assignment #4: Introductory English Survey Course

C. Writing

The high school graduate can:

C1. Plan writing by taking notes, writing informal outlines and researching.

- See Workplace Task #4: Wafer Fabrication Technician and Manufacturing Technician
- See Workplace Task #5: Events Manager
- See Workplace Task #6: Loan Officer
- See Postsecondary Assignments #4: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #5: Wafer Fabrication Technician and Manufacturing Technician

- See Postsecondary Assignments #6: Wafer Fabrication Technician and Manufacturing Technician

C2. Select and use formal, informal, literary or technical language appropriate for the purpose, audience and context of the communication.

- See Workplace Task #4: Wafer Fabrication Technician and Manufacturing Technician
- See Workplace Task #5: Events Manager
- See Workplace Task #6: Loan Officer
- See Postsecondary Assignments #4: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #5: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #6: Wafer Fabrication Technician and Manufacturing Technician

C3. Organize ideas in writing with a thesis statement in the introduction, well-constructed paragraphs, a conclusion and transition sentences that connect paragraphs into a coherent whole.

- See Workplace Task #4: Wafer Fabrication Technician and Manufacturing Technician
- See Workplace Task #5: Events Manager
- See Workplace Task #6: Loan Officer
- See Postsecondary Assignments #4: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #5: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #6: Wafer Fabrication Technician and Manufacturing Technician

C4. Drawing on readers' comments on working drafts, revise documents to develop or support ideas more clearly, address potential objections, ensure effective transitions between paragraphs and correct errors in logic.

- See Workplace Task #4: Wafer Fabrication Technician and Manufacturing Technician
- See Workplace Task #5: Events Manager
- See Workplace Task #6: Loan Officer
- See Postsecondary Assignments #4: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #5: Wafer Fabrication Technician and Manufacturing Technician

- See Postsecondary Assignments #6: Wafer Fabrication Technician and Manufacturing Technician

C5. Edit both one's own and others' work for grammar, style and tone appropriate to audience, purpose and context.

- See Workplace Task #4: Wafer Fabrication Technician and Manufacturing Technician
- See Workplace Task #5: Events Manager
- See Workplace Task #6: Loan Officer
- See Postsecondary Assignments #4: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #5: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #6: Wafer Fabrication Technician and Manufacturing Technician

C6. Cite print or electronic sources properly when paraphrasing or summarizing information, quoting, or using graphics.

C7. Determine how, when and whether to employ technologies (such as computer software, photographs and video) in lieu of, or in addition to, written communication.

C8. Present written material using basic software programs (such as Word, Excel and PowerPoint) and graphics (such as charts, ratios and tables) to present information and ideas best understood visually.

C9. Write an academic essay (for example, a summary, an explanation, a description, a literary analysis essay) that:

- develops a thesis;
- creates an organizing structure appropriate to purpose, audience and context; includes relevant information and excludes extraneous information;
- makes valid inferences;
- supports judgments with relevant and substantial evidence and well-chosen details; and
- provides a coherent conclusion.

For more information:

- See Postsecondary Assignments #4: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #5: Wafer Fabrication Technician and Manufacturing Technician
- See Postsecondary Assignments #6: Wafer Fabrication Technician and Manufacturing Technician

C10. Produce work-related texts (for example, memos, e-mails, correspondence, project plans, work orders, proposals, bios) that:

- address audience needs, stated purpose and context;
- translate technical language into non-technical English;
- include relevant information and exclude extraneous information;
- use appropriate strategies, such as providing facts and details, describing or analyzing the subject, explaining benefits or limitations, comparing or contrasting, and providing a scenario to illustrate;
- anticipate potential problems, mistakes and misunderstandings that might arise for the reader;
- create predictable structures through the use of headings, white space and graphics, as appropriate; and
- adopt a customary format, including proper salutation, closing and signature, when appropriate.

For more information:

- See Workplace Task #4: Wafer Fabrication Technician and Manufacturing Technician
- See Workplace Task #5: Events Manager
- See Workplace Task #6: Loan Officer

D. Research

The high school graduate can:

D1. Define and narrow a problem or research topic. (Associated Workplace Tasks: #4 and 6)

D2. Gather relevant information from a variety of print and electronic sources, as well as from direct observation, interviews and surveys. (Associated Workplace Tasks: #3, 4, 5 and 6) (Associated Postsecondary Assignment: #4)

D3. Make distinctions about the credibility, reliability, consistency, strengths and limitations of resources, including information gathered from Web sites. (Associated Workplace Task: #5)

D4. Report findings within prescribed time and/or length requirements, as appropriate. (Associated Workplace Tasks: #4, 5 and 6)

D5. Write an extended research essay (approximately six to 10 pages), building on primary and secondary sources, that:

- marshals evidence in support of a clear thesis statement and related claims;
- paraphrases and summarizes with accuracy and fidelity the range of arguments and evidence supporting or refuting the thesis, as appropriate; and

- cites sources correctly and documents quotations, paraphrases and other information using a standard format. (Associated Workplace Task: #4)

E. Logic

The high school graduate can:

E1. Distinguish among facts and opinions, evidence and inferences. (Associated Postsecondary Assignment: #5)

E2. Identify false premises in an argument. (Associated Postsecondary Assignment: #5)

E3. Describe the structure of a given argument; identify its claims and evidence; and evaluate connections among evidence, inferences and claims. (Associated Postsecondary Assignment: #5)

E4. Evaluate the range and quality of evidence used to support or oppose an argument. (Associated Workplace Task: #6)

E5. Recognize common logical fallacies, such as the appeal to pity (argumentum ad misericordiam), the personal attack (argumentum ad hominem), the appeal to common opinion (argumentum ad populum) and the false dilemma (assuming only two options when there are more options available); understand why these fallacies do not prove the point being argued.

E6. Analyze written or oral communications for false assumptions, errors, loaded terms, caricature, sarcasm, leading questions and faulty reasoning.

E7. Understand the distinction between a deductive argument (where, if the premises are all true and the argument's form is valid, the conclusion is inescapably true) and inductive reasoning (in which the conclusion provides the best or most probable explanation of the truth of the premises, but is not necessarily true). (Associated Workplace Task: #4)

E8. Analyze two or more texts addressing the same topic to determine how authors reach similar or different conclusions.

E9. Construct arguments (both orally and in writing) that:

- develop a thesis that demonstrates clear and knowledgeable judgment;
- structure ideas in a sustained and logical fashion;
- use a range of strategies to elaborate and persuade, such as descriptions, anecdotes, case studies, analogies and illustrations;
- clarify and defend positions with precise and relevant evidence, including facts, expert opinions, quotations and/or expressions of commonly accepted beliefs and logical reasoning;
- anticipate and address the reader's concerns and counterclaims; and
- provide clear and effective conclusions. (Associated Postsecondary Assignments: #5 and 6)

F. Informational Text

The high school graduate can:

F1. Follow instructions in informational or technical texts to perform specific tasks, answer questions or solve problems.

F2. Identify the main ideas of informational text and determine the essential elements that elaborate them.

F3. Summarize informational and technical texts and explain the visual components that support them. (Associated Workplace Tasks: #3 and 6)

F4. Distinguish between a summary and a critique.

F5. Interpret and use information in maps, charts, graphs, time lines, tables and diagrams. (Associated Workplace Tasks: #3 and 4)

(Associated Postsecondary Assignments: #2 and 3)

F6. Identify interrelationships between and among ideas and concepts within a text, such as cause-and-effect relationships.

F7. Synthesize information from multiple informational and technical sources. (Associated Workplace Tasks: #4, 5 and 6)

F8. Draw conclusions based on evidence from informational and technical texts.

F9. Analyze the ways in which a text's organizational structure supports or confounds its meaning or purpose. (Associated Workplace Tasks: #5 and 6)

F10. Recognize the use or abuse of ambiguity, contradiction, paradox, irony, incongruities, overstatement and understatement in text and explain their effect on the reader.

F11. Evaluate informational and technical texts for their clarity, simplicity and coherence and for the appropriateness of their graphics and visual appeal.

G. Media

The high school graduate can:

G1. Evaluate the aural, visual and written images and other special effects used in television, radio, film and the Internet for their ability to inform, persuade and entertain (for example, anecdote, expert witness, vivid detail, tearful testimony and humor).

G2. Examine the intersections and conflicts between the visual (such as media images, painting, film and graphic arts) and the verbal. (Associated Postsecondary Assignment: #4)

G3. Recognize how visual and sound techniques or design (such as special effects, camera angles and music) carry or influence messages in various media. (Associated Postsecondary Assignment: #4)

G4. Apply and adapt the principles of written composition to create coherent media productions using effective images, text, graphics, music and/or sound effects—if

possible—and present a distinctive point of view on a topic (for example, PowerPoint presentations, videos).

H. Literature

The high school graduate can:

H1. Demonstrate knowledge of 18th and 19th century foundational works of American literature. (Associated Postsecondary Assignment: #6)

H2. Analyze foundational U.S. documents for their historical and literary significance (for example, The Declaration of Independence, the Preamble to the U.S. Constitution, Abraham Lincoln's "Gettysburg Address," Martin Luther King's "Letter from Birmingham Jail").

H3. Interpret significant works from various forms of literature: poetry, novel, biography, short story, essay and dramatic literature; use understanding of genre characteristics to make deeper and subtler interpretations of the meaning of the text. (Associated Postsecondary Assignments: #5 and 6)

H4. Analyze the setting, plot, theme, characterization and narration of classic and contemporary short stories and novels. (Associated Postsecondary Assignment: #6)

H5. Demonstrate knowledge of metrics, rhyme scheme, rhythm, alliteration and other conventions of verse in poetry. (Associated Postsecondary Assignments: #4 and 6)

H6. Identify how elements of dramatic literature (for example, dramatic irony, soliloquy, stage direction and dialogue) articulate a playwright's vision.

H7. Analyze works of literature for what they suggest about the historical period in which they were written. (Associated Postsecondary Assignment: #5)

H8. Analyze the moral dilemmas in works of literature, as revealed by characters' motivation and behavior.

H9. Identify and explain the themes found in a single literary work; analyze the ways in which similar themes and ideas are developed in more than one literary work.

Mathematics Benchmarks

I. Number Sense and Numerical Operations

Because major areas of study at postsecondary institutions have different prerequisites, certain mathematics benchmarks are marked with an asterisk (*). These asterisked benchmarks represent content that is recommended for all students, but is required for those students who plan to take calculus in college, a requisite for mathematics and many mathematics-intensive majors. The high school graduate can:

I1. Compute fluently and accurately with rational numbers without a calculator:

I1.1. Add, subtract, multiply and divide integers, fractions and decimals. (Associated Workplace Tasks: #1, 2, 3 and 6) (Associated Postsecondary Assignments: #1 and 2)

Example:

$3\frac{3}{4} \div 1.2 = 15/4 \div 6/5 = 15/4 \text{ x } 5/6 = 75/24 = 25/8 = 3\frac{1}{8} = 3.125$

Example:

Estimate the total of a column of 10 to 15 numbers (typically, dollars and cents) and then add them manually (e.g., by grouping 10s).

I1.2. Calculate and apply ratios, proportions, rates and percentages to solve problems. (Associated Workplace Tasks: #1, 2, 3 and 6) (Associated Postsecondary Assignment: #2)

Example:

In the last four quarters, the returns reported for your mutual fund were, in succession, +2.33%, -1.75%, +3.02%, -2.54%. What was your return for the year?

I1.3. Use the correct order of operations to evaluate arithmetic expressions, including those containing parentheses.

I1.4. Explain and apply basic number theory concepts such as prime number, factor, divisibility, least common multiple and greatest common divisor.

I1.5. Multiply and divide numbers expressed in scientific notation. (Associated Postsecondary Assignment: #2)

Example:

Multiply 3.6×10^{3} by 4.5×10^{4} to obtain 16.2×10^{7}, adjust to conform first to the standard form for scientific notation to obtain 1.62×10^{8}, and round to the appropriate number of significant digits as determined by the original equation to obtain 1.6×10^{8}.

I2. Recognize and apply magnitude (absolute value) and ordering of real numbers:

I2.1. Locate the position of a number on the number line, know that its distance from the origin is its absolute value and know that the distance between two numbers on the number line is the absolute value of their difference.

I2.2. Determine the relative position on the number line of numbers and the relative magnitude of numbers expressed in fractional form, in decimal form, as roots or in scientific notation.

Example:

Determine which of the two fractions -3/5 and -4/7 is larger and which has greater magnitude without using a calculator.

Example:

Order the following numbers from least to greatest without using a calculator: $\sqrt{12}$, 3, $\sqrt[3]{18}$, 2, $\sqrt{15}$, 4

Example:

Approximate how much larger 6×10^{4} is than 3×10^{-5} and check that approximation by dividing 6×10^{4} by 3×10^{-5} to obtain $\left(6\times10^{4}\right)\div\left(3\times10^{-5}\right)=2\times10^{9}$ to see that 6×10^{4} is two billion times as large as 3×10^{-5}.

I3. Understand that to solve certain problems and equations, number systems need to be extended from whole numbers to the set of all integers (positive, negative and zero), from integers to rational numbers, from rational numbers to real numbers (rational and irrational numbers) and from real numbers to complex numbers; define and give examples of each of these types of numbers. (Associated Workplace Task: #3) (Associated Postsecondary Assignments: #1 and 2)

Note: Negative integers are required to measure quantities such as temperatures below zero, rational numbers are required to measure quantities that are not integers such as the length of each piece of a 5-foot wire cut into two equal pieces, irrational numbers are required to measure quantities such as the length of the diagonal of a unit square, and complex numbers are required to solve equations.

I4. Understand the capabilities and the limitations of calculators and computers in solving problems:

I4.1. Use calculators appropriately and make estimations without a calculator regularly to detect potential errors. (Associated Workplace Task: #2)

I4.2. Use graphing calculators and computer spreadsheets. (Associated Workplace Tasks: #3 and 6) (Associated Postsecondary Assignment: #2)

J. Algebra

Because major areas of study at postsecondary institutions have different prerequisites, certain mathematics benchmarks are marked with an asterisk (*). These asterisked benchmarks represent content that is recommended for all students, but is required for those students who plan to take calculus in college, a requisite for mathematics and many mathematics-intensive majors. The high school graduate can:

J1. Perform basic operations on algebraic expressions fluently and accurately:

J1.1. Understand the properties of integer exponents and roots and apply these properties to simplify algebraic expressions.

Example:

Simplify the expression $\left(\frac{a}{b}\right)^m \cdot c^{2m}$ to obtain either $\frac{(ac^2)^m}{b^m}$ or $\left(\frac{ac^2}{b}\right)^m$.

J1.2. *Understand the properties of rational exponents and apply these properties to simplify algebraic expressions.

Example:

Explain why $\sqrt[3]{x^2} \cdot \sqrt{x} = x^{\frac{2}{3}} \cdot x^{\frac{1}{2}} = x^{\frac{7}{6}} = \sqrt[6]{x^7} = x\sqrt[6]{x}$ for any non-negative number x.

J1.3. Add, subtract and multiply polynomials; divide a polynomial by a low-degree polynomial.

Example:

Divide $x^3 - 8$ by $x - 2$ to obtain $x^2 + 2x + 4$;

divide $x4 - 5x3 - 2x$ by x^2 to obtain $x^2 - 5x - \frac{2}{x}$.

Example:

Divide $x3 - x2 + x - 2$ by $x2 + 1$ to obtain $x - 1 + \frac{-1}{x^2+1}$ and understand that also means that $(x2 + 1)(x - 1) - 1 = x3 - x2 + x - 2$.

J1.4. Factor polynomials by removing the greatest common factor; factor quadratic polynomials.

Example:

Remove the greatest common factor $3x3y$ from $12x3y2 + 9x4y + 6x5y3$ to obtain the factorization $3x3y(4y + 3x + 2x2y2)$.

Example:

Factor $x2 - 36$, $4x2 + 12xy + 9y2$ and $x2 - 5x - 6$ to obtain $(x + 6)(x - 6)$, $(2x + 3y)2$ and $(x - 6)(x + 1)$ respectively.

J1.5. Add, subtract, multiply, divide and simplify rational expressions. (Associated Workplace Task: #1) (Associated Postsecondary Assignments: #1 and 2)

Example:

Express $\frac{1}{x} + \frac{1}{y}$ as a single fraction to obtain $\frac{x+y}{xy}$.

Example:

Simplify to obtain $\frac{a^2-b^2}{2b}\cdot\frac{6ab}{a+b}$ to obtain *3a (a – b)*.

J1.6. Evaluate polynomial and rational expressions and expressions containing radicals and absolute values at specified values of their variables.

J1.7. * Derive and use the formulas for the general term and summation of finite arithmetic and geometric series; find the sum of an infinite geometric series whose common ratio, r, is in the interval (–1, 1).

Example:

Derive the formula for the sum S of the first N terms of a geometric series whose first term is 1 and common ratio is *r* to obtain $S = 1 + r + r^2 + r^3 + \ldots + r^{N-1} = \frac{1-r^N}{1-r}$.

Example:

Determine the 126th term of the arithmetic sequence whose third term is 5 and seventh term is 29.

J2. Understand functions, their representations and their properties:

J2.1. Recognize whether a relationship given in symbolic or graphical form is a function.

J2.2. *Determine the domain of a function represented in either symbolic or graphical form.

Example:

Determine that the domain of the function $f(x) = \sqrt{x-2}$ can be written in interval form as and the domain of the function $g(x) = \frac{1}{x^2-9}$ contains all real numbers except 3 and -3.

J2.3. Understand functional notation and evaluate a function at a specified point in its domain. (Associated Postsecondary Assignment: #1)

J2.4. *Combine functions by composition, as well as by addition, subtraction, multiplication and division.

J2.5. *Identify whether a function has an inverse and when functions are inverses of each other; explain why the graph of a function and its inverse are reflections of one another over the line $y = x$.

J2.6. *Know that the inverse of an exponential function is a logarithm, prove basic properties of a logarithm using properties of its inverse and apply those properties to solve problems.

J3. Apply basic algebraic operations to solve equations and inequalities:

J3.1. Solve linear equations and inequalities in one variable including those involving the absolute value of a linear function.

Example:

The length L of a spring in centimeters is given by $L = \frac{4}{7}F + 9$, where F is the applied force in dynes. What force F will produce a spring length of 14 centimeters?

Example:

A pipe is to be cut to a length of 5 meters accurate to within a tenth of a centimeter. Recognize that an acceptable length (in meters) of the pipe satisfies the inequality $|x - 5| \leq 0.001$.

J3.2. Solve an equation involving several variables for one variable in terms of the others. (Associated Postsecondary Assignment: #2)

Example:

If C represents the temperature in degrees Celsius and F represents the temperature in degrees Fahrenheit, then $C = \frac{5}{9}(F - 32)$. Solve this equation for *F* to obtain $F = \frac{9}{5}C + 32$.

Example:

Newton's law of gravitation says that the force *F* exerted by a body of mass *m* on a body of mass *M* is $F = \frac{GmM}{r^2}$, where *G* is the gravitational constant and *r* is the distance between the bodies. Solve this equation for *r* to obtain $r = \sqrt{\frac{GmM}{F}}$.

J3.3. Solve systems of two linear equations in two variables.

J3.4. *Solve systems of three linear equations in three variables. (Associated Postsecondary Assignment: #1)

J3.5. Solve quadratic equations in one variable. (Associated Postsecondary Assignment: #1)

Example:

Solve $x2 - x - 6 = 0$ by recognizing that $x2 - x - 6 = (x - 3)(x + 2)$ can be factored to obtain the two solutions and $x = 3$ and $x = -2$.

Example:

Solve $x2 + 4x + 2 = 0$ by using the quadratic formula or by completing the square.

J4. Graph a variety of equations and inequalities in two variables, demonstrate understanding of the relationships between the algebraic properties of an equation and the geometric properties of its graph, and interpret a graph:

J4.1. Graph a linear equation and demonstrate that it has a constant rate of change. (Associated Postsecondary Assignment: #1)

J4.2. Understand the relationship between the coefficients of a linear equation and the slope and x- and y-intercepts of its graph. (Associated Postsecondary Assignment: #3)

J4.3. Understand the relationship between a solution of a system of two linear equations in two variables and the graphs of the corresponding lines.

J4.4. Graph the solution set of a linear inequality and identify whether the solution set is an open or a closed half-plane; graph the solution set of a system of two or three linear inequalities.

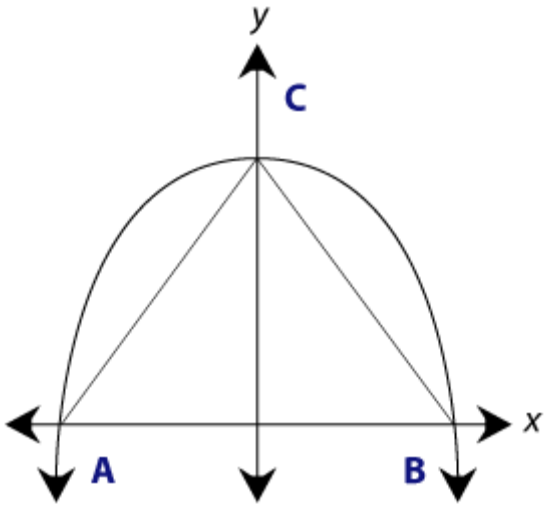
Example:

Graph the solution set of the system of linear inequalities: $2x + y \leq 4 \quad x \geq 1$.

J4.5. Graph a quadratic function and understand the relationship between its real zeros and the x-intercepts of its graph. (Associated Postsecondary Assignment: #1)

Example:

The parabola shown below has equation $y = -x2 + 2$ and passes through the points A, B and C. What is the area of the triangle ABC, rounded to two decimal places?



J4.6. *Graph ellipses and hyperbolas whose axes are parallel to the x and y axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.

J.4.7. Graph exponential functions and identify their key characteristics.

Example:

Graph the exponential function $y(x) = 2x$. Recognize that $y(x+1)$ is twice as large as $y(x)$ since $y(x+1) = 2x+1 = 2 \bullet 2x = 2 \bullet y(x)$.

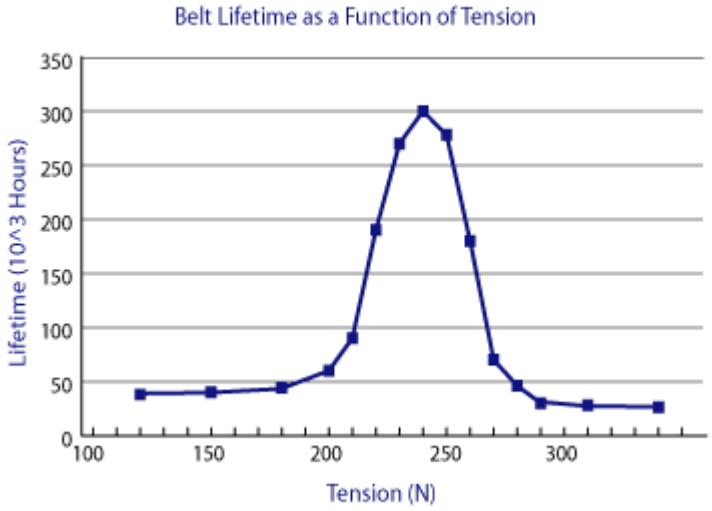
Example:

How much money must be invested at 6% annual interest if you want to have $40,000 in 20 years?

J4.8. Read information and draw conclusions from graphs; identify properties of a graph that provide useful information about the original problem. (Associated Postsecondary Assignment: #3)

Example:

The lifetime of the timing belt in your car depends on the tensioning of the belt. The manufacturer specifies 240 N as the proper tension, but the mechanic working on your car can be off by as much as 10%. Use the following graph to estimate the reduction in the life of the belt that can occur with this error in tensioning.



J5. Solve problems by converting the verbal information given into an appropriate mathematics model involving equations or systems of equations; apply appropriate mathematics techniques to analyze these mathematics models; and

interpret the solution obtained in written form using appropriate units of measurement:

J5.1. Recognize and solve problems that can be modeled using a linear equation in one variable, such as time/rate/distance problems, percentage increase or decrease problems, and ratio and proportion problems. (Associated Workplace Tasks: #1 and 2) (Associated Postsecondary Assignment: #2)

J5.2. Recognize and solve problems that can be modeled using a system of two equations in two variables, such as mixture problems. (Associated Postsecondary Assignment: #2)

Example:

A chemist has available two solutions of acid. The first solution contains 12% acid, and the second solution contains 20% acid. He wants to mix the two solutions to obtain a 500-milliliter mixture containing 15% acid. How many milliliters of each solution should he mix?

J5.3. Recognize and solve problems that can be modeled using a quadratic equation, such as the motion of an object under the force of gravity. (Associated Postsecondary Assignment: #1)

Example:

A stone is dropped off a cliff 660 feet above ground. When will the stone hit the ground if its height in feet at time seconds after it is dropped is given by $h(t) = 660 - 16 * t2$?

J5.4. Recognize and solve problems that can be modeled using an exponential function, such as compound interest problems.

J5.5. *Recognize and solve problems that can be modeled using an exponential function but whose solution requires facility with logarithms, such as exponential growth and decay problems. (Associated Postsecondary Assignments: #1 and 2)

Example:

How long will it take the balance in your savings account to double if you earn 1.5% compounded annually?

J5.6. Recognize and solve problems that can be modeled using a finite geometric series, such as home mortgage problems and other compound interest problems. (Associated Workplace Task: #3) (Associated Postsecondary Assignment: #1)

Example:

How much money will you have in a retirement fund if you deposit $1,000 each year for 20 years and the interest rate remains constant at 4%?

J6. *Understand the binomial theorem and its connections to combinatorics, Pascal's triangle and probability.

K. Geometry

Because major areas of study at postsecondary institutions have different prerequisites, certain mathematics benchmarks are marked with an asterisk (*). These asterisked benchmarks represent content that is recommended for all students, but is required for those students who plan to take calculus in college, a requisite for mathematics and many mathematics-intensive majors. The high school graduate can:

K1. Understand the different roles played by axioms, definitions and theorems in the logical structure of mathematics, especially in geometry:

K1.1. Identify, explain the necessity of and give examples of definitions, axioms and theorems.

K1.2. State and prove key basic theorems in geometry such as the Pythagorean theorem, the sum of the angles of a triangle is 180 degrees, and the line joining the midpoints of two sides of a triangle is parallel to the third side and half its length.

K1.3. Recognize that there are geometries, other than Euclidean geometry, in which the parallel postulate is not true.

Example:

On a globe the lines of longitude intersect at both the North and South Poles creating a closed figure with only two sides; this is an example of a situation that cannot occur in Euclidean geometry but does occur in spherical geometry.

K2. Identify and apply the definitions related to lines and angles and use them to prove theorems in (Euclidean) geometry, solve problems, and perform basic geometric constructions using a straight edge and compass:

K2.1. Identify and apply properties of and theorems about parallel lines and use them to prove theorems such as two lines parallel to a third are parallel to each other and to perform constructions such as a line parallel to a given line through a point not on the line.

K2.2 Identify and apply properties of and theorems about perpendicular lines and use them to prove theorems such as the perpendicular bisectors of line segments are the set of all points equidistant from the two end points and to perform constructions such as the perpendicular bisector of a line segment.

K2.3. Identify and apply properties of and theorems about angles and use them to prove theorems such as two lines are parallel exactly when the alternate interior angles they make with a transversal are equal and to perform constructions such as the bisector of an angle.

K3. Know the basic theorems about congruent and similar triangles and use them to prove additional theorems and solve problems.

Example:

When you set a projector 12 feet from the screen, the image on the screen measures 8 feet across. What will the width of the image be if you move the projector 3 feet further from the screen?

K4. Know the definitions and basic properties of a circle and use them to prove basic theorems and solve problems. (Associated Postsecondary Assignment: #1)

Example:

A line tangent line to a circle is perpendicular to the line segment from the center of the circle to the point of tangency.

K5. Apply the Pythagorean theorem, its converse and properties of special right triangles to solve problems. (Associated Postsecondary Assignment: #1)

Example:

Given the lengths of two sides of a right triangle, find the length of the third side.

Example:

Given a triangle with side lengths of 12 and 13 inches, identify the triangle as acute, right, obtuse or not a triangle at all for various lengths of the third side such as 4, 5, 6, 18 or 26 inches. Justify your answers.

Example:

Determine the lengths of the sides of the special right triangle with angles 30, 60 and 90 degrees and the special right triangle with angles 45, 45 and 90 degrees if the length of the smallest side in each case is 1 meter.

K6. Use rigid motions (compositions of reflections, translations and rotations) to determine whether two geometric figures are congruent and to create and analyze geometric designs.

Example:

Prove the side-angle-side criterion for showing that two triangles are congruent.

Example:

Analyze tessellations of the plane.

K7. Know about the similarity of figures and use the scale factor to solve problems.

Example:

Read and extract information from scale drawings; compute lengths and areas from scale drawings.

K8. Know that geometric measurements (length, area, perimeter, volume) depend on the choice of a unit and that measurements made on physical objects are approximations; calculate the measurements of common plane and solid geometric figures:

K8.1. Understand that numerical values associated with measurements of physical quantities must be assigned units of measurement or dimensions; apply such units correctly in expressions, equations and problem solutions that involve measurements; and convert a measurement using one unit of measurement to another unit of measurement. (Associated Workplace Tasks: #1 and 2) (Associated Postsecondary Assignment: #2)

Example:

Convert feet per second to miles per hour, and use dimensional analysis to verify that the calculation yields the appropriate measurement unit $1\frac{\text{ft}}{\text{sec}} = 1\frac{\text{ft}}{\text{sec}} \times 3600\frac{\text{sec}}{\text{hr}} \times \frac{1}{5280}\frac{\text{mi}}{\text{ft}} = \frac{30}{44}\frac{\text{mi}}{\text{hr}}$.

Example:

Confirm that the distance traveled in 45 minutes at the rate of 2.4 meters per second is 6.48 kilometers.

$$d = rt = 2.4\frac{\text{m}}{\text{sec}} \times \frac{1}{1000}\frac{\text{km}}{\text{m}} \times 45\text{min} \times 60\frac{\text{sec}}{\text{min}} = 6.48\text{km}$$

Example:

Convert speed of 150 meters per second to miles per hour.

$$150\frac{\text{meters}}{\text{second}} = \frac{150\text{ meters}}{1\text{ second}} \times \frac{3600\text{ seconds}}{1\text{ hour}} \times \frac{1\text{ mile}}{1610\text{ meters}} \approx 335\frac{\text{miles}}{\text{hour}}$$

K8.2. Determine the perimeter of a polygon and the circumference of a circle; the area of a rectangle, a circle, a triangle and a polygon with more than four sides by decomposing it into triangles; the surface area of a prism, a pyramid, a cone and a sphere; and the volume of a rectangular box, a prism, a pyramid, a cone and a sphere.

(Associated Workplace Task: #1)

(Associated Postsecondary Assignment: #1)

Example:

How much material is removed when you drill a hole with a diameter of 2 cm through a block of metal that is 3 cm thick?

K8.3. Know that the effect of a scale factor *k* on length, area and volume is to multiply each by *k*, *k2* and *k3*, respectively.

Example:

Know that a 16″ (diameter) pizza has four times as much pizza as an 8″ (diameter) pizza.

K9. Visualize solids and surfaces in three-dimensional space when given two-dimensional representations (e.g., nets, multiple views) and create two-dimensional representations for the surfaces of three-dimensional objects.

K10. Represent geometric objects and figures algebraically using coordinates; use algebra to solve geometric problems: (Associated Postsecondary Assignment: #1)

K10.1. Express the intuitive concept of the "slant" of a line in terms of the precise concept of slope, use the coordinates of two points on a line to define its slope, and use slope to express the parallelism and perpendicularity of lines.

K10.2. Describe a line by a linear equation.

Example:

Find an equation for the line containing the points (32, 0) and (212, 100). If the first coordinate of a point on this line is 98.6, what is the second coordinate? Identify the point on this line where the two coordinates are the same.

K10.3. Find the distance between two points using their coordinates and the Pythagorean theorem.

K10.4. *Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius. (Associated Postsecondary Assignment: #1)

Example:

The circle with radius 5 and center at (1, 0) has equation $(x – 1)2 + y2 = 25$.

Example:

Transform the quadratic equation $x2 + 2x + y2 – 4y = 4$ into the form $(x + 1)2 + (y – 2)2 = 9$ by completing the square; realize that the graph of the equation is a circle with center at (–1, 2) and with radius 3.

K11. Understand basic right-triangle trigonometry and apply it to solve problems:

K11.1. Understand how similarity of right triangles allows the trigonometric functions sine, cosine and tangent to be defined as ratios of sides and be able to use these functions to solve problems. (Associated Postsecondary Assignment: #1)

K11.2. Apply the trigonometric functions sine, cosine and tangent to solve for an unknown length of a side of a right triangle, given one of the acute angles and the length of another side.

Example:

Safety regulations require that the angle between a ladder and the wall should be between 25 and 30 degrees. What is the range of safe placements (distance from the wall) for the bottom of a 12-foot ladder? Where should the base of a 20-foot ladder be placed to satisfy the same safety regulation?

K11.3. Use the standard formula for the area of a triangle, $A = \frac{1}{2}bh$, to explain the area formula, $A = \frac{1}{2}ab\sin C$ where a and b are the lengths of two sides of a triangle and C is the measure of the included angle formed by these two sides, and use it to find the area of a triangle when given the lengths of two of its sides and the included angle.

K12. *Know how the trigonometric functions can be extended to periodic functions on the real line, derive basic formulas involving these functions, and use these functions and formulas to solve problems:

K12.1. *Know that the trigonometric functions sine and cosine, and thus all trigonometric functions, can be extended to periodic functions on the real line by defining them as functions on the unit circle, that radian measure of an angle between 0 and 360 degrees is the arc length of the unit circle subtended by that central angle, and that by similarity, the arc length s of a circle of radius r subtended by a central angle of measure t radians is $s = rt$.

K12.2. *Know and use the basic identities, such as $\sin^2(x) + \cos^2(x) = 1$ and $\cos\left(\frac{\pi}{2} - x\right) = \sin(x)$ and formulas for sine and cosine, such as addition and double angle formulas.

Example:

Use the identity $\sin^2(x) + \cos^2(x) = 1$ to determine the sine of an angle when its cosine is known. Example: Use the addition formula to find the amplitude, period and phase shift of a $\cos(wt) + b\sin(wt)$ by expressing it as $c\sin(wt + d)$ for some constants c and d.

K12.3. *Graph sine, cosine and tangent as well as their reciprocals, secant, cosecant and cotangent; identify key characteristics.

K12.4. *Know and use the law of cosines and the law of sines to find missing sides and angles of a triangle.

L. Data Interpretation, Statistics and Probability

Because major areas of study at postsecondary institutions have different prerequisites, certain mathematics benchmarks are marked with an asterisk (*). These asterisked benchmarks represent content that is recommended for all students, but is required for those students who plan to take calculus in college, a requisite for mathematics and many mathematics-intensive majors. The high school graduate can:

L1. Explain and apply quantitative information:

L1.1. Organize and display data using appropriate methods (including spreadsheets) to detect patterns and departures from patterns. (Associated Workplace Task: #4)

L1.2. Read and interpret tables, charts and graphs. (Associated Workplace Tasks: #3 and 4)

L1.3. Compute and explain summary statistics for distributions of data including measures of center (mean, median) and spread (range, percentiles, variance, standard deviation).

L1.4. Compare data sets using graphs and summary statistics.

Example:

Create a box plot of a school's test scores for 1995 and for 2000 and ask what changes occurred in the five years.

L1.5. Create scatter plots, analyze patterns and describe relationships in paired data.

L1.6. Know the characteristics of the Gaussian normal distribution (bell-shaped curve).

Example:

If a set of data is approximately normally distributed, know that approximately 95% of the data in the set are within two standard deviations of the mean and that approximately 99% of the data in the set are within three standard deviations of the mean.

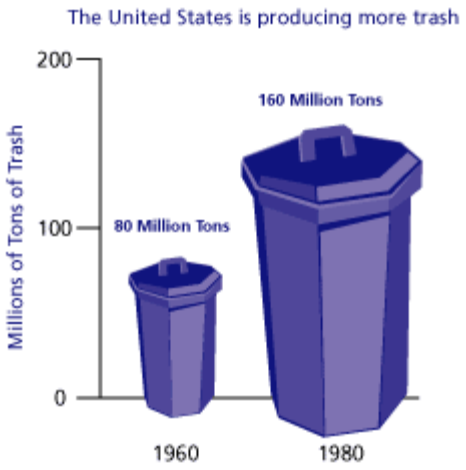
L2. Explain and critique alternative ways of presenting and using information:

L2.1. Evaluate reports based on data published in the media by considering the source of the data, the design of the study, and the way the data are analyzed and displayed.

L2.2. Identify and explain misleading uses of data.

Example:

Explain why the following graphic misrepresents the data it is intended to illustrate.



L2.3. Recognize when arguments based on data confuse correlation with causation.

Example:

Researchers have noticed that the number of golf courses and the number of divorces in the United States are strongly correlated and both have been increasing over the last several decades. Can you conclude that the increasing number of golf courses is causing the number of divorces to increase? Explain your answer.

L3. Explain the use of data and statistical thinking to draw inferences, make predictions and justify conclusions:

L3.1. Explain the impact of sampling methods, bias and the phrasing of questions asked during data collection and the conclusions that can rightfully be made.

L3.2. Design simple experiments or investigations to collect data to answer questions of interest. (Associated Workplace Task: #4)

L3.3. Explain the differences between randomized experiments and observational studies. (Associated Workplace Task: #4)

L3.4. Construct a scatter plot of a set of paired data and if it demonstrates a linear trend, use a graphing calculator to find the regression line that best fits this data; recognize that the correlation coefficient measures goodness of fit and explain when it is appropriate to use the regression line to make predictions.

Example:

The following table gives the winning speeds (in miles per hour) at the Indianapolis 500 race for 20 years. Explain why it is not appropriate to use the linear regression equation for these data to estimate what the winning time was in 1920 or to predict the winning speed in 1990. *Source: The World Almanac*

year	1961	1962	1963	1964	1965
speed (mph)	139.1	140.3	143.1	147.4	151.4

year	1966	1967	1968	1969	1970
speed (mph)	144.3	151.2	152.9	156.9	155.7

year	1971	1972	1973	1974	1975
speed (mph)	157.7	163.5	159.0	158.6	149.2

year	1976	1977	1978	1979	1980
speed (mph)	148.7	161.3	161.4	158.9	142.9

L4. Explain and apply probability concepts and calculate simple probabilities:

L4.1. Explain how probability quantifies the likelihood that an event occurs in terms of numbers. (Associated Workplace Task: #3)

L4.2. Explain how the relative frequency of a specified outcome of an event can be used to estimate the probability of the outcome.

Example:

Typically, 35 out of every 100 teenagers in a certain community have received a traffic ticket. Of those teenagers who have received a ticket, 55% were charged with speeding. What is the probability that a teenager chosen at random will have received a speeding ticket?

L4.3. Explain how the law of large numbers can be applied in simple examples.

Example:

Toss a fair coin 10 times, record the number of heads and apply the data to estimate the probability of getting heads on a single toss of the coin. Toss the coin 20 more times, add the results to the previous data and apply the 30 tosses to estimate the probability of getting a heads. Toss the coin 30 more times and make

another estimate of the probability of getting a heads. What can you observe about the probability as the number of tosses increases?

L4.4. Apply probability concepts such as conditional probability and independent events to calculate simple probabilities.

Example:

A fair coin is tossed three times, and three heads are obtained. Understand that the probability of obtaining a head on the fourth toss is 1/2 because this event is independent of outcomes of the three previous tosses.

Example:

If two marbles are drawn randomly one after the other without replacement from a bag containing 4 red and 6 blue marbles, the probability that both marbles drawn are red is 4/10 x 3/9 = 2/15 because the probability of drawing a red marble on the second draw depends, or is conditional upon, the color of the first marble drawn.

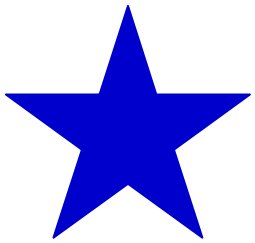
L4.5. Apply probability concepts to practical situations to make informed decisions. (Associated Workplace Tasks: #3 and 4)

Example:

A company has 6 telephone lines coming into its business. Efficiency experts performed a study for a week and determined that the following table could give the number of lines in use at any one time. Determine the probability that at most four lines were in use at one time during the week.

# of lines in use	0	1	2	3	4	5	6
percent of time	0.15	0.10	0.20	0.25	0.15	0.11	0.04

*Benchmarks marked with an asterisk represent content that is recommended for all students but is required for those students who plan to take calculus in college.



Appendix B

U. S. Bureau of Labor Statistics Job Outlook Projections

Job outlook projections from the U. S. Bureau of Labor Statistics (2005) show that many jobs of the future will require higher levels of knowledge and skills. These projections show that the fastest growing occupations for the 2004–2014 decade will be primarily in the computer and health-related fields. All these occupations require some postsecondary education or training. In fact, 22 of these 30 fastest growing occupations require an associate's, bachelor's, master's, or doctoral degree.

Table B.1

Fastest Growing Occupations, 2004–20014 (Numbers in thousands)

Occupation	Projected Employment Change, Number	Projected Employment Change, Percent	Most Significant Source of Education or Training
Home health aides	350	56	Short-term on the job training
Network systems and data communications analysts	126	55	Bachelor's degree
Medical assistants	202	52	Moderate-term on the job training
Physician assistants	31	50	Bachelor's degree
Computer software engineers, application	222	48	Bachelor's degree
Physical therapist assistants	26	44	Associate's degree
Dental hygienists	68	43	Associate's degree
Computer software engineers, systems software	146	43	Bachelor's degree
Dental assistants	114	43	Moderate-term on the job training
Personal and home care aides	287	41	Short-term on the job training
Network and computer systems administrators	107	38	Bachelor's degree
Database administrators	40	38	Bachelor's degree

Occupation	Projected Employment Change, Number	Projected Employment Change, Percent	Most Significant Source of Education or Training
Physical therapists	57	37	Master's degree
Forensic science technicians	4	36	Associate's degree
Veterinary technologists and technicians	21	35	Associate's degree
Diagnostic medical sonographers	15	35	Associate's degree
Physical therapist aides	15	34	Short-term on the job training
Occupational therapist assistants	7	34	Associate's degree
Medical scientists, except epidemiologists	25	34	Doctoral degree
Occupational therapists	31	34	Master's degree
Preschool teachers, except special education	143	33	Postsecondary vocational award
Cardiovascular technologists and technicians	15	33	Associate's degree
Postsecondary teachers	524	32	Master's degree
Hydrologists	3	32	Master's degree
Computer systems analysts	153	31	Bachelor's degree
Hazardous materials removal workers	12	31	Moderate-term on the job training
Biomedical engineers	3	31	Bachelor's degree
Employment, recruitment, and placement specialists	55	30	Bachelor's degree
Environmental engineers	15	30	Bachelor's degree
Paralegals and legal assistants	67	30	Associate's degree

Appendix C

Paul E. Barton, *High School Reform and Work: Facing Labor Market Realities*

A study by Barton (2006), which was referenced in testimony to the Commission, rejects the notion that students entering the workforce need the same level of knowledge and skills as those entering college credit-bearing courses. While acknowledging that high school graduates need some level of advanced academic skills to compete successfully for the good jobs available to workers without a postsecondary degree, Barton points to surveys, such as one by the National Association of Manufacturers in 2001, that indicate a much higher percentage of applicants are rejected for jobs because of inadequate employability skills (often referred to as *soft skills*) than for inadequate reading/writing, mathematics, problem-solving, and oral communication skills. These soft skills include attendance, timeliness, attitude and work ethic. Table C.1 shows the reasons for applicant rejections.

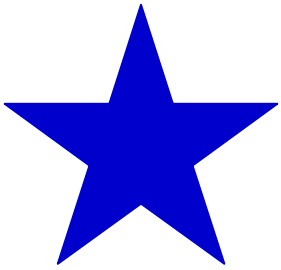
Table C.1
Most Common Reasons Companies Reject Applicants as Hourly Production Workers

Reason	Percentage
Inadequate basic employability skills ("soft skills")	69%
Insufficient work experience	34%
Inadequate reading/writing skills	32%
Applicants do not pass drug screening	27%
Inadequate mathematics skills	21%
Poor references from previous employer	20%
Inadequate oral-communication skills	18%
Inability to work in a team environment	12%
Inadequate problem-solving skills	11%
Inadequate technical/computer skills	11%
Lack of degree or vocational training	8%
Problems with citizenship/immigration status	7%
Other	4%

Source: National Association of Manufacturers

Additionally, Barton argues that while the fastest growing occupations in the United States do have the highest educational requirements, those occupations still constitute a small percentage of the total number of jobs, and the average education and training requirements for all occupations remains unchanged.

The study also promotes the use of internship programs or cooperative education, where students work while they are in school, as a way for employers to instill in students the behaviors, abilities, and attitudes that make them marketable for future employment.

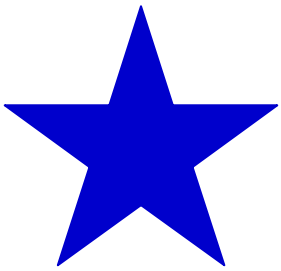


Appendix D

U. S. Department of Education's Regional Education Lab Southwest Analysis of Reading Demand

REL Southwest, at the request of the Commission, analyzed the reading demand of textbooks at the high school, community college and university levels and compared those to the Commended, Higher Education Readiness Certification (HERC) standards, and the Standard/Passing scores adopted by the SBOE and the THECB for the exit-level English TAKS. Reading demand was measured by Lexiles, a widely used measure of text demand for many textbooks and curriculum and workplace materials. The findings from this analysis show:

- There is a substantial gap in the average Lexile level of 11th and 12th grade textbooks (1123) and first year college texts (1355)—a finding that suggests students are not prepared to read at the level required in freshman college courses.
- University reading demands exceed those required by the TAKS English HERC scores and are slightly below the Commended scores—a finding that suggests that the Commended standard for performance is more appropriate than the current level of proficiency required of high school graduates on state assessments.
- Only about 36% of high school students taking the English exit-level TAKS in April 2005 were reading at a Lexile level that matches reading demands of college textbooks—a finding that suggests the vast majority of Texas public high school graduates are unprepared to succeed in postsecondary education. (Rolfhus, 2007).



Appendix E

Study by The Perryman Group

The Perryman Group (2007), a Texas-based economic research and analysis firm, provided the Commission with a study quantifying the economic benefits of meeting the goals established by the THECB in its *Closing the Gaps by 2015* plan. These goals challenge Texas higher education institutions to increase attendance and graduation rates for all students, particularly Hispanics and African-Americans, and boost federal research funding flowing to the state and research expenditures.

The study paints a bleak picture of Texas' current position in key education-related statistics.

- Texas ranks below every other state except Mississippi in the percentage of population 25 years of age or older with a high school diploma, at 78.8%.
- Texas ranks last among the 10 most populous states in the proportion of the Texas workforce with bachelor's degrees. The percentage of Asians completing a bachelor's degree or higher was 53%, with 27.1% of white, 18.3% of African Americans, and only 10.4% of Hispanics earning a bachelor's degree.

The analysis highlights the economic and social differences between individuals with only a high school diploma and those with postsecondary degrees.

- The average (median) income for a Texan with a bachelor's degree was $49,167 in 2003 compared to $25,455 for a person with a high school diploma.
- The average (mean) earnings of a male worker between the ages of 35 and 44 with a bachelor's degree were 94% higher than one with a high school diploma.
- A 1% increase in higher education attainment equates to a 4% decrease in welfare dependency, an almost 2% decrease in poverty, and a reduction in unemployment.
- The chances of being imprisoned also drop with higher education attainment with 1.2% of adults with only a high school diploma behind bars compared to only .1 percent of those with college degrees.

Figure E.1 underscores the importance of education in providing higher levels of annual income.

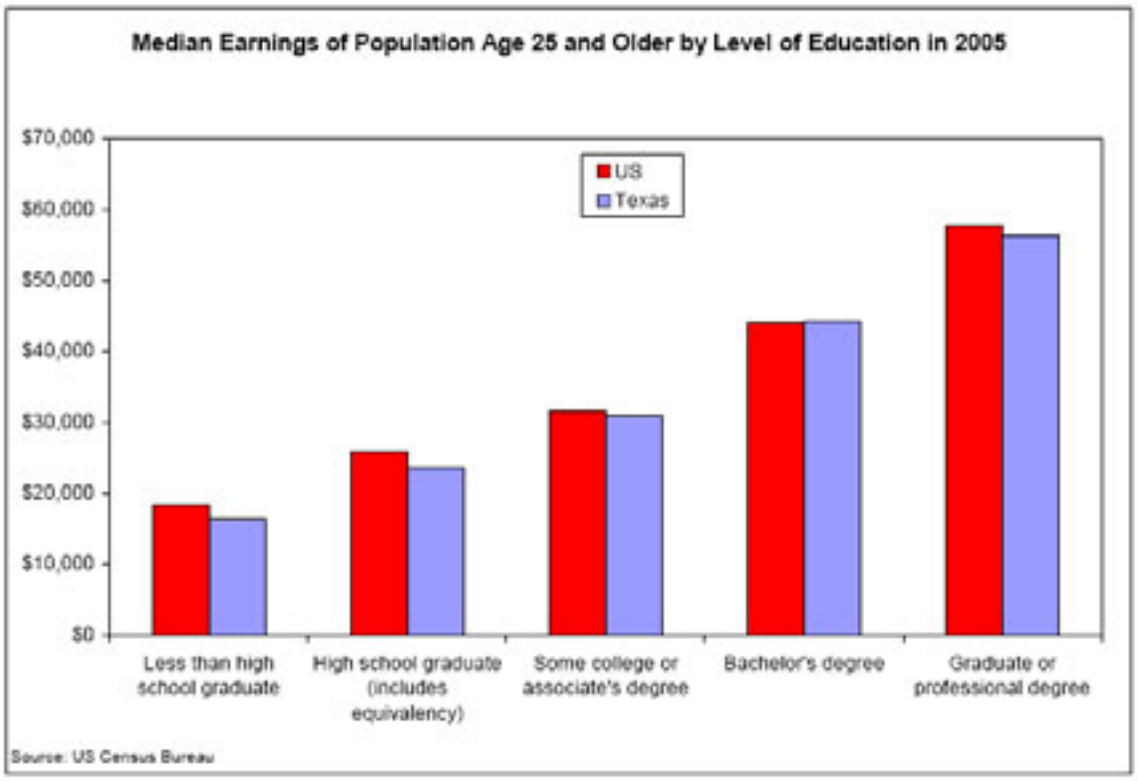


Figure E.1. Median earnings by level of education.

The report also measures the potential gains to the Texas economy associated with reaching the participation, completion, and research goals set forth by the THECB. The growth comes from additional income, output, and productivity as well as a reduced demand for social services. The prospective benefits to the economy of attaining these goals are striking:

- The annual increase in gross state product would be $1.95 billion higher with a cumulative additional output of more than $1.9 trillion from 2006–2030.
- The increase in state tax revenue from 2006–2030 would be more than $85.3 billion with an additional $73.5 billion in tax revenue going to local governments.
- More than 1 million additional Texans would be employed.
- Annual personal income would be almost $122 billion higher by 2030.

Appendix F

Summary of College Readiness and Developmental Education in Texas: 1998–2005

Background

This report presents the key findings from a large-scale empirical study investigating several issues related to college readiness in the state of Texas. In particular, the research focused on (a) identifying factors associated with college success in Texas and (b) alleviating gaps in knowledge about the state's developmental education program. The study followed all graduates of Texas public high schools from 1998 to 2005 (1.1 million students) into Texas higher education, observing demographic characteristics, high school course-taking patterns, Texas Academic Skills Program/Texas Higher Education Assessment (TASP/THEA) scores, SAT scores, and a large number of academic outcomes in college. The research was conducted on behalf of the Commission by Darwin Miller, Department of Economics, Stanford University.

Research Methodologies

The study used the following data reported by Texas public colleges and universities directly to the Texas Higher Education Coordinating Board (THECB) for the years 1998–2005 and all Texas colleges and universities (public and private) for the years 2003–2005: the Student Report, the Graduation Report, and the Texas Academic Skills Program/Texas Success Initiative (TASP/TSI) report. Texas Education Agency (TEA) data was reported directly to TEA by all Texas public high schools for the years 1998–2005, and TEA provided this data to the THECB. The study uses cohorts of 1998–2005 high school graduates. THECB annually purchases the College Board data from the College Board; THECB has College Board data for years 1998–2004. In addition to math and verbal SAT scores for each SAT-taker in the state, it includes self-reported demographic data on the SAT questionnaire. Data on the Texas Academic Skills Program/Texas Higher Education Assessment (TASP/THEA) exams is reported by National Evaluation Systems (NES) annually to the THECB. NES has detailed information on the scores for all TASP/THEA exams taken by all students in the state.

All of the data was linked by means of the student's Social Security Number (SSN). The researcher created cohorts of Texas public high school graduates for the years 1998–2005, keeping track of their demographic characteristics and course-taking patterns during the senior year of high school. SSNs were used to merge the data sources and track individual students into Texas public colleges and universities, keeping track of their SAT, ACT, and TASP/THEA scores, provided they took those exams. In the end, the researcher created five cohorts of high school graduates ranging in size from 177,864 for 1998 to 226,932 for 2005.

Some of the models in the report use information about the cutoff score used at individual colleges for placing students in developmental mathematics courses. This

data came from a detailed inspection of the individual plans for developmental education submitted to THECB by individual institutions.

The research began by asking the question, "What factors are associated with college-readiness in Texas?" To address this question the study looked at a series of collegiate outcome variables and isolated the demographic factors, test scores, and course-taking patterns associated with college success in Texas. In addition, the research explored the relationship between college readiness and TASP/THEA scores, demographic factors, and high school curriculum, paying particular attention to functional form. In particular, the study included the following analyses:

- An examination of all graduates of Texas public high schools from the years 1998–2005 who entered Texas higher education, observing demographic characteristics, high school course-taking patterns, TASP/THEA scores, SAT scores, and a large number of academic outcomes in college.
- An analysis of the correlation of the courses taken during the senior year of high school with their degree of association with college completion.
- An examination of the factors associated with college readiness in the state of Texas. Looking at a series of collegiate outcome variables, including completion rates, persistence rates, and college GPA, statistical models were run designed to isolate the demographic factors, test scores, and course-taking patterns associated with college success.
- An exploration of the functional form of the relationship between college completion and the TASP/THEA score. The research began by choosing a very flexible continuous function between the TASP/THEA score and several measures of college success. Next, a statistical model was run to fit the data to that functional form. Finally, for each possible TASP/THEA score, the data was rerun through the model, allowing for a discontinuity (a large discrete jump) at that score point. If the true relationship between the TASP/THEA score and college success were not captured by the continuous functional form chosen, then one would expect to find statistically significant discontinuities in the relationship. The study found that the relationship is largely a continuous one.
- A description of the characteristics and outcomes of students enrolled in developmental education in Texas colleges and universities through a detailed descriptive study of the developmental education program in Texas.
- An extension of the existing literature on developmental coursework through a large-scale descriptive analysis of the outcomes of students enrolling in developmental education in Texas. In an attempt to eliminate as many confounding factors as possible, controls were progressively added for demographic factors and high school course-taking patterns, and the scope of the analysis was narrowed to students scoring near the TASP/THEA cutoff score.
- An examination of the results of research by Martorell and McFarlin (2007). The results by Martorell and McFarlin, who employed a regression discontinuity

design, suggest that students scoring near the state-mandated cutoff on the TASP/THEA exam do not benefit from and are most likely hurt by taking developmental courses. The author of this study exploited institutional variation in cutoff scores for placement in developmental mathematics courses to examine the potential causal impact on most academic outcomes early in the college career for students scoring between 230 and 270 on the TASP/THEA mathematics exam.

Findings

- Senior year courses that vary positively with college completion include AP Math, Pre-calculus, Physics, AP English, a fourth year of a foreign language, other AP courses, a third year of a foreign language, and Biology. Senior year courses that vary negatively with college completion include Geometry, Algebra II, Algebra I, a second year of a foreign language, AP foreign language, a first year of a foreign language, and Chemistry. (The courses for both positive association and negative association are listed in order of the size of the relationship: Those exhibiting the strongest relationship are listed first; those exhibiting the weakest relationship are listed last.)
- These course-taking results suggest that a high school course load strong in mathematics and science, and to some extent foreign language, is a strong indicator of college success, even conditional upon student demographics and test scores. In particular, students taking Pre-calculus or AP Math during the senior year are considerably more likely to complete a baccalaureate degree than are students taking Algebra II or Geometry. Similarly, those taking the fourth year of foreign language during the senior year of high school are considerably more likely to complete a baccalaureate degree than are students taking the first or second year of foreign language. This clearly suggests the importance of taking the full sequence of these courses. It also suggests that students who have not taken sequential courses (particularly mathematics and language courses) earlier in their high school careers and who do not complete the full sequence of courses suffer a negative impact on college readiness.
- Although test scores (in this study the referenced test scores are assessments given to college-going students, including the TASP/THEA, SAT, and placement tests) and demographic factors are important correlates of college success, there is strong evidence that the impact of high test scores can be replicated by taking strong mathematics, science, and Advanced Placement courses during the senior year of high school.
- The study found that the relationship between the TASP/THEA score and college readiness is, by-and-large, a continuous one. The findings suggest a more holistic view of college readiness than the one currently used by the state. First, test scores alone explain only a small portion of the variance in college success; demographic factors and course-taking patterns are important as well. Second, it

appears as if college readiness is not a Yes or No question, as the state's rigid placement policies would suggest, but rather a matter of degree. Taken together, the evidence suggests that high school course-taking patterns, demographic factors, and test scores can provide information about the likelihood of college success, but they cannot determine with certainty whether or not a student will achieve success in college.

- Students taking developmental courses were more likely to be enrolled in community colleges, were of lower socioeconomic status, took fewer college preparatory courses during the senior year of high school, and did not perform as well in college as their peers who did not take developmental courses. When re-running data to control for these factors, the study found that demographic factors, high school curriculum, and test scores explain some, but not all, of the relatively poor academic outcomes for students taking developmental courses.
- A key finding, which is consistent with the national literature, is that students taking developmental courses in Texas do not fare as well academically as student not taking those courses.

Recommendations

The report makes the following policy recommendations:

- Adopt a more holistic view of college readiness.

  The results in this report strongly suggest that while test scores are, indeed, important correlates of college success, demographic factors and high school curriculum are important as well. Although a strong TASP/THEA score is a strong predictor of success in college, the effect of TASP/THEA can be replicated by taking a strong college-preparatory curriculum in high school. Why not adopt a definition of college-readiness that uses more information?

- Why the rigid definition of college-readiness?

  The results in this report provide strong evidence that college-readiness is not a Yes or No question, but one of degree. Although test scores and a strong high school curriculum can tell us something about the likelihood of college success, they can never tell us if a student is truly college ready. Why not adopt a continuous measure of college readiness that reflects the continuous nature of the distribution of college readiness in Texas?

- Clarify the language in the Texas Success Initiative (TSI) granting institutions the authority to remedy academic deficiencies on a case-by-case basis.

  Although the freedom granted under TSI enables institutions quite a bit of leeway to decide how to remedy academic deficiencies, an inspection of institutional plans for developmental education reveals that most colleges continue to use rigid TASP/THEA cutoff scores to determine placement in

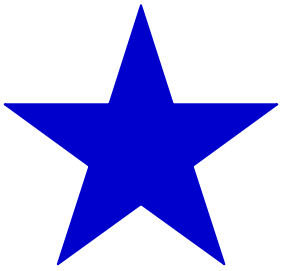
course-based developmental education. Are institutions reluctant to use the leeway granted under TSI, and if so, why?

- Do not raise the THEA cutoff score for placement in course-based developmental education without making the content more beneficial to better prepared students.

  All available evidence points to the conclusion that today's developmental courses have a negative causal impact on academic outcomes for students scoring at or just above the current THEA cutoff score. Requiring these students to take developmental courses as they are given today would almost certainly hurt them.

- If the content of developmental courses is not altered, lower the cutoff score.

  Results by Miller as well as Martorell and McFarlin point to a negative causal impact of developmental courses on academic outcomes for students scoring just at the THEA cutoff score. If the content of these courses is not altered, these students would benefit from not being forced to take developmental courses.



Appendix G

Achieve's American Diploma Project Survey of High School Graduates, College Instructors, and Employers

ADP, as part of its work to develop college and workplace readiness standards, surveyed college faculty, employers, and recent high school graduates who were in college or working. The survey was designed to determine if high schools are adequately preparing students for college and jobs. A surprising finding was that almost 40% of recent high school graduates felt that their academic preparation was not of sufficient rigor to prepare them for college or the workplace.

Of those surveyed who were in college, only 15% felt they were extremely well prepared for college expectations, and 7% said they were poorly prepared with large deficiencies in the skills, abilities, and work habits necessary to succeed in college.

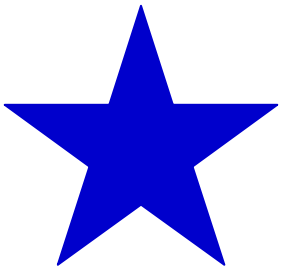
Even among those surveyed who felt they were extremely or well prepared in high school for college coursework, 31% had taken at least one remedial class in college. Of those who said there were deficiencies in their preparation, 46% had enrolled in at least one remedial course.

When asked about specific skills (oral communication, science, mathematics, ability to do research, writing, reading comprehension), results showed that only 14% of graduates surveyed felt prepared in all six areas. The breakdown by skill was:

- 45% identified gaps in oral communication skills
- 44% saw gaps in science preparation
- 42% acknowledged gaps in mathematics preparation
- 40% noticed gaps in research ability
- 35% identified gaps in writing

However, graduates who attended high schools that they felt had high academic expectations were more than twice as likely to feel prepared for college as those from high schools with low expectations (80% and 37%, respectively). Additionally, the number and difficulty of core classes taken in high school impacted how those surveyed felt they had been prepared for college. As an example, those who had taken at least Algebra II in high school were more than twice as likely to feel prepared for college mathematics expectations as those who did not take Algebra II (60% and 26%, respectively).

Sixty-five percent of those surveyed who were in college said they would have worked harder and taken a more challenging curriculum if they had understood the expectations of college. Specifically, 94% agreed that high school students should be given more opportunities for rigorous courses, such as honors, AP, or International Baccalaureate classes, and 74% support requiring 4 years of mathematics and science in order to graduate (Peter D. Hart Research Associates, 2005).



Appendix H

Amended Draft of English Language Arts Standards in Writing, Reading, Speaking, and Listening

I. Writing

A. Compose a variety of texts with clear focus, important ideas, rich detail, well-developed paragraphs, logical development, language that advances the writer's purpose, and appropriate use of Standard English conventions.

1. Determine effective writing approaches, forms, and rhetorical techniques that demonstrate understanding of writer, purpose, and audience when completing informational, analytical, persuasive, or work-related writing.

a. Prepare topic proposals that specify a purpose and justify the choice of audience to achieve that purpose.

b. Identify the writing types (e.g., informational, analytical, persuasive) and forms (e.g., letter, editorial, essay) that are appropriate for writer's purpose and audience.

c. List rhetorical techniques appropriate to the purposes, audiences, and forms of particular written compositions.

d. Determine writing approaches (e.g., describing, narrating, analyzing, evaluating) that are appropriate to the purposes of written compositions.

2. Generate ideas and gather information relevant to the topic and purpose, keeping careful records of outside sources.

a. Design an appropriate search strategy (e.g., generate lists of ideas, forecast questions that might be raised by the audience).

b. Prepare annotated bibliographies of outside sources.

3. Evaluate relevance, quality, sufficiency, and depth of preliminary ideas and information, organize material generated, and formulate thesis.

a. Craft thesis statements that articulate a position and logically group the relevant evidence and examples that support the thesis statement.

b. Identify additional ideas or perspectives that must be addressed and areas that require more detail or support to accomplish the writer's purpose for the specified audience.

4. Compose a draft that contains significant ideas with supporting details, organizes content in a way that suits the writer's purpose and writing approach and that supports the underlying logic of the ideas, uses language effectively, and has the greatest impact on the writer's audience.

    a. Produce drafts that are logically organized in relation to the writer's purpose, audience, and chosen form.

    b. Produce drafts that create tone and style appropriate to topic, audience, and task, including non-Standard English when appropriate.

    c. Produce drafts that use precise and engaging vocabulary appropriate to audience, purpose, and task, using sentences that are well crafted and varied in structure.

    d. Present positions through thesis statements supported by relevant evidence and examples, cogent reasoning, and anticipation of counterarguments.

    e. Produce drafts of functional texts (e.g., application, resume, operation manual) that present information to the intended audience by using clear language, appropriate organizational patterns, and conventional formatting to achieve intended effects.

    f. Produce texts that translate technical language into non-technical language and include sufficient detail, address potential misunderstandings by readers, and use conventional formatting structures (e.g., headings, graphics, white space).

    g. Cite print or electronic sources properly when summarizing, paraphrasing, or quoting source material, including graphics.

5. Revise drafts to improve logic and sufficiency of content, coherence, clarity, organization, and style.

    a. Produce final texts with a clear position and thesis statement supported by relevant and sufficient evidence and examples, cogent reasoning, and anticipation of counterarguments.

    b. Produce final texts that use precise, engaging vocabulary in sentences that are varied and well crafted.

    c. Produce final texts that convey a tone and style appropriate for the audience, purpose, and task.

    d. Produce final texts with coherence within and between paragraphs.

e. Submit multiple drafts that reflect judicious use of peer and instructor feedback.

6. Edit according to the conventions of Standard English when appropriate to the writer's purpose.

a. Edit for correct spelling, capitalization, and punctuation.

b. Edit for subject-verb agreement.

c. Edit for pronoun reference and agreement.

d. Edit for appropriate tense and voice.

e. Edit for correct word use.

f. Edit for correct syntax (e.g., misplaced modifiers).

g. Improve coherence by increasing logical connections within and between sentences.

h. Edit for correct sentence structure (e.g., subordination, coordination).

i. Consult reference guides for citation conventions, grammar, mechanics, and punctuation.

j. Use a variety of proofreading techniques to compensate for the limitations of automated aids such as electronic spell and grammar checks.

II. Reading

A. Locate and recall textually explicit information, make complex inferences, analyze, and evaluate within and across texts.

1. Use effective pre-reading strategies to situate a text.

a. Use the title, knowledge of author, and place of publication to make predictions about a text.

b. Use the table of contents to preview a text and understand its design.

c. Scan headline sections or other division markers, graphics, or sidebars to form an overview of a text.

2. Use text features and graphics to form an overview of texts and to determine where to locate information.

a. Identify key information in tables, graphs, and charts.

b. Use tables of contents, headings, and subheadings to locate information for answering questions.

3. Identify implicit information in text including main ideas and author's purpose.
    a. Identify main ideas and supporting details.
    b. Identify authors' purposes in magazine articles.
4. Make and support complex inferences from text to summarize, to draw conclusions, and to distinguish facts from claims and opinions.
    a. Analyze moral dilemmas in works of literature as revealed by characters' motivations and behaviors.
    b. Summarize key points in important historical documents.
5. Analyze the presentation of information and the strength and quality of evidence used by the author, and judge the coherence and logic of the presentation and the credibility of an argument.
    a. Describe errors in logic in editorial letters submitted to local newspapers.
    b. Evaluate the sufficiency and strength of evidence used in research papers.
6. Analyze how patterns of imagery connect to themes and set tone.
    a. Analyze how imagery sets tone in classic American poetry, such as that of Robert Frost or Emily Dickinson.
    b. Analyze how patterns of imagery evoke emotions in primary documents, such as Lincoln's Gettysburg Address, or in fiction, such as Kate Chopin's *The Awakening*.
7. Evaluate the way an author uses language (e.g., descriptive terminology, phrases, sentence variation, syntax) to inform or influence readers.
    a. Describe how authors use style to evoke specific cultures, locations, or time periods, such as Sandra Cisneros's use of style in *The House on Mango Street*.
    b. Evaluate how authors use language to change readers' perspectives on a topic, such as how Rachel Carson used language in *Silent Spring* to change readers' views about the environment.
    c. Explain how authors such as Langston Hughes use dialect to convey character and setting.
8. Compare and analyze how genre features are used across texts.

a. Compare and analyze use of farce in humorous essays and in comic dramas to show how the authors use this feature to achieve their purpose.

b. Analyze the use of persona in autobiographies written by women from different historical periods.

9. Identify and analyze the audience, purpose, and message of an informational or persuasive text.

a. Analyze and evaluate the logic and use of evidence in authors' arguments.

b. Make inferences about prevailing public opinions or concerns by reading newspaper reports and presidential speeches from specific historical periods.

10. Identify and analyze how an author's use of language appeals to the senses, creates imagery, and suggests mood.

a. Identify words that inform readers of aspects of a setting or time period, such as how words in Harper Lee's *To Kill a Mockingbird* help the reader understand the climate and mood of the American South.

11. Identify, analyze, and evaluate similarities and differences in how multiple texts present information, argue a position, or relate a theme.

a. Analyze similarities and differences in how authors develop the same theme in several short stories.

b. Read diaries written during a particular event or period and use evidence from the diaries to demonstrate similarities and differences in how each author feels about the event.

c. Analyze how authors present opposing viewpoints on the same issue.

B. Understand new vocabulary and concepts and use them accurately in reading, speaking, and writing.

1. Identify new words and concepts acquired through study of their relationships to other words and concepts.

a. Describe meanings of words read in texts based on context clues.

2. Apply knowledge of roots and affixes to infer the meanings of new words.

a. Identify meanings of several scientific terms based on their Greek or Latin roots.

b. Infer meanings of new words in texts based on their affixes.

3. Use reference guides to confirm the meaning of new words or concepts.

a. After using context clues to infer word meanings, use dictionaries, online glossaries, or other references to confirm their meanings.

C. Describe, analyze, and evaluate within and across literary and other texts from a variety of cultures and historical periods.

1. Know characteristic forms, subjects, and key authors of major periods of European, American, and World literatures.

2. Identify, analyze, and apply knowledge of the themes, structures, and elements of myths, traditional narratives, and classical and contemporary literature, and provide supporting evidence from the texts.

a. Describe how the authors of short stories based on legends or myths translate the legends or myths into contemporary settings.

b. Apply knowledge of world history to interpret the theme of a world literary text (e.g., describe the theme of Chinua Achebe's *Things Fall Apart* based on knowledge of colonial African History).

3. Analyze works of literature for what they suggest about the historical period and cultural contexts in which they were written.

a. Analyze how significant historical periods influenced authors (e.g., Colonial America and Cotton Mather).

b. Describe how the social conditions of a particular geographic region or time influenced authors (e.g., Dickens' views in *Hard Times*).

4. Analyze and compare the use of language in literary works from a variety of world cultures.

a. Analyze biblical parables and European essays on the same theme to compare how the authors achieve their purpose.

b. Compare contemporary poems from major writers from different nations.

D. Explain how literary and other texts relate to one's own experiences, world events, and other means of expression (e.g., theater, film).

1. Describe insights gained about oneself, others, or the world from reading specific texts.

a. Compare one's own life experiences with those of a novel's main character.

b. Compare current world events with those described in essays from the turn of the 20th century.

2. Analyze the influence of myths, folk tales, fables, and classical literature from a variety of world cultures on later literature and film.

a. Select a historic play and describe its influence on contemporary literature (e.g., Baum's *The Wizard of Oz* and its influence on the novel and/or stage play *Wicked*).

b. Analyze the influence of Greek mythology on contemporary science fiction.

Speaking

A. Understand own and others' communication in group discussions and formal presentations (e.g., accuracy, relevance, and organization of information; clarity of delivery; relationships among purpose, audience, and content; types of arguments used; effectiveness of own contributions).

1. Understands how style and content of spoken language varies in different contexts and how this influences the hearer's interpretation.

a. Understands influences on language use (e.g., political beliefs, positions of social power, culture).

b. Communicate effectively to audience based on social characteristics (e.g., religion, culture, gender).

c. Monitor the audience's reaction and adjust message, wording, and delivery (e.g., pace, tone, body language) to suit the audience.

2. Adjusts message wording and delivery to particular audiences and for particular audiences and for particular purposes (e.g., to advocate or defend a position, to entertain, to inform, to persuade).

a. Use effective verbal and non-verbal response strategies to adjust the message.

b. Analyze discussion techniques while confronting or rebutting opposing viewpoints.

B. Speak effectively using language appropriate to the situation and audience.

1. Participate actively and effectively in one-on-one oral communication situations.

a. Communicate, in an appropriate format, information that was gathered by inquiry (e.g., research, interviews).

b. Critique a speaker's use of words and language in relation to the purpose of an oral communication and the impact the words may have on the audience.

c. Communicate understanding of materials, concepts, and ideas.

2. Participate actively and effectively in group discussions.

a. Cooperates with peers to put together a group; establishes roles, responsibilities, ground rules, and schedule in relation to task; follows through on assignments; evaluates the work of the group based on criteria.

b. Use discussion techniques to arrive at a consensus or complete a task.

c. Use relevant evidence and rhetorical devices to advocate and defend a position.

3. Plan and deliver focused and coherent presentations that convey clear and distinct perspectives and demonstrate solid reasoning.

a. Present and support a clear thesis statement with sound reasoning and appropriate types of proof (e.g., statistics, testimony, examples) that meet standard tests for evidence, including credibility and validity.

b. Use clear and concise language to explain complex concepts and information expressively, informatively, and analytically.

c. Recite poems, selections from speeches, or dramatic soliloquies with attention to performance details to achieve clarity, force, and aesthetic effect and to demonstrate an understanding of the meaning.

Listening

A. Apply listening skills as individuals and members of a group in a variety of settings (e.g., lectures, discussions, conversations, team projects, presentations, interviews).

1. Analyze and evaluate.

a. Critique the speaker's delivery skills (e.g., word choice, pitch, feelings, tone, voice).

b. Analyze, synthesize, and evaluate the effectiveness of a speaker's presentation.

2. Interpret a speaker's message; identify the position taken and the evidence in support of that position.

a. Evaluate the multiple levels of meaning and age, gender, social position, and cultural traditions of the speaker.

b. Analyze the effectiveness of speaker's nonverbal messages (e.g., eye contact, gestures, facial expressions, posture, spatial proximity).

3. Use a variety of strategies to enhance listening comprehension (e.g., focus on attention on message, monitor message for clarity and understanding; provide verbal and nonverbal feedback; note cues such as change of pace or particular words that indicate a new point is about to be made; select and organize key information).

a. Develop and ask questions related to the content for clarification and elaboration.

b. Follow complex verbal instructions that include technical vocabulary and processes.

c. Paraphrase or summarize information with appropriate editorial comment.

d. Take concise notes that accurately reflect the presentation or discussion.

B. Listen effectively in informal and formal situations.

1. Listen critically and respond appropriately to presentations.

a. Define new words and concepts, and note questions raised by the presentation to draw interpretations of the speaker's content and attitude toward the subject.

b. Synthesize information, ideas, and opinions to highlight areas for critical reflection.

c. Use critical listening responses, such as refutation and commentary, to analyze, synthesize, and evaluate the accuracy and effectiveness of presentation.

2. Listen actively and effectively in one-on-one communication situations.

   a. Ask probing, idea-generating questions and make appropriate statements to clarify and add to meaning.

   b. Accurately paraphrase what has been heard.

   c. Revise a draft based on oral peer critique.

3. Listen actively and effectively in group discussions.

   a. Take effective notes during group discussion.

   b. Use effective listening techniques to arrive at a consensus of opinion in a productive deliberation.

   c. Use effective listening techniques to complete a group task.

Appendix I

Summary of Individual Stakeholder Input From Statewide Meetings

April 23, 2007
Thompson Conference Center
Austin, Texas

Dr. Diane Bryant, The University of Texas at Austin, College of Education, Vaughn Gross Center for Reading and Language Arts

Dr. Bryant focused on college readiness in reading and what the state standards in that area should include. She called for state standards in reading that (a) incorporate scientifically based principles of reading and reading instruction, (b) include standards language that is measurable, (c) state specific grade-level expectations rather than by grade bands, (d) specify a progression of specific reading skills throughout the grade levels to identify increasingly complex expectations for proficiency, and (e) provide examples of the variety of reading material and level of reading proficiency at each grade.

Jane F. Schielack, Texas A&M University, Department of Mathematics

Dr. Schielack identified two possible reasons why Texas students do not exhibit proficiency in mathematics and proposed strategies for closing the performance gap. These reasons are (a) a deficient depth of understanding of critical concepts in high school courses, and (b) failure to connect the critical concepts presented in all high school mathematics courses. She proposed the following strategies for improving college readiness in mathematics.

- Revise the mathematics curriculum to teach concepts deeply and organize it within and across grades levels by "big ideas" such as equivalence and proportionality.
- Provide effective professional development to prepare teachers to teach for depth and connections.
- Refine state tests to assess a deep understanding of concepts and not just lower-level skills and connections among fundamental mathematics ideas through problem solving.

May 8, 2007
Higher Education Coordinating Board Offices
Austin, Texas

Dennis Brown, El Paso Community College, Vice President for Instruction
Maggy Smith, The University of Texas at El Paso, Vice Provost for Undergraduate Studies and Dean of University College
Richard Bentley, Ysleta Independent School District, Associate Superintendent of Academics

Drs. Brown, Smith, and Bentley reported on the College Readiness Consortium in the El Paso area, which is comprised of 12 school districts, the El Paso Community College (EPCC), and The University of Texas at El Paso (UTEP). The consortium's goal is to ensure that college-bound high school graduates' initial college enrollment is in credit-bearing courses. The Consortium is attempting to accomplish this by (a) administering the EPCC- and UTEP-required placement test, ACCUPLACER, to high school juniors and seniors and providing early intervention to those who don't meet the standards for placing out of developmental education, and (b) providing incoming college freshmen with supplemental support to ensure success in first year credit-bearing classes. These individuals credit the initial success of the consortium to a strong articulation system among the participating entities, common placement standards, and a commitment among all parties to collaborative curriculum development.

June 18, 2007
University of Houston
Houston, Texas

Dianne Johnson, Houston Independent School District, Trustee

Ms. Johnson's testimony emphasized the need for the state's accountability system to measure academic growth and not minimum standards. She outlined some of the college readiness initiatives in Houston ISD that have been successful. These include requiring each student to take the PSAT, which is used for placing students who are prepared for academic rigor in Advanced Placement (AP) classes; rewarding teachers and students with a $300 performance bonus for scoring a 3 or higher on an AP exam; and increasing dramatically the number of student enrolled in dual credit classes. Additionally, she urged the state to create a P–16 information system that enables school districts to access data on their students' college performance.

Jim Windham, Texas Institute for Education Reform, President

Mr. Windham's statement focused on urgent actions the State should take to ensure that students are prepared for higher education in light of evidence that current TAKS proficiency standards are well below the NAEP proficiency and basic standards in

fourth and eighth grade reading, and well below NAEP proficiency standards in fourth and eighth grade mathematics. Recommended actions include:

- Overhauling the current Texas Essential Knowledge and Skills (TEKS) to reflect higher expectations, grade level specificity, and progression of rigor, and to ensure that the standards are measurable
- Enhancing the P–12 Public Education Information Management System (PEIMS) to enable student, teacher, and teacher preparation data to be linked at the classroom level
- Phasing in higher proficiency standards for TAKS, similar to those used by NAEP and ACT, for assessing college readiness
- Adopting a value-added methodology for measuring student achievement growth

Christopher Hammons, Houston Baptist University, Associate Professor of Political Science

Dr. Hammons provided the Commission with his 2005 report, *The Education Deficit in the Lone Star State: The Financial Impact on Texas When Students Fail to Learn Basic Skills*, which was prepared for the Texas Public Policy Foundation. The report quantifies the financial impact to the state when students leave high school without learning the necessary reading, writing and mathematics skills to perform successfully in college or the workplace. The financial impact is based on lower earnings and poor worker productivity, increased spending on social programs, and direct costs of remediation by colleges and universities and employers. Dr. Hammons suggested that efforts to address college and job readiness should focus on two steps: (a) requiring students to pass rigorous skills tests that demonstrate proficiency before receiving a diploma; and (b) implementing more school choice for families.

July 31, 2007
UT Arlington
Arlington, Texas

Tegwin Pulley, Texas Instruments/Texas Engineering and Technical Consortium

Mr. Pulley stated that a high level of reading, mathematics, and communication skills are needed whether a student starts work after high school or goes to college. High school graduates must have a good grasp of concepts taught in Algebra II and be able to apply that knowledge in real-world situations. However, about 30% of job applicants today cannot even do eighth grade mathematics. When looking at creating college readiness standards for Texas, the state must develop ones that are comparable to the best in the world because of the globalization of the economy.

Wes Jurey, Arlington Chamber of Commerce

Mr. Jurey said it is critical that Texas standards be benchmarked against national and international competitors because of the harsh reality of global competition. Leaders also need to ensure that public education and higher education curriculum is vertically aligned and employer needs are factored in to standards development. Additionally, the state's high school exit test must begin to reflect the skills and knowledge needed to be successful in college and the workplace.

Scott Kahl, Human Resources Director, National Semiconductor

Mr. Kahl stated that National Semiconductor participates in various educational partnerships with local school districts. He noted that students need to be better prepared for careers in science and mathematics, and that Texas lags in several national assessments in these areas. He stated that Texas' teacher certification in mathematics and science trails national figures. He advocated adequate preparation and reward for qualified teachers, eliminating student's ability to skip end-of-course exams, and expanding programs that enable students to have real-world experience. He also agrees that all students should be prepared for college or the workforce.

Frank Roby, Greater Dallas Chamber of Commerce

The chamber supports the Commission's efforts to create higher standards so all high school graduates are college and career ready. Mr. Roby stressed the importance of moving quickly to accommodate the ever-increasing employment needs of Texas businesses.

Terri Patterson and Jim Lowder, Lubbock Economic Development Alliance

Ms. Patterson and Mr. Lowder have worked with industry in the Lubbock area to create standards for career and technical education. Students, often in dual credit programs, are earning credits for high school and community college, as well as often working jobs that enable them to apply what they are learning.

Robert F. Pence, President and CEO, Freese & Nichols (an engineering and architectural firm)

Mr. Pence urged the Commission to address the high school dropout problem by supporting successful dropout prevention programs. He stated that the brightest students must be cultivated and that all students should be exposed to real-world experiences. He believes that college readiness and workforce readiness must be examined together to develop communication and interpersonal skills. He supports experimental learning partnerships where schools and business can partner together.

Judith Bean, Texas Woman's University

Ms. Bean said TWU has many students who took 4 years of mathematics in high school and were still required to enroll in developmental mathematics their freshman year. There also are high rates of failure in freshman science courses because of the poor reading skills of entering students. She is hopeful that higher curriculum standards in high school will ease the need for developmental education courses in college.

James M. Hays, University of North Texas, Doctoral Student, College of Education

Mr. Hays shared his extensive 2007 policy brief on the remediation of the college ready student. Among his findings are that: (a) Texas is not on track to meet the diversity participation and completion targets in *Closing the Gaps by 2015*; (b) considerable variance exists between high schools, community colleges, and universities in grading policies and curriculum rigor; (c) higher education institutions are reticent to define what knowledge and skills they want enrolling freshmen to possess and prefer to use score ranges on college entrance exams; and (d) "seats" in college classrooms are the lifeblood of most postsecondary institutions.

He recommended that the state develop a coherent strategy of improving college readiness that includes:

- Adopting an aligned statewide curriculum for kindergarten through four years of college
- Establishing a state cabinet-level position of Secretary of Education to bring about cohesion of purpose and more accountability
- Adopting inclusive university entrance standards independent of the SAT and ACT
- Enacting laws to require community colleges to be the primary provider of remedial or developmental education

Gary L. Schepf, The Academy of Irving ISD, Advanced Technology and Legal Studies, Intern Coordinator

Mr. Schepf emphasized the importance of Texas implementing the new Rs—rigor, relevance, and relationships—in high schools and addressing both college and workforce readiness. He pointed to career and technology education as a way to demonstrate the relevance of what students are learning while promoting technical writing, real world mathematics, logic and problem-solving skills.

Barbara Terry, Association of Texas Professional Educators

Ms. Terry expressed concern that some students are not prepared for the rigor of courses that prepare them for college or competitive jobs, and pointed to the need to begin developing higher level thinking skills beginning in fourth and fifth grade. Extended

day and Saturday programs should be used for those students falling behind in skills development.

September 14, 2007
Henry B. Gonzalez Convention Center
San Antonio, Texas

Mr. Duane LaBom, Toyota
Dr. Federico Zaragoza, Alamo Community College District
Mr. Trey Jacobson, Office of the Mayor of San Antonio

These individuals reported that there is a large shortage of skilled manufacturing technicians in the San Antonio area, and the opinion of technical education programs must change if we are to meet the job demand. They all agreed that the reading and mathematics skills required for these technicians are the same as those required for college, but said that these skills could be taught effectively through academic or career and technology courses. It was pointed out that the technical training program at St. Phillips College in San Antonio is a model across the country.

John Hipple, Texas College Counseling Association, Executive Board

Dr. Hipple shared with the Commission the importance of having professional counselors at every level of schooling—elementary, middle, high school, community and 4-year colleges—to assist students in making sound decisions about academic preparation, course selections and degree planning.

Bruce Leslie, Chancellor, Alamo Community College District

Mr. Leslie stated that high schools, community colleges, and universities must work together with a single focus of ensuring that students are prepared to succeed in college and attain a degree. College expectations should be instilled in students and parents at an early age.

Anna Romero, Intercultural Development Research Association

Ms. Romero emphasized the need for complete alignment between K–12 and higher education, and she supports an emphasis on dual credit courses in high school. She urged the state to assist school districts and higher education in providing summer academic camps as a way to prevent remediation in college.

Lennie Irven, Dan Dimitriu, and Ellen Walroth, San Antonio College

These three individuals stated that college readiness really starts in kindergarten and the standards-setting process shouldn't be limited to high school. There needs to be more corporate involvement, particularly for internships, to enable secondary students to truly understand what skills are needed for high-level jobs.

Joe Burke, Junior Achievement

Mr. Burke shared with the Commission that Junior Achievement enables students to see relevance in what they learn in school. Their experience is that students who participate in Junior Achievement are more likely to go to college or gain employment and have higher self-esteem.

Velma Ibarra, Harlandale ISD

Ms. Ibarra reported on the work of the Alamo Tech Pre Consortium.

Ricardo Gonzalez, UT San Antonio

Mr. Gonzalez described the work that UT San Antonio is doing through its office of P–20 Initiatives. This includes working with 17 area school districts in dual enrollment programs, Early College High Schools, and a variety of college recruitment programs.

Eric Reno, President, Northeast Lakeview College

Mr. Reno urged the Commission to remember that many colleges are serving a large percentage of "non-traditional" students—those older than age 25—who often must receive remedial help to recover knowledge and skills lost since high school.

Simon Salas, Texas Association of Workforce Boards

Mr. Salas stated that college readiness and workforce readiness involve the same knowledge and skills, and recommended that students in middle school be allowed to earn high school credits and be required to complete a career preparation plan.

Evelyn Hardeman, Association of Texas Professional Educators

Ms. Hardeman supports the alignment of TAKS to the SAT and ACT, and wants to integrate secondary and postsecondary environments.

Manuel Berriozábal, UT San Antonio, Texas Pre-freshman Engineering Program

Mr. Berriozábal urged a rewrite of the current mathematics TEKS so that mastery of academic content is clearly emphasized in place of learning processes. He also supports the expansion of programs, such as the Texas Academy of Mathematics and Science at the University of North Texas and Mathematics Camp at Texas State University, to provide more learning opportunities for able students.

Written Testimony
Submitted Directly to Commission

Mike McLamore, Education Excellence for All Texans Programs

Mr. McLamore supports the establishment of an open enrollment period for student and teacher assignments to campuses. He also advocates basing teacher compensation on average daily attendance funding.

Susan Dawson, E3 Alliance

Ms. Dawson supports leveraging alignment opportunities among educational partners to meet the goals of *Closing the Gaps* and produce a workforce for targeted industry jobs in Central Texas. The E3 Alliance has produced a report that concludes that almost all students should be college/career ready, the current measures of college readiness are inadequate, too few students graduate from high school college ready, the gaps in college readiness among groups of students remain large, and the data to support change is largely inaccessible.

Linda Bridges, President, Texas AFT (American Federation of Teachers)

Ms. Bridges shared that college readiness not only involves student mastery of basic skills and core knowledge, but also a capacity for critical thinking and problem solving, and a strong work ethic. She stated that funding per pupil and investment in teacher salaries, benefits, and professional development must be increased. She supports making testing more appropriate to postsecondary readiness. She urged providing additional funding for student aid, particularly among low-income students, and for Texas' community colleges.

Kaplan K–12 Learning Services and the International Center for Leadership in Education

The document provided by these groups supports preparing students for higher level academic work and the larger world through a coherent development and honing of academic skills. Students should be exposed to rich and deep academic content through a rigorous and relevant curriculum via several learning criteria.

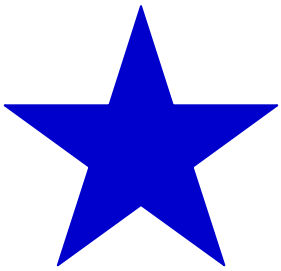
Francine Burris, English Department Chairman, Arlington High School

Ms. Burris supports adding several skills to the English language arts and reading TEKS, including research skills, skills related to essay writing, and practice with analyzing and creating an argument in essay writing.

Urban League of Greater Dallas and North Central Texas

The organization supports the goal of providing college readiness for all students. It notes that inadequate college preparation leads to a longer and more expensive college

experience because of remedial coursework. It advocates strengthening teacher preparation at the university and professional level, studies tracking students from elementary school to college, and the adoption of high, yet attainable, college readiness standards for all students.



Appendix J

Summary of Stakeholder Input From Regional Meetings

Midland/Odessa, Harlingen and Lubbock

August 14, 2007
Midland/Odessa, Texas

Commission members Jose Cuevas, Jr. and Dr. Linda Ferreira-Buckley were joined by Dr. Rex Peebles, Vice President of Instruction at Midland College, Ms. Lorraine Perryman, Secretary of the Texas Higher Education Coordinating Board, in hosting the meeting to receive ideas from political, education and business leaders and the public on how to improve the college readiness of students in the Midland/Odessa region.

Several speakers pointed to alarming education statistics for that area of the state:

- Odessa ISD's school dropout rate is 11%
- West Texas has the lowest college attendance rate in Texas
- 2005 census data shows that only 11% of the Odessa population has a bachelor's degree compared to 27% nationally.

The panel received public testimony from nine individuals. Following is a summary of their comments.

Mr. Buddy West, State Representative, Texas Legislature

State Rep. West stated that all of West Texas must move forward to educate our children. He said we need to change the mindset of some of our legislators and work with our education system to help kids build their field of dreams. Kids are our future.

Dr. David Watts, President, The University of Texas of the Permian Basin (UTPB)

Statistics report that college graduates' lifetime earnings are $1 million more than high school graduates, and they are reported to have a higher level of happiness and a longer lifespan, and participate more at civic and community levels. West Texas has the lowest college attendance rate in Texas. Dr. Watts stated that UTPB will continue an extensive student support services system at no additional cost to the student and aggressively intervene with students who need those services. UTPB has proposed the establishment of rigorous course work for high school seniors to expose them to the academic environment of the university and has created a Regional P–16 Council for the Permian Basin. Appropriate funding for higher education is needed to help students and parents understand the importance of an education, and West Texas teachers are underpaid and need to be better compensated.

Dr. Greg Williams, President, Odessa College

Dr. Williams said early childhood development is critical, and parents need to begin early, investing in their children's future by going to the elementary schools and getting involved. Schools need to reach out and develop programs to educate parents. College counseling is also critical. He said we need to work harder and better at preparing our students for college.

Dr. Clayton Alred, Vice President of Instruction, Odessa College

Dr. Alred stated that 2005 census data indicates that only 11% of the Odessa population possesses a bachelor's degree compared to 27% across the nation. He said an educated workforce is critical, and it is important that we work on the attitudes and commitment of students and families. Dr. Alred suggested that extensive efforts be made to educate the public and expand our college awareness programs.

Dr. Sylvester Perez, Superintendent, Midland ISD

Dr. Perez suggested aligning the state and federal accountability systems to make it less confusing and addressing the importance of pre-kindergarten and early childhood education in addition to preparing students for postsecondary education. Teachers' pay is a main challenge for Texas education, and more flexibility is needed for students to attend school in non-traditional school settings. Midland ISD offers a Career Connection class for eighth grade students to explore various careers and life skills. The district also has added more counselors at the elementary level and plans to do so at the middle and high school levels.

Mr. Hector Mendez, Interim Superintendent, Ector County ISD

Mr. Mendez said that education is a civil right, and we must provide students with a firm and solid research-based education foundation so all Texas citizens can take advantage of their education opportunities. Student support services must be provided for entering college freshman so they can be successful. Universities should accept students' work experience and give credit for AP classes.

Mr. Patrick Canty, Vice President, Ector County ISD Education Foundation

Mr. Canty urged leaders to begin collecting data to support the needs to improve college readiness in the community. Business leaders and parents must become involved and develop solutions to improve postsecondary and career preparation. The participation of the Regional P–16 Council is needed to help raise funds to support initiatives. It is unfair to expect school districts or colleges to solely support college readiness programs.

Mr. Kirk Edwards, Chairman, Odessa Chamber of Commerce

Mr. Edwards said we need an educated workforce to attract new industries and to become a more diversified economy. Odessa has an 11% dropout rate. Many youths lack the necessary education and workforce skills. Mr. Edwards said we need to do a better job of educating students and parents about the higher earning potential that results from staying in school and graduating.

Mr. Willie Taylor, CEO, Permian Basin Workforce Development Board

Mr. Taylor stated we must take a comprehensive approach to education and prepare all our youth for college with good reading, writing, and computer skills in their chosen field of study.

September 11, 2007
Harlingen, Texas

The Harlingen regional meeting was hosted by Dr. Linda Wade, Superintendent of Harlingen ISD. Commission members George McShan, David Merrill, and John Fitzpatrick received testimony from area school superintendents, school board members, representatives of The University of Texas at Brownsville and Texas Southmost College, and other community education and business leaders about what college readiness means in the Lower Rio Grande Valley. Following is a summary of comments from the 10 individuals who attended the meeting.

Gloria Casas, LaFeria School Board Member

Ms. Casas stated that the pathway to college starts at home and the state should be encouraging partnerships between school districts.

Linda Fossen, Associate Vice President for Enrollment Planning, The University of Texas at Brownsville/Texas Southmost College

Ms. Fossen outlined the benefits of the dual enrollment program. In the past school year, four students graduated from high school with a diploma and an associate's degree. Ms. Fossen explained that the program utilizes intense parental involvement and learning communities, and parental support has made a big difference in the success of students.

Dr. Linda Wade, Superintendent, Harlingen ISD
Hector Gonzales, Superintendent, Brownsville ISD
Martin Peña, Region 1 Education Service Center

These individuals provided an overview of the characteristics of the student population in the Valley (e.g., racial/ethnic breakdown, percentage of economically disadvantaged, percentage of high school graduates and college enrollees) and outlined the new state

laws and rules in place to improve the college readiness of students. They also cited the development of a good, solid statewide curriculum as critical to the success of students in their region.

Dr. Daniel King, Superintendent of Pharr-San Juan-Alamo ISD

Dr. King stated that an alignment of college and high school curriculum is long overdue, and the key is to connect the workforce with the educational experience in a meaningful way.

Fernando Castillo, Superintendent of Progresso ISD

Ms. Castillo discussed the need to implement early college programs beginning in the seventh grade to better prepare students for college.

Oscar Rodriguez, Superintendent of Mission ISD

Mr. Rodriguez reported that Mission Independent School District has been proactive in increasing college readiness by increasing the number of required high school credits from 26 to 27. Mr. Rodriguez also stated that the Commission needs to focus the accountability of colleges.

Tom Torkelson, Superintendent of IDEA Public Schools

Mr. Torkelson spoke about the need to prepare students for a vigorous college career by recalibrating expectations of students and parents and by making high schools look more like college.

Mike Willis, Executive Director of the South Texas Manufacturers Association, McAllen

Mr. Willis stated that less than half of students graduating from high school in 2005 were prepared for college mathematics and science, and that much stronger technology instruction and application is needed in high schools. Entry-level jobs now need more skills, including an associate's degree.

Pat Bubb, Tech Prep of the Rio Grande Valley

Ms. Bubb stated that Tech Prep partners with 10 school districts and three colleges and universities to provide reality-based learning for students so they are successful participants in the Rio Grande Valley workforce.

Emma Doggett, Director of Teach for America

Ms. Doggett pointed to the need to focus on teacher preparation because teachers who are better prepared can develop college- ready students.

October 3, 2007
Lubbock, Texas

The Lubbock regional meeting was hosted by the Lubbock Economic Development Alliance and the United Way of Lubbock. Commission members Jose Cuevas, Jr. and Dr. Linda Ferreira-Buckley received testimony from many individuals representing higher and public education in the Lubbock area and local business leaders.

Dr. William Marcy, Texas Tech University

Dr. Marcy discussed how educators and the community are not adequately preparing students to be successful in higher education. Dr. Marcy believes that only 55% of students enrolled at Texas Tech will earn a degree. He stated that he is extremely frustrated with the success rates of freshman and particularly those of engineering students. He believes the students are not prepared enough to succeed in the mathematics, science, and engineering fields. To succeed in these fields, students must have abstract reasoning skills.

Rick Stewart, Lubbock Independent School District, Byron Martin Advanced Technology Center (BMATC)

Mr. Stewart stated that we need to ensure that students are ready for higher education or the workforce. The end result should be to fit folks with jobs. To do this, we must change the paradigm of vocational education; develop a new career curriculum delivery system that allows for the flexible use of state and federal funding; develop rigorous courses that meet industry and college standards to ensure that students do not lose; develop articulations between dual credit career classes and accredited national certification; and develop and identify a sensible and flexible 4 x 4 plan.

Dr. Tim Maxwell, Texas Tech University

Dr. Maxwell stressed the importance of teaching abstract thinking in mathematics and science and the use of hands-on training to reinforce concepts. He discussed the need to educate students and parents about all postsecondary options.

Bill Miller, Lubbock Chamber of Commerce, Chairman of Education Committee

The Lubbock Chamber of Commerce believes the definition of *college ready* should encompass both college and technical training. Students need to be taught how to adapt within the ever-changing workforce and how to think critically, with an emphasis on reading and literacy that leads to success in mathematics and science. There should be a complete integration of the public schools, technical training, and universities.

Dr. Dean Fontenot, Texas Tech University, Director of T-STEM Center

Texas has seven STEM centers that focus on professor and teacher professional development. The professional development, which is very rigorous, promotes the teaching of abstract reasoning and critical thinking skills. Dr. Fontenot stressed the need to do this because 85% of jobs require some postsecondary training, only 34% of graduates are ready for college, only 18% of freshman graduate in 4 years, and 33% of students must take remedial courses. He stressed that teachers can't do this all by themselves and that parents must play a vital role.

Dr. Alice White, Texas Tech University

Dr. White stressed the importance of giving students and parents optional pathways to success, particularly those that show relevance to their lives.

Tom Hurley, Hurley Packaging

Mr. Hurley stated that most workers lack basic skills, such as mathematics, and the ability to communicate effectively. He feels that family involvement is vital to improving academic success and that students must have a support system of parents, other relatives, and friends to promote achievement in school.

Clark Self, Former Director, Slaton Economic Development and Board Member, West Texas Coalition for Innovation and Commercialization (WTCIC)

Mr. Self said that we must get students and parents to realize the value of education. There should also be partnerships between businesses and schools that enable students to earn credits while working and learning valuable skills.

Kelvin Sharp, President, South Plains College

The state should support good tech prep and dual credit programs, as well as offer students multiple pathways for success. Mr. Sharp said we must think outside the box to get students interested in college while maintaining high standards so all students can succeed whether they choose college or the workforce.

Bill Landis, Lubbock ISD

Mr. Landis stressed the need for students to focus on what they want to do in life and why they want to do it. He is concerned about the rigidity of requiring four specific mathematics and sciences courses for all students. We need to be flexible and allow students to choose between multiple pathways.

Jill Berset, South Plains College, Tech Prep

Ms. Berset stated that we need to be realistic with students about the availability of jobs in specific fields and that more hands-on education will improve student success in

academics. She believes that students must be exposed to jobs within business and industry, and there should be more emphasis on teaching reading across all disciplines. She also cited a need for additional counseling and advising of students.

Cindy Miller, Frenship ISD

Ms. Miller pointed to the need to help students not only prepare for college but find their passions in life. Career awareness must be promoted beginning in the eighth grade.

Gordon Davis, CEV Multimedia

Mr. Davis stated that we need to consider how we train our students to be employable, college bound or not, because 75% of employers report severe difficulty in trying to hire employees. He remarked that career and technology education (CTE) needs additional funding, and the negative view of CTE can be changed through more accountability. He also remarked that we need to focus on the 16 career pathways identified by the federal government.

Kim Spicer, Frenship ISD, Teacher

Ms. Spicer stated that dual credit courses provide students with the belief that they can be successful in postsecondary courses. At Frenship, they offer more than 100 dual credit hours in partnership with South Plains College. However, the courses don't always transfer, especially to a university. She urged the commission to look at creating a freshman college curriculum for high school seniors. She also mentioned that the majority of Frenship ISD students struggle with college entrance exams, and she would like the new high school standards to be fully aligned with college entrance exams.

Bonnie Stinnett, Frenship ISD, Teacher

Ms. Stinnett remarked that P–16 councils are forming across the state and there is a lack of representation from the secondary level on these councils. She stated that there are expectations at the college level, but that communication is lacking between the colleges and high schools.

Kellie Kiker, Frenship ISD, Senior Counselor

Ms. Kiker stated that the curriculum at all colleges should be standardized, thus making the dual credit classes taught on high school campuses accepted at all colleges and universities. She also stressed a need for additional counselors in high schools.

Carolyn Simpson, United Way, Success by 6

Ms. Simpson remarked that although all the college readiness discussions were relevant, none matter if the right skill sets are not taught to children at a young age. She encouraged policy initiatives for young children to close the gap in learning. This would include increasing access for all young children to quality programs, increasing the

education levels and training for teachers and other care providers of young children, and aligning what is taught in preschools and early care centers with the curriculum in public schools.

Phil Warrant, Superintendent, Shallowater ISD

Mr. Warrant urged financial support for a program out of Kansas called *Parents as Teachers.*

Dale Gannaway, Director, WTCIC

Mr. Gannaway supports a regional focus on applied research and technology education aligned with the eight clusters identified by the governor's office.

Robbie Appling, P-20 Council

Ms. Appling highlighted some of the positive happenings in the community, including the establishment of a P–20 Council comprised of business, community, and faith-based organizations; the Go campaign in which groups of students train younger students in career/college preparation; and job shadowing between students and business professionals.

Dr. Johnson, Associate Dean, Texas Tech University, Teacher Ed Council

Dr. Johnson stated that we need to focus on increasing the number of teachers we have in the state. The numbers have not changed over the years, remaining fixed at 26,000, while the number of students has increased. Dr. Johnson encouraged the Commission to look at how alternative certification programs can be an answer to our teacher shortfall. It was also stated that teacher attrition is a concern, with 50% of teachers leaving the profession within the first 5 years.

Earl Sandry, Director of Instruction, South Plains College

Mr. Sandry supports dual credit programs and stated that the dual credit classes accepted at South Plains College are taught by instructors who meet the same credentials that all South Plains faculty have. He also reported that all dual credit classes are approved by South Plains department chairpersons and the course syllabi are provided to the high school teachers.

Dr. Karen Alexander, Professor at Texas Tech University, Council for "Achieve Texas"

Dr. Alexander supports rigor and relevance in 4 x 4 programs and pointed to a coordination grant initiative, details of which can be found at www.achievetexas.org.

Appendix K

Summary of Specific Input From College Faculty and Business Leaders Focus Group

Following is a summary of the specific recommendations and comments provided by the participants in each of the four core curriculum areas.

Mathematics

There was general agreement among focus group participants, but particularly emphasized by the mathematics faculty member on the panel, that the general content statements in mathematics that were common to all the nationally recognized college readiness standards compared by REL Southwest represent the skills and knowledge necessary for all students to be successful with technical work as well as higher education.

In addition, there was agreement that some level of knowledge of data interpretation and statistics is desirable for high school graduates.

Specific recommendations and comments for mathematics workplace and college readiness standards are:

- *High school mathematics requirements should be higher than Algebra II.* This is essential for college and helpful for students pursuing an associate's degree or vocational training. It is not necessary for unskilled jobs, however.
- *Although there was no consensus that data interpretation skills should be included in college readiness standards, all participants agreed that these skills are needed in college as well as the workplace.*
- *Understanding the use of spreadsheets, such as Excel, is essential.* Although several participants expressed the opinion that calculator usage is important, they all agreed that teaching students to create and use spreadsheets and employ other technology tools is more significant.
- *Although in-depth statistics may not be necessary for all students, students need to understand some statistics.* High school graduates entering the workforce need to have basic knowledge of statistics. The faculty did not view statistics as critical to college readiness because those skills are taught in beginning college statistics courses.

Science

There was agreement among focus group participants that high school graduates must possess the science knowledge and skills contained in the general content statements common to all sets of nationally recognized standards compared by REL Southwest. However, the business leaders on the panel had grave concerns about the lack of standards on emerging technologies, such as nanotechnology. They also expressed great

concern about the deficiency of understanding in the standards-setting process that science can no longer be taught as separate subjects—Biology, Chemistry, Physics—but must be integrated to acknowledge what happens in most science-related professions, such as science and medicine, in the real world. Specific recommendations and comments for science workplace and college readiness standards are:

- *The standards must address the role that technology plays in the world of science.* Technology changes so rapidly, however, that we must develop new ways of keeping the expectations of learning and instructional materials current.
- *Although the standards treat each discipline (Biology, Chemistry, and Physics) separately and distinctly, students need to be able to integrate knowledge across disciplines. There are no standards on emerging fields, such as nanotechnology.* Concern was expressed that high school and entry-level college courses are taught separately and discretely (characterized as silos). The ability of students to work across disciplines and integrate knowledge from each is critical. An example that was given is nanotechnology, which is a multi-disciplinary field that draws from physics, chemistry, engineering, and materials science. It was suggested that the Commission look at international standards that integrate knowledge and skills of various science disciplines. It was acknowledged that the standards in the crosswalk are largely based on consensual, professional judgment that often is weak in informing us about cutting-edge matters in science.
- *High school physics courses should cover energy and power, electricity and magnetism, and the nature of matter.* Students going to college, particularly in science, technology, engineering, and mathematics (STEM) careers, will learn this important knowledge. Students who go directly into the workforce, however, will not have the same opportunity, so it is important that all high school students receive basic instruction in these topics.
- *Astronomy and astronomy principles are cross-cutting science skills that should be included in the standards.* One participant questioned why classical mechanics is not included as well.
- *Science standards should be written using active words.* The mathematics standards use active words to describe the standards but science standards use inactive verbs such as *watching* and *knowing*.
- *Many of the knowledge and skills listed for high school science should be taught before a student enters high school.* It was acknowledged that the standards examined do not indicate when knowledge and skills are taught but only that students need to know these things before they graduate from high school.

English/Language Arts/Reading

There was consensus among the business leaders and faculty that the English skills described across the nationally recognized college readiness standards compared by REL Southwest are of importance in the workplace and in college. However, some skills

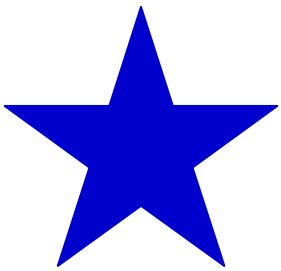
deemed vital in some of the standards but not all, such as oral presentation skills, comprehension of informational text, writing work-related materials, and working in teams, were found to be crucial by the focus group. Specific recommendations and comments for English workplace and college readiness standards are:

- *Comprehension and writing skills are critically important.* All college students and employees need to be taught how to read with comprehension and write succinctly.
- *Technical reading and writing are not included in the standards and should be.*
- *Students must be taught grammar.* The correct use of our language in writing, whether in the workplace or school, is a fundamental skill that is often taught unsuccessfully. It was suggested that teachers use text messaging and other interactive tools to engage students in learning grammar.
- *The ability to create resumes, cover letters, and work in teams should be taught in English.*
- *Students must learn to present information succinctly with crisp speech.* PowerPoint may be helpful because it can help students organize their thoughts.

Social Studies

Although the Commission did not have a crosswalk created for social studies because little work has been done to create standards in this area, the focus group discussed general themes that the Vertical Team adopted regarding social studies standards. Specific input from the business leaders on what should be taught in high school social studies was solicited. Their comments and recommendations include:

- *Economics should play a larger role in social studies.* Students should know how a company works, what capitalism means, why a business plan is essential to a business' success, and need to understand the global context in which they live.
- *It is important to understand cultural differences*. It is crucial that people in the workplace understand and appreciate cultural differences.
- *Rethink the way history is taught.* College American History courses assume no prior knowledge of American history, but all students take History in high school. What is essential in U.S. history should be addressed in high school and not repeated in college.
- *Technology has a role to play.* There are many technological tools that can be used in geography to provide visual images and to report on people and places.
- *It is important to examine the concepts of civic values, principles, and beliefs to explain why government is necessary and to evaluate major debates of past events.*
- *Students today need a second language.* This is a way to understand and appreciate different cultures and be poised to work in the global marketplace.



Appendix L

Summary of Input From Texas Workforce Development Boards

The heads of the Workforce Development Boards across Texas were surveyed to identify the most important knowledge and skills needed by workers today. Twenty-nine board chairs responded to the survey. The knowledge and skills used in the survey instrument were derived from the common standards and content statements identified in REL Southwest's comparison of nationally recognized college readiness standards.

In **mathematics**, the top three required knowledge/skills for college readiness identified through the surveys were:

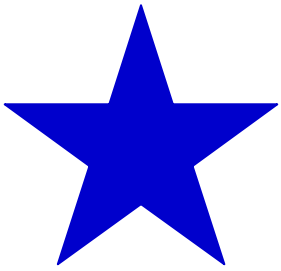
- Fluency in basic computations: addition, subtraction, multiplication, and division of integers, fractions, decimals, and rational expressions
- Ability to work fluently in real-world measurement (e.g., perimeter, area, volume, surface area)
- Ability to translate between graphical, geometric, algebraic, and verbal representations of problems

In **English**, the most important knowledge/skills were:

- Proper use of grammar and punctuation
- The ability to infer meaning of unfamiliar words: (a) ability to use dictionaries, (b) knowledge of roots/affixes/cognates, (c) ability to use context.
- Ability to think logically and solve problems.

In **science**, respondents rated these skills highest:

- Physics was rated number one of the sciences
    - Understanding of heat and temperature
    - Laws of mechanics: classical Newtonian physics
    - Understanding of energy and power
    - Electricity, magnetism and their relationship
    - Two Laws of Thermodynamics
- Technology and computer literacy



Appendix M

Summary of Input From TASA/TASB Survey

Attendees of the 2007 TASA/TASB Conference were surveyed to identify the most important knowledge and skills for college readiness. Twenty individuals responded to the survey. The knowledge and skills used in the survey instrument were derived from the common standards and content statements identified in REL Southwest's comparison of nationally recognized college readiness standards.

In English, the top three required knowledge/skills for college readiness identified through the surveys were:

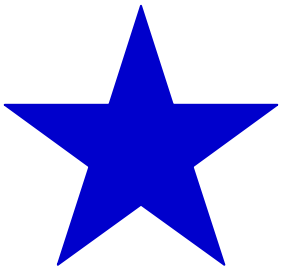
- Ability to construct proper sentences and paragraphs linked together appropriately to support a thesis.
- Ability to conduct research by gathering relevant information with proper reference and citation of sources, and ability to critically evaluate evidence, credibility, and validity.
- Ability to revise drafts based on self-review and feedback from others.

In mathematics, the areas rated as most necessary for college readiness include:

- Ability to work fluently with real-world measurement (e.g., perimeter, area, volume, surface area).
- Fluency in basic computations: addition, subtraction, multiplication, and division of integers, fractions, decimals, and rational expressions; and ability to apply order of operations.
- Ability to create and interpret various types of data-representations (e.g., charts, graphs, plots).

In science, the areas rated as most necessary for college readiness include:

- Understanding of interactions between humans and environment.
- Understanding of the relationship between science and technology, and application of technology to solve problems.
- Understanding of the nature of science and the ability to apply scientific methods: theories, hypothesis testing, nature of scientific evidence, replication, peer-review, multiple methods, and convergent validity.



Appendix N

Glossary of Acronyms Used in Commission Report

ADP—American Diploma Project (Achieve)

ELAR—English language arts/reading

HERC—Higher Education Readiness Certification

NCEA—National Center for Educational Accountability

REL—Regional Education Lab (U. S. Department of Education)

SAT—Scholastic Aptitude Test

SBOE—State Board of Education

TAKS—Texas Assessment of Knowledge and Skills

TASA—Texas Association of School Administrators

TASB—Texas Association of School Boards

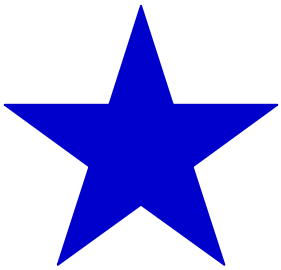
TASP/THEA—Texas Academic Skills Program/Texas Higher Education Assessment

TEA—Texas Education Agency

TEKS—Texas Essential Knowledge and Skills

THEA—Texas Higher Education Assessment

THECB—Texas Higher Education Coordinating Board



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