Model Core Curriculum *for* Iowa High Schools

Final Report to the State Board of Education
May 2006

State of Iowa
Department of Education
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Purpose Statement

Model Core Curriculum Project Lead Team

The purpose of the Project Lead Team is to collaborate with subcommittees in identifying the essential content and skills of a world-class core curriculum and present its findings to the State Board of Education in partial fulfillment of Senate File 245.

The initial work in the model core curriculum will focus on the areas of science, literacy, and mathematics. The intent of this work is two-fold:

1) To ensure that all Iowa students have access to a rigorous and relevant curriculum to prepare them for success in post-secondary education, the workforce, and the emerging global economy, and
2) To provide a tool for Iowa educators to use to assure that essential subject matter is being taught and essential knowledge and skills are being learned.

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Executive Summary

Iowa's students are among the nation's best. But with performance expectations rising globally for all students, the state of Iowa recognizes a need for model curriculum to ensure that its high school graduates continue to rank among the best-prepared for 21st century demands.

The curriculum project arose after the Department of Education and State Board of Education completed a series of high school visits in spring 2005. About the same time, the Iowa Legislature passed and Governor Thomas J. Vilsack signed into law Senate File 245, which requires identification of a model core curriculum among other directives. This report to the State Board is a first step in addressing the requirements of SF 245.

A Lead Team – representing teachers, students, administrators, school board members, higher education, the business community, and experts in the fields of science, literacy, and math – laid the foundation for what is included here. The group began its work in fall 2005, dedicated to the legislation's two-fold mission:

- To ensure that all Iowa students have the opportunity for a rigorous and relevant learning environment that prepares them for success after graduation.
- To give Iowa educators a tool to ensure that essential subject matter is being taught and essential knowledge and skills are being learned.

Lead Team members worked in tandem with three Work Teams assigned to the areas of science, literacy, and mathematics. All recognized that the biggest challenge would be narrowing the focus to just the essential skills and content. Lead Team members also were attuned to:

- **Putting students first.** A successful outcome would boost student achievement when stacked against the nation and – like it or not – the world**.** After all, it's the students who are expected to master bedrock learning skills while grappling with an ever-expanding dose of "future content" – the exploding digital world and the ethical, political and social issues that accompany it.
- **A changing workforce and rising global competition**. Employers candidly told team members about graduates ill-prepared for the demands of the work world. Members also heard about exponential growth in job opportunities for scientists, engineers and technicians. Will U.S. students be ready to compete for those jobs or will other nations be more nimble in responding to a changing marketplace? At the moment, the scale is tipped in favor of other countries such as China and India.

A rigorous, relevant education was an ever-present project goal. So Lead Team and Work Team members examined success stories in other states and countries, curriculum-related efforts by the leading testing programs, and earlier research by the Department of Education. They read or talked with some of the trailblazers in curriculum reform. Teams also revisited curriculum recommendations from leading national professional associations in the three subject areas.

Work Teams included teachers, Area Education Agency consultants, curriculum directors, and university and college instructors from throughout Iowa. Work Team members were selected for their expertise in content areas, and each team ranged in size from 8 to 11 people. The final reports demonstrate the importance placed on:

- Delivering a rigorous, relevant education for all high school students.
- Arming teachers with concrete examples to bring the curriculum to life in the classroom.
- Gathering feedback, including a validation process that contacted more than 275 teachers, students, parents, opinion leaders and business professionals.

Curriculum recommendations appear in detail in the pages that follow. Among the highlights:

- View these as guidelines, not mandates for school districts. Each district must determine what should come next to raise the bar for student performance.

- Describing essential skills and concepts is just the start of curriculum reform. How it comes to life with students and teachers remains the heart and soul of this initiative.
- An interdisciplinary approach is key to successfully upgrading the rigor and relevance of students' work.
- To be truly successful, curriculum changes cannot begin and end with high schools. Coordination throughout the entire K-12 curriculum will be vital.

Highlights within subject areas:

Science:

- The emphasis must be on student inquiry. Deep grasp of scientific concepts and processes isn't possible with a classroom diet of lectures, readings and "cookbook" labs. Students must be actively investigating, designing the experiments, questioning and exploring, and defending conclusions.
- The curriculum follows the guidelines of the respected National Science Education Standards, including its focus on four content-specific categories: Science as inquiry, physical science, earth and space science, and life science.
- The curriculum is designed for all students, not just those who have traditionally succeeded in science classes.

Literacy:

- Increasingly sophisticated levels of literacy are needed by the successful student-turned-adult. A literate person is able to become informed, inform others and make informed decisions.
- Curriculum goals include mastery of reading, writing, speaking, listening and thinking. And, with the explosion in visual mediums delivering messages, viewing effectively is included.
- Literacy is fundamental to all teaching and learning. Thus, all high school teachers must take ownership for literacy development if students are to succeed.

Math:

- Recent test results both nationally and internationally show the United States faces a crisis in math education, with American students losing ground. The main reason: Schools trying to cover too many topics without any depth.
- To reverse the trend, math curriculum in Iowa must provide deep understanding of the most important areas of mathematics – algebra, geometry, statistics and probability, and quantitative literacy.
- The most important *skills* required in the math arena are problem solving, communication, reasoning and proof, an ability to make connections and representation.
- A world-class math curriculum should include eight main characteristics including teaching for understanding, problem-based instructional tasks, distributed practice that is meaningful, an emphasis on mathematical modeling, effective use of technology, and teaching that is integrated and connected.

This report represents a next-step in curriculum improvement. It isn't intended as a panacea for curriculum issues in Iowa schools.

- It must be tailored to fit local needs. Local districts should follow a similar review process to identify the steps most critical to delivering a world-class curriculum.
- Work must expand to other content areas. Social studies and foreign languages were both identified by the Lead Team as essential content for a world-class curriculum.
- Work also should expand to other areas of "21st Century skills, including media literacy, financial literacy, critical thinking, and problem solving.
- Professional development training for educators will be a vital component.
- Follow-up studies – monitoring high schools that adopt key recommendations – will be fundamental to evaluating the success of this project. The question that will require answering: Did this model curriculum really benefit Iowa's students?

Making High School Meaningful

Iowa's Model Core Curriculum for High School

Introduction

Iowa prizes its reputation as an "education state". By almost any measure, its students are standouts in the classroom and later in the workplace. Employers know Iowa hires perform well and bring a great work ethic to the job. Hence, our state's college grads are recruited to all corners of the country.

But the world is changing rapidly, and Iowa's reputation is at risk. The threat comes not just from other schools or even other states. The biggest challenge comes from other nations as global economic forces drive U.S. business operations overseas and allow foreign students to compete for the same jobs sought by U.S. workers. As the world effectively grows smaller, the workplace, too, is becoming more sophisticated about the kind of knowledge and skills needed.

Iowa schools cannot afford to stand still and expect to graduate students who are adequately prepared. We must jettison the status quo just to stay competitive, *not* just to remain at the top.

A few numbers tell the story in stark terms:

- China will produce 3.3 million college graduates this year.
- India will produce 3.1 million, all fluent in English.
- The United States will produce 1.3 million graduates.

In science and engineering alone, jobs are growing at a rate four times faster than overall job growth. Yet China and India are churning out engineers in numbers that dwarf U.S. statistics. Meanwhile, U.S. colleges over the past five years have seen a steady decline in the numbers of students interested in science and engineering degrees.

Sometimes, it's hard to see a need to change when the rivals aren't right in your face. Parents and educators who benefited from Iowa schools may be lulled into a false sense of security. After all, the state's school system worked just fine for them. Dr. Willard Daggett, keynote speaker for the January 2006 Iowa High School Summit, addressed that issue head on for his audience of 1,500 educators:

> "Iowa has a bigger problem in this area than in any other state. Everyone thinks things are just fine."

Not everyone, actually. Iowa Governor Tom Vilsack and the Iowa Legislature recognize the urgent challenge facing Iowa schools if they are to meet the needs of a global economy, rapid technology change and a demanding workplace. Gov. Vilsack delivered his own blunt message to the high school summit:

> "The case for change in America's high schools is well documented: the graduation rate is too low, too many students are struggling learners, and much of the curriculum needs to be revamped to better prepare our youth – not just to become employed, but also to be informed, compassionate and productive citizens."
>
> Gov. Tom Vilsack, May 17, 2005, testifying before the U.S. House Committee on Education and the Workforce

"Our ability to grow as a state, our ability to continue to increase the number of college-experienced workers in our workforce – as we have the past three years – is absolutely dependent upon our job being done in high schools, having youngsters prepared for that future. The state's economy depends on it. For that matter, the nation's economy depends on it."

In 2005, the Legislature adopted and the governor signed Senate File 245 calling for the creation of a world-class core curriculum to guide Iowa's high schools. This in-depth report is the response to that legislation. It proposes nothing less than a paradigm shift for Iowa high schools and their approach to educating our youth.

"The reality is that we're no longer competing just against our fellow states. We're no longer competing against Nebraska and Wisconsin. I wish we were, but we're not. We're competing all over the world.

Gov. Tom Vilsack
Iowa High School Summit, January 23, 2006

The timing for meaningful change is ideal. Everywhere you turn, the debate rages about the threat to U.S. superiority in science, math and technology. Schools across the country search for a silver bullet, tinkering with everything from curriculum to class size to what defines a high school (with new technology, students and teachers need not even share a classroom, as Iowa has effectively shown through its groundbreaking distance-learning programs).

Nationally, a week doesn't pass without a story in the general media about the troubled U.S. education system vs. the global economy. Last fall, it was Thomas Friedman, author of *The World is Flat*, writing in the *New York Times*:

> "What if we were really having a national discussion about what is most important to the country today and on the minds of most parents? I have no doubt that it would be a loud, noisy dinner-table conversation about why so many U.S. manufacturers are moving abroad – not just to find lower wages, but to find smarter workers, better infrastructure and cheaper health care…Yes, we'd be talking about why the world is racing us to the top, not the bottom and why we are quietly falling behind."

In February, *Time* magazine weighed in with the cover story, "Is America Flunking Science?"

> "By almost any measure – academic prizes, patents granted to U.S. companies, the trade deficit in high technology products – we're losing ground while countries like China, South Korea and India are catching up fast. Unless things change, they will overtake us…"

Education reform has been a hot-button issue under Iowa's capitol dome, too, with strong bi-partisan support. The Institute for Tomorrow's Workforce, a nonprofit education foundation comprised of business and education leaders, is another voice for change, calling for an educational system that will prepare *all* learners for the 21st century. They want graduates ready to be problem-solvers, change agents and effective team players.

Iowa's problems are mild compared with those faced by other states. But the state still needs to be alert to some key questions about today's high school learners:

"We cannot continue to teach a huge series of concepts at a shallow depth. This model requires that students engage carefully selected meaningful content at a deeper level with frequent opportunities to engage the content in different contexts."

Shannon Cde Baca
Science Work Team
Iowa Learning Online
Omaha, NE

- Do all Iowa students have access to a rigorous and relevant high school education?
- Are we doing all we can to sustain Iowa's enviable high school graduation rates?
- Are high school students adequately prepared for college-level courses?
- Are our graduates entering the job markets with the skills employers want and need?

To that last question, rising complaints from employers highlight another surprising trend: Increasingly, companies hiring students right out of high school want and need the same higher-level skills that colleges demand for admission. So no high school student – college-bound or not – is immune from these rising expectations.

The international economy and the U.S. job market aren't the only significant areas of change. Students have changed, too. Today's high schooler is a product of the Net Generation, a life of iPods, instant messaging, cell phones, Xbox games, and Google. Multi-tasking is a given. But those changes don't always extend to learning and teaching styles. Too many students tune out once inside the classroom. Dropouts include some of our best and brightest who simply aren't engaged by the same old teaching styles. Schools that successfully captivate this information-age mindset with higher-level learning find student motivation explodes, and not just among the top performers.

The message then is clear: Students shouldn't be expected to power down at the schoolhouse door.

All this means dramatic change for our schools and our curriculum – both in content and in delivery styles.

The Model Core Curriculum Project Lead Team eagerly embraced its mission to identify essential content and skills for science, literacy, and math. **The detailed recommendations that follow will empower Iowa high school students to find greater success – in education, in the international workplace, in their communities and in their personal lives. It also will empower the state's educators to become important agents of change.**

The path to a new Iowa high school curriculum

When faced with a challenge, we're all better at proposing new ideas than suggesting what can be taken off the plate. Such has been the dilemma facing our teachers and students: The demand for new subjects and learning expectations grows, but resources and classroom hours do not. The result can be a curriculum that is a mile wide and an inch deep. Nothing winds up being done well.

This project's mission was to face that head-on by identifying just the *essential* skills and content of a world-class model core high school curriculum – with emphasis on science, literacy, and math. The recommendations that follow make tough choices in all three fields on how best to spend precious class and teaching time. Each curriculum team addresses:

- Meeting the *right* standards
- Teaching the *most critical* curriculum
- Fostering the *best* learning environment

The path to a new core curriculum began in earnest last fall with the creation of the Lead Team, a 25-member volunteer group from across the state and with expertise ranging from high school teaching and administration to higher education, from curriculum administration to the private sector. The team was selected to assure expectations of SF 245 were met or exceeded *(see Addendum A, page 36, for a complete copy of the bill).*

From the first moments of the team's discussions, the emphasis was on students and their needs, not solely on the legislation. Iowa Department of Education Director Judy Jeffrey set the tone for the Team, urging the group to focus on creative ways to put students first. She reviewed the compelling statistics cited earlier in this report to buttress the need for change now. "We are racing to maintain our competitive edge, not racing to be on top," she cautioned.

Beyond delivering the required report, Jeffrey said, the task force should strive to makes its plan a valuable and flexible tool. It must do more than collect dust on a shelf. Creating standards and assessments that merely result in educators who "teach to the test" – is an inflexible learning environment. She asked the group to think about that gap between the standards and the assessments – "the rich, challenging curriculum, the curriculum that builds on the knowledge and experiences gained by students as they move through school and life, the curriculum that is the bridge from one grade to the next. School districts are very interested in having guidance on what this looks like." Jeffrey heard that message repeatedly during her 2005 high school visits around Iowa.

"This (core) curriculum will be a tool that teachers can use to assure that essential world-class subject matter, knowledge and skills are being targeted in language arts, math and science."

Director Judy Jeffrey
Iowa Dept. of Education
High School Summit,
January 23, 2006

She also challenged the team to serve the high school students who do NOT walk in with a vision of going to college. In fact, she said, some increasingly wonder if a technical program – rather than a four-year program – is even more appropriate for some career opportunities.

After listening to their charge from Jeffrey, team members launched a broad search for the most compelling information about the state of U.S. and Iowa high school educational curriculum.

The group reviewed Iowa's historical performance in all major assessments, including the National Assessment of Educational Progress (NAEP) and standardized tests such as ACT and the Iowa Test of Educational Development. Representatives from both testing programs also addressed the Lead Team about changes they advocate or expect to see in high school instruction and evaluation.

ACT

Doug Becker, ACT vice president, said his company has been troubled by the rising number of U.S. students needing remedial courses once they arrive in college:

- 63 percent at public two-year colleges
- 38 percent at public four-year colleges
- 17 percent at private four-year colleges

> "This curriculum offers more than the typical sterile standards imposed by the vast majority of states that often lead to an alarming narrowing of learning possibilities. With this curriculum model, schools can tailor their curricula to the unique needs of their students, allowing for high and meaningful standards for all of students instead of the all too common one size fits all mentality."
>
> Tim Ansley
> Lead Team Member
> University of Iowa

Iowa students perform better but still face hurdles, particularly in math and science. While 77 percent of Iowa students were "ready" in English, just 34 percent of the Iowans met the science benchmark. Only 25 percent of Iowa students taking the ACT met all four college readiness benchmarks in English, math, reading and science.

"Some estimate it's become a billion-dollar problem," said Becker. And the greater a student's need for remedial courses, the less likely he or she is to earn a college degree, ACT has found.

In its search for the keys to college readiness, ACT identified ten schools that regularly produce top ACT test scores. Common threads among these schools:

- Consistent delivery of high-level, college oriented courses
- Experienced teachers
- Strong tutoring
- Integration of life experiences to make coursework highly relevant

Becker said ACT also spotted a direct link between college readiness and a strong diet of core courses:

- Four years of English
- Three years of math
- Three years of social sciences
- Three years of natural/physical sciences

These must be higher-level courses, too, including calculus and physics.

Iowa Testing Program

Tim Ansley, who is both a Lead Team member and director of the Iowa Test of Educational Development in Iowa City, said the Iowa Testing Program is rolling out some multiple choice tests in key math and science areas that could be used for an end-of-course exam. Current plans call for piloting these new exams this spring, and a full rollout in spring of 2007. The tests are designed to be appropriate for all students, inexpensive, and linked to universal requirements. "We are not trying to dictate curriculum," said Ansley, who is also associate professor of measurement and statistics at the University of Iowa.

Sources

The essential concepts and skill sets of a Model Core Curriculum in science, literacy, and math were developed after a thorough investigation of relevant sources. Included in that investigation were the following:

- ACT's College Readiness Standards
- College Board's Standards for College Success
- Information provided by Iowa Testing Programs
- International Center for Leadership in Education's Curriculum Survey of Essential Skills
- NAEP Frameworks in Reading, Writing, Mathematics, and Science
- Standards from the National Council of Teachers of English/International Reading Association, National Science Teacher' Association, and the National Council of Teachers of Mathematics
- ACHIEVE

The Lead and Work teams also searched previous Iowa education programs for findings relevant to the Model Core Curriculum, including:

- Iowa Learns Council
- The Iowa Department of Education's 2005 report on Rigor and Relevance
- Community conversations co-hosted by the Department and Education and local school districts, spring 2005
- High school visits led last spring by Director Jeffrey
- Model Schools Project

Iowa job, demographic trends

The group also heard from Iowa employers, state economists and workforce development experts about historic and future trends for Iowa.

Teresa Taylor, bureau chief of the labor market and economic research bureau with Iowa Workforce Development, and Beth Henning, coordinator of the State Data Center of Iowa, together briefed the Lead Team on employment and population trends including:

- **What is happening to Iowa's population?** The state continues to be a net exporter of college graduates. The influx of immigrants that helped keep state population growth lively in the 1990s has dropped off in a post-9/11 environment. So while the state is still growing, it's growing slowly – courtesy of a low birth rate and a cooling pace of immigration.

- **Where will job growth come?** Technology, engineering, and science jobs can go begging nationally as employers' needs outstrip the available pool of trained hires. In Iowa, Taylor said, demand for technology-savvy high school graduates is also fed by so-called non-technical jobs that increasingly require basic tech skills, too.

- **What expectations will employers have for high school and college graduates**? Employers want candidates with strong "soft" skills, the team was told. The nickname is SWANS – which stands for people who are smart, work hard, are ambitious and nice.

Preparing students for the work world

The Lead Team also wanted to ensure that concerns of the private sector were taken into account. A panel of Jeffrey, Brian Rowe of Interpower Corp. and Lead Team Member Alissa Jourdan of Kemin Industries talked about the widening gulf between employers' needs and students' readiness.

Employers want a core curriculum that will arm high school graduates with essential reading and writing skills, the ability to communicate effectively, critical thinking skills and baseline computer skills. Rowe and Jourdan also called for more basic changes: improving reading and writing skills, and ensuring that classes meet the current needs of the workplace.

"Our kids will face a global economy after graduation. They will be competing against and working with people from around the world. Our kids deserve the best educational foundation available anywhere in the world to prepare for these opportunities."

Diane Crookham-Johnson
Lead Team Member
Vice President-Administration,
Musco Corp., Oskaloosa

When asked if other states were outperforming Iowa students, Jourdan said she doubted other *states* were but said other *countries* were, echoing that same theme heard from the national studies and experts.

Team members also were briefed on recent education innovations, with particular attention paid to the works of Professor Chris Dede at Harvard University and Willard Daggett, Ed.D, a consultant and founder of the International Center for Leadership in Education (ICLE).

Dede's new learning styles

In a videoconference with the Lead Team, Dr. Dede shared his passion for changing teaching styles to reach the tech-savvy student. He reviewed cutting-edge efforts to apply a video-game-like learning environment to deliver higher-level, complex learning. Rather than listen to a lecture on the environment, for example, students might use a handheld computer and enter a virtual reality world where real-time problems arise and students must develop solutions on the fly.

These learning styles produce successful, motivated students. Even lower-performing students get fired up when they realize they can combine a love for technology and video-gaming with higher-level learning.

Just a few years ago, educators thought the only way to fuse technology and the classroom would be issuing laptops to every student, a prohibitively expensive idea. But Dede said new wireless mobile devices and PDAs can offer 60 percent of a laptop's power at 10 percent of the cost.

Still, hurdles remain to rolling this out in any broad-based way. While scripting these new learning approaches can be relatively easy, Dede said, assessing performance remains a challenge.

Daggett's Rigor and Relevance

In almost any conversation about education reform these days, the words "rigor" and "relevance" crop up. Dr. Daggett is a pioneer in advocating the importance of rigorous content that is most relevant in today's economy. The Iowa Department of Education also wrote extensively on rigor and relevance in a September 2005 report that was also endorsed by the State Board of Education.

To recap, the premise of rigor and relevance says high schools can no longer get by teaching a set of facts. Instead, they must also teach students *how* to think and how to apply those facts in problem-solving situations that eventually involve real-world situations. "Stretch learning" is another term for this teaching approach.

The benefit is a high school graduate armed with a deeper understanding of a given subject and, more important, an appreciation for how the facts that may still be learned by rote will be relevant to his or her future.

"The results of the Iowa Task Force should not be condensed or collapsed into course offerings. This latter conclusion may be be most difficult for districts because they really must determine if, where and how the identified content and skills are taught *across* and *within* the schools' curricula. Therein lies the *rigor!*"

Mary Jean Montgomery
Lead Team Member,
Member, State Board of Education

> "It is not higher education in America that is putting pressure on K-12 education to raise the standards. It is the workplace."
>
> Dr. Willard Daggett
> President,
> International Center for Leadership in Education
> Iowa High School Summit
> January 23, 2006

Dr. Daggett often illustrates rigor and relevance in terms of four learning quadrants, with Quadrant A at the low end or basic knowledge and Quadrant D teaching more complex lessons. The goal is to infuse curriculum with more Quadrant C and D work. This "rigor and relevance framework" was endorsed by the Lead Team and all three Work Teams to help educators visualize how essential curriculum skills can be put into practice with real-world problem-solving examples. It also can be used by teachers to assess progress.

Quadrant C - Assimilation Students extend and refine their acquired knowledge to be able to use that knowledge automatically and routinely to analyze and solve problems and create solutions.	**Quadrant D - Adaptation** Students have the competence to think in complex ways and to apply their knowledge and skills. Even when confronted with perplexing unknowns, students are able to use extensive knowledge and skill to create solutions and take action that further develops their skills and knowledge.
Quadrant A - Acquisition Students gather and store bits of knowledge and information. Students are primarily expected to remember or understand this knowledge.	**Quadrant B - Application** Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations.

Source: International Center for Leadership in Education

Daggett's work has shown that schools with the highest levels of rigor and relevance also had a strong program of student support – from family, peers, teachers, and community partnerships. (To read more, visit http://www.leadered.com/ and look for the "rigor and relevance" title).

For a more comprehensive look at preparations by the Lead and Work teams, a complete list of resources can be found on page 41.

Setting standards for Work Teams

The Lead Team developed three key lists to guide Work Teams: *characteristics* of a world-class core curriculum *(Addendum B, page 39*), *essential student skills* to be developed via this curriculum *(Addendum C, page 39)* and *essential content (Addendum D, page 40).*

Among the key curriculum characteristics:

- Empowers students
- Makes it relevant and engaging
- Promotes working as a team
- Improves student achievement

"Stakeholder involvement has been an important aspect of this work. The willingness of people to work on the Model Core Project has been inspiring. Almost every teacher, AEA consultant, business and industry representative, principal, curriculum director, and college or university instructor invited to help with the project readily agreed. Many people are interested in making high school a more demanding, invigorating learning environment.

Rita Martens
Lead Team facilitator
Literacy consultant
Iowa Department of Education

"It is critical for school districts to understand... that the essential content and skills are really a synthesis of Iowa curriculum experts, teachers and administrators, education policy-makers, higher education spokespersons, representatives of stakeholder organizations and business and industry *and* the work of a number of national commissions challenged by the same questions."

Mary Jean Montgomery
Lead Team Member
Member, State Board of Education

- Infuses core skills across curriculums
- Reaches all students, not just top-tier

Among essential skills, students must be:

- Critical, higher-order thinkers
- Flexible, able to apply learning to new situations
- Team players and collaborators
- Life-long learners
- Caring, confident and globally aware

The list of essential content included science, literacy (or language arts), and math, as well as social studies, foreign languages and a need to integrate careers and technology into all content.

Developing the core curriculums

The spotlight next shifted to the three Work Teams. Lead Team members suggested members for all three, and the Department of Education also identified candidates. In the end, Work Team membership included experts from the content areas and various levels of education: higher education, both two-year and four-year programs; high school, K-8, and area education agencies.

As with the Lead Team, Work Team members first reviewed the same background information mined by the Lead Team and developed a consensus on overall goals. Each group also revisited national curriculum standards in their respective fields (the individual Work Team reports include details on all resources and materials used). With this as background, they developed essential skills for each subject area.

Despite the varied subject matter, everyone – from the Lead Team to the Work Teams – stressed the importance of an interdisciplinary approach to this new high school curriculum. Yes, it's a common sight in a first-grade classroom to hear a teacher working on literacy skills while also teaching math skills. But by high school, walls tend to rise, creating more of a silo approach to teaching. There is a need now to break down those walls or at least open new doors.

Team members also stressed that a core curriculum cannot be limited to high school. To be successful, districts must look at the entire K-12 curriculum and ensure close coordination among the grade school, middle school and high school curriculums.

The Work Teams each followed their own paths to developing a core curriculum. But in general terms, it involved multiple meetings, usually in the Des Moines area, with several documents shared among the members. Progress reports from each team were presented to the Lead Team in February and April, and feedback and refinements were suggested.

The resulting reports are similar in format, each highlighting the essential findings. They present learning quadrant examples to help educators translate the guidelines to rigorous, relevant classwork.

Science Core Curriculum highlights

The Science Model Core Curriculum, which draws its standards from the National Science Educastion Standards (NSES), views science as nothing short of a way of thinking and investigating.

The recommendations reflect the belief that ALL students should experience science through a curriculum that is rigorous, relevant, global in its perspective, collaborative in nature, and connected by strong visible links to other areas of study.

"The 9-12 (Science) Core is predicated on how important it is to have a viable, comprehensive K-8 science program within the vertical district science curriculum in order to develop a strong base of science conceptual understandings and abilities."

Bruce Frana
Science Work Team
Science Curriculum Consultant
Grant Wood AEA
Cedar Rapids

But a deep grasp of scientific concepts and processes isn't possible with a routine classroom diet of lectures, readings and unimaginative lab experiments. A more rigorous curriculum must see students questioning, evaluating and defending their findings.

As a result, student inquiry is at the heart of the science core curriculum. The science team targeted four essential subject areas, all recognized by NSES:

- Science as inquiry
- Physical science
- Earth and space science
- Life science

Science as inquiry and additional categories that address the application of knowledge are folded into the knowledge base by design. One other content category – unifying concepts and processes such as form and function or systems, order and organization – complement the other essential subjects. So it, too, is included.

Literacy Core Curriculum highlights

Increasingly sophisticated levels of literacy are required by the student-turned-adult to successfully navigate society. Literacy, after all, allows people to be informed, to inform others and to make informed decisions.

"Collaboration between teachers and the integration of different curricular areas are two important concepts for schools to understand. Information Literacy is the foundation for this collaboration and integration."

Mary Ritchie
Teacher / librarian
Valley High School
West Des Moines

To meet these goals, the literacy curriculum identifies essential concepts or skill sets for reading, writing, speaking, listening, and thinking. Even viewing is included, recognition that the explosion of visual mediums creates an additional, significant means of communication.

Recognizing the changing demands of the workplace, the curriculum also includes reading technical texts and functional documents. Also, while the most familiar writing forms are represented, "writing on demand" skills – considered important to job success – are incorporated.

An interdisciplinary approach to teaching the core curriculums was mentioned by every content area and by the Lead Team. But the Literacy Team gives this the greatest emphasis, noting that literacy is fundamental to all teaching and learning.

Math Core Curriculum highlights

Mathematics is the most-cited subject when talk turns to U.S. students losing ground to international students. The Math Team attributes that in part to schools' attempts to cover too many topics in too little depth.

To avoid that trap, the curriculum identifies the "big ideas" for mathematics teaching. These essential skills, content and characteristics will arm students with a deep understanding of the most important mathematics.

Important math content includes algebra, geometry, statistics and probability, and quantitative literacy. Essential skills for math touch on problem solving, communication, reasoning and proof, an ability to make connections, and representation.

The report also identifies seven characteristics essential to a world-class mathematics curriculum:

- Teaching for understanding
- Problem-based instructional tasks
- Distributed practice that is meaningful and purposeful
- Emphasis on Mathematical Modeling
- A focus on deep conceptual and procedural knowledge
- Effective use of technology
- Integrated and connected

"Iowa is falling behind the rest of the world in mathematics. It is necessary for us to take a critical look at what we have been doing and find ways to improve. Most will agree on what needs to be taught and learned, the challenge is how we approach this learning."

Dan Petrak
Math Instructor
Des Moines Area
Community College
West Des Moines

Lead Team review

At its February and April meetings, Lead Team members vetted the three core curriculum reports. The questions they wanted answered:

- **Had each report captured the foundational skills needed to boost Iowa student achievement?** The answer was a resounding "yes".
- **What pieces would make the core curriculum more useful for educators?** The answer was adding teaching examples, now found in all three team reports, to illustrate how to infuse rigor and relevance in the classroom.
- **Would the final curriculum serve students, parents and employers as well as educators?** That was deemed a requirement, not an option. All three reports met the goal.

Web-based validation

The Department of Education and Lead Team wanted maximum feedback to the proposals while meeting a challenging timetable. The solution: Tap the power and speed of the web. Essential concepts and skills of all three reports were shaped into a web-based validation survey. Respondents were then asked to indicate their level of agreement for including the concepts and skills in a world-class high school curriculum.

Lead Team members could suggest people to receive the survey, and it was also sent to Department of Education consultants, AEA consultants, school administrators and curriculum specialists, teachers, university or

college faculty members, and college and high school students. More than 275 people logged on to the survey site, and half of those chose to respond to one or more curriculum area surveys.

At its final May session, Lead Team members reviewed all responses, including the rich assortment of comments about specific skills and concepts, and took one more careful look at the Work Team reports. Among the concerns reviewed: Making certain that all the reports were content-driven, not course specific, and that essential skills stretched across the three content areas. For example, was technical reading emphasized in Literacy, and were communications skills strongly reflected in Science and Math?

Lead Team endorsement

After a thorough review of the three content reports, the Team gave its endorsement to all. Members talked excitedly about potential gains for Iowa schools, while also stressing the need to thoroughly explain the proposals to *all* the stakeholders, in particular teachers. Sample lessons – a part of every team report – were praised as one of the more important components.

What's next?

From the start, the Team talked of important "next steps", all critical to ensuring that this doesn't become the latest report to collect dust on a shelf. To that end, it adopted four recommendations:

1. Expand the work to other curriculum areas, specifically:
    - Social Studies
    - Foreign Language
    - 21st Century Skills
    - Health and Wellness
2. Expand work to elementary and middle schools, to ensure curriculum synergy with the entire kindergarten through 12th grade system. Support needed to do this will vary by district.
3. Allocate money for professional development to deepen the K-12 content and instructional expertise of Iowa educators.
4. Call on the State Board of Education to be advocates for the plan.

The team also brainstormed bringing the core curriculum ideas to life in Iowa classrooms. Among the themes:

- share the team's excitement about the project's potential
- help teachers and schools embrace it
- make the content interactive, to launch a web dialog with educators
- effectively measure student achievement

The team broke into six groups to devise ways of reaching these goals. The major ideas:

- **Communication**: Sending the message:

"This curriculum is not an end in itself, not a checklist, but rather a guideline toward a larger goal: the citizen we graduate should see education not as fact-finding or job training, but as a process for examining our lives, for living differently, for realizing our full human potential."

Vicki Goldsmith
Lead Team Member
Iowa Teacher of the Year
Des Moines Public Schools

- Why a new curriculum is needed now – a high school diploma isn't enough any more; teaching should be more relevant to real life.
- What the compelling "preferred future" will be when it's used – students are more engaged; continual improvement becomes the norm.

"New learning for a changing world," was one suggested "sound bite" for publicizing the project both within the education system and publicly.

- **Measurements**: Doing as much as possible to measure achievement with existing tests, to avoid adding another costly layer for schools. (ITED is awaiting the core curriculum results to marry that with its new end-of-course tests.)

- **Leadership:** Recast some of the existing programs, such as Community Conversations and leadership academies for administrators, to focus more on core curriculum. Consider content academies, too, for teachers and high schools, perhaps using web delivery. Involve universities to expose teachers-in-training to the new curriculum concepts.

- **A Core Curriculum Website**: From the beginning, members have wanted a robust web site to not only spread the word about the curriculum report but also give educators a place to share ideas and find help. For example, teachers' new lesson plans – especially for higher-level learning in Quadrant D – could be shared via the web and include email links.

- **Professional Development**: Considered a key ingredient by the Lead Team. Suggestions included using the directors of the Area Education Agencies and the Urban Education Network as core curriculum "messengers" for their respective groups. Those groups can then decide on the best ways to deliver it to their schools. Leverage existing Department of Education programs, such as "Every Student Counts", to demonstrate the core curriculum.

- **Support Systems for Success**: Make the project student-centered, beginning with development of a four-year learning plan for 8th graders to ensure the concepts and skills will be mastered by graduation. Broaden support systems to offer more flexible learning options for students, involve the business community's support (via dollars or just volunteer time), and create a climate for a cooperative teaching experience that cuts across content areas.

> "We've got to give up the old assembly-line model of moving from one course to the next. It's about mastering content. Did they meet the competencies?"
>
> John Winter
> Lead Team Member,
> Retired, Deere & Co.
> Waterloo

What's the benefit for Iowa high schools?

Many Iowa high schools already feel the pressure to improve curriculum and produce stronger graduates. They've asked the Iowa Department of Education for help. This model core curriculum is a major step toward answering their request.

> A school must do three things with this model:
> - Determine where these skills and concepts are or should be in their curriculum.
> - Establish a level of performance that will be expected of every student for each skill/concept.
> - Do whatever it takes to bring each student to the level of performance.
>
> Warren K. Weber
> Consultant
> Iowa Department of Education

Schools that enthusiastically embrace the guidelines are guaranteed results. It's that simple. If the recommendations made here are adopted extensively, a high school will be armed with new teaching tools to literally transform students, classroom atmosphere, and activities.

The final reports are to be shared in print and on the web to reach the widest possible audience. When parents see these core curriculums, they may be surprised by what is expected of *all* students. It certainly will look and feel different from what parents faced when they were in high school.

But that's OK. It's a different world facing today's young people.

Students exposed to these more rigorous and relevant content will be more engaged and vibrant, more excited about learning as a lifelong endeavor. Lead Team members envision students who are more purposeful, ethical, questioning and passionate.

By the time students walk across the stage to pick up their diplomas, they will be carrying an arsenal of skills and knowledge to serve them well beyond graduation. They'll have the opportunity for success, even if they don't yet know what their futures may hold.

And Iowans will know they will have done their very best for the state's young people.

Work Team Reports

Model Core Curriculums for Science, Literacy, Math

This document is designed to be used as a model for high school science, literacy, and mathmatics core curriculae. It is not course specific. Within a literacy, science, or mathematics program, students should experience rich, rigorous and relevant activities for each of the essential concepts and skill sets.

The document provides a view of what students should be expected to master by the end of the 12th grade year. The document does not address elementary or middle school. The science, literacy, and mathematics work team members were explicit in their view that this K-8 foundation would have to be strong for students to understand these concepts and demonstrate these skill sets by graduation.

Curriculum designers should use this document to design backwards to the previous grades. This model should prompt discussions about the depth and breadth of the science, literacy, and mathematics curriculum for students in elementary and middle school. The science, literacy, and mathematics curriculum in those earlier grades must change to reflect a clear path for all students that will move them toward these core concepts and skills. It is easier to design a curriculum when you have a clear picture of the expectations at the end of grade twelve.

Essential Concepts and Skill Sets of a World-Class Curriculum

Science

We believe that the scientifically literate person is one who is aware that science, mathematics and technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes.

Science for All Americans, 1990

More than two decades ago the educational standards movement started with the intention to clarify and raise expectations by providing a common set of expectations for all students. Since then many standards documents have been produced by educational organizations and states. In particular *Science for All Americans* and *Benchmarks for Scientific Literacy* (AAAS) gave schools a road map for curriculum reform. The later state and district standards documents are based upon the respected work of the National Research Council (NRC) in their *National Science Education Standards* (NSES). The Science Model Core Curriculum draws its standards from the NSES document to provide a tool for Iowa educators to use to assure that essential subject matter is being taught and essential knowledge and skills are being learned.

"As the workplace becomes more sophisticated and the world becomes smaller, Iowa high schools are challenged to equip their students with the knowledge and skills necessary to succeed in this rapidly changing environment. As Governor Vilsack recently testified to Congress, the need to reinvent the high school is well documented. Graduation rates are too low, too many learners continue to struggle, and much of the curriculum needs to be revamped to better prepare our youth - not just to become employed, but also to be informed, concerned and productive citizens."

High Schools: Brighter Futures, 2005

The need for scientific literacy in today's increasingly technological world, for fundamental reforms in how science is taught, and for well validated models that districts might emulate are by now well known and documented. Expressions of concern from business leaders, scientists and educators have led to national, state, and local initiatives. The Iowa Model Core Curriculum rose from those concerns. It has been a two-decade process in which the Department of Education initiated conversations and produced documents that laid the groundwork for this model. Each of those early efforts led us closer to the design that would produce the clearest picture and become the most useful. This committee used each of those documents in this process.

As the amount of scientific knowledge expands, the need for ALL students to have a deep understanding of fundamental concepts increases. Technological advances have made information more readily available and decreased the need to memorize vocabulary and formulas. The scientific community agrees that we should teach fewer concepts at greater depth. The difficulty lies in what to leave out. There are 855 benchmarks in the 200-page NSES document. The Iowa Science Model Core Curriculum of fundamental concepts and abilities is a rich yet manageable set that will give each student a strong foundation.

The Iowa Science Model Core Curriculum reflects the beliefs that ALL students should experience science through a curriculum that is rigorous, relevant, global in its perspective, collaborative in nature, and connected by strong visible links to other areas of study. This document follows the format and content of the National Science Education Standards (NSES) in which there are eight categories of standards and the unifying concepts and processes relevant to these standards. Four of the categories (Science as Inquiry, Physical Science, Earth and Space Science, and Life Science) are content specific, while the remaining categories (Science and Technology, Science in Personal

and Social Perspectives and The History and Nature of Science) address the application of knowledge. Science as Inquiry and the application standards from the NSES are integrated into the knowledge base by design. The content category of Unifying Concepts and Processes complement the other standards. These concepts and processes include the following:

- Systems, order and organization
- Evidence, models and explanation
- Constancy, change and measurement
- Evolution and equilibrium
- Form and function

Science is more than a body of knowledge. It is a way of thinking and a way of investigating. Students must have the opportunity to examine the impact science has had and will continue to have on the environment and society. These opportunities are the focus of the integrated standards.

The Iowa Science Model Core Curriculum emphasizes student inquiry. The depth of understanding required of our students is not possible with lectures, readings, cookbook labs, and plug-and-chug problem solving. Students must be actively investigating: designing experiments, observing, questioning, exploring, making and testing hypotheses, making and comparing predictions, evaluating data, and communicating and defending conclusions. The science instruction should be engaging and relevant for the students. Strong connections between the lessons and the students' daily lives must be made, as well as connections among other disciplines. This core curriculum reflects high standards of science achievement for ALL students and not just those who have traditionally succeeded in science classes.

Curricular Area	**Essential Concept or Skill Set**
Science as Inquiry	Identifies questions and concepts that guide scientific investigations.
	Designs and conducts scientific investigations.
	Uses technology and mathematics to improve investigations and communications.
	Formulates and revises scientific explanations and models using logic and evidence.
	Recognizes and analyzes alternative explanations and models.
	Communicates and defends a scientific argument.
	Understands about scientific inquiry.

Earth and space	Understands and applies knowledge of energy in the earth system.
	Understands and applies knowledge of Geochemical cycles.
	Understands and applies knowledge of the origin and evolution of the earth system.
	Understands and applies knowledge of the origin and evolution of the universe.

Illustration of ***Understands and applies knowledge of energy in the earth system*** in the ICLE's Rigor and Relevance Framework	
Quadrant C Students are asked to write an explanation of why earthquakes and volcanic eruptions tend to "cluster" in certain belts and areas of the Earth's crust and not in others. The teacher directs them to use their knowledge of convection in the crust, plate tectonics and a map locating plate boundaries to predict where such disasters might affect North and Central America. *Evidence, Models and Explanation	**Quadrant D** At least two major disasters have occurred recently (2004-2005) that were caused by the movement of the earth's plates. Students are asked to respond to the following questions regarding these two disasters: Where were these located? How were their causes alike and different? How could these disasters be better predicted, both in scope and location? What recommendations would you provide to government and relief agencies in order for them to be better prepared to serve people's needs before and after such emergencies?
Quadrant A Students are asked to build a model, using different colors of clay, to demonstrate earth plates and the various tectonic plate movements. *Evidence, models and Explanation	**Quadrant B** Students are asked to create sketches on a black or white board and use them to describe how convection currents in the mantle drive the movements of tectonic plates on the surface. If needed they are asked to use a large beaker or pan of boiling water to help illustrate their explanation. *Evidence, Models and Explanation

*Unifying Concept (NSES) represented in this activity. Unifying concepts cross discipline areas and provide students with productive and insightful ways of thinking about and integrating basic ideas that explain the natural and designed world.

Life science	Understands and applies knowledge of the cell.
	Understands and applies knowledge of the molecular basis of heredity.
	Understands and applies knowledge of biological evolution.
	Understands and applies knowledge of the inter-dependence of organisms.
	Understands and applies knowledge of matter, energy, and organization in living systems.
	Understands and applies knowledge of the behavior of organisms.

Illustration of ***Understands and applies knowledge of the cell*** in the ICLE's Rigor and Relevance Framework

Quadrant C Students are asked to explain the control system for the cell cycle. How would genes be involved? How would selective gene expression affect proteins and enzymes? *Evidence, Models, and Explanation	**Quadrant D** When people move from one country to another cancer rates follow the pattern of the country in which they reside. Students are asked to explain this in terms of environmental factors. *Constancy, Change, and Measurement
Quadrant A Students are asked to compare the time line (in minutes) of a normal cell cycle to that of a cancerous cell cycle. How are they different? Which parts of the cell cycle are most different? * Form and Function	**Quadrant B** Students are asked to research the effect of UV rays on cell division in the dermis and epidermis. *Systems, Order and Organization

*Unifying Concept (NSES) represented in this activity. Unifying concepts cross discipline areas and provide students with productive and insightful ways of thinking about and integrating basic ideas that explain the natural and designed world.

Physical science	Understands and applies knowledge of the structure of atoms.
	Understands and applies knowledge of the structure and properties of matter.
	Understands and applies knowledge of chemical reactions.
	Understands and applies knowledge of motions and forces.
	Understands and applies knowledge of conservation of energy and increase in disorder.
	Understands and applies knowledge of interactions of energy and matter.

Illustration of ***Understands and applies knowledge of the structure of atoms*** in the ICLE's Rigor and Relevance Framework

Quadrant C Students will construct a model of the atom to human-scale that would allow them to compare and contrast the relative size and distance between component particles. *Evidence, Models, and Explanation	**Quadrant D** Students will use the internet and other resources to construct a time-line that traces the historical development of the model of the atom including John Dalton, J.J. Thomson, Ernest Rutherford, and Neils Bohr with the scientific and technological developments of the time that may have contributed to the development of these models.
Quadrant A Students will use tools including microscopes to investigate the physical and chemical properties of various materials that provide evidence for the existence and structure of atoms (e.g., crystalline structure of various minerals).	**Quadrant B** Students will model the importance of indirect evidence in identifying the existence and structure of atoms by determining the size and shape of an unknown object inside a closed container without direct observation (e.g., obscertainers). They will then make connections to how this is related to modern science tools e.g., scanning tunneling microscope and atomic force microscope) that are used for imaging atoms on a surface.

*Unifying Concept (NSES) represented in this activity. Unifying concepts cross discipline areas and provide students with productive and insightful ways of thinking about and integrating basic ideas that explain the natural and designed world.

Essential Concepts and Skill Sets of a World-Class Curriculum

Literacy

Literacy – defined by Meltzer, Smith, and Clark as the ability to read, write, speak, listen, and think effectively – enables adolescents to learn and to communicate clearly about what they know. Being literate gives people the ability to become informed, to inform others, and to make informed decisions (2001). Literacy is synonymous with learning. The partnerships between reading, writing, speaking, listening, and viewing, connecting with the ever-increasing knowledge base for each content area, provide the means for thinking among and between concepts and ideas. It is an active process.

Increasingly sophisticated levels of literacy are required to negotiate the world as one matures. Because of the recursive nature of learning in English language arts, students at every grade level apply fundamentally the same language concepts and skills. But as they learn and mature, students are asked to adapt these skills and concepts in new, more complex ways. In the process of adapting these skills and strategies to new situations, students gain independence and sophistication.

By its nature, literacy is social. In being effective critical members of a literacy community, students collaborate with others. Whether it be engaging the ideas of an author who lived centuries ago or actively debating issues about their contemporary lives with their peers, this collaboration helps students gain an appreciation of themselves, others, and the world. There is a cumulative advantage to the reciprocity of sharing ideas. The more students engage in literacy tasks, the deeper becomes their conceptual understanding and motivation to learn.

The interdisciplinary nature of literacy is also an important consideration when reviewing these essential skill sets. Literacy skills need to be developed across the curriculum, not simply in an English/Language Arts classroom. Students expand their range when applying literacy skills to a variety of content areas because the academic discourses and disciplinary concepts in those require different approaches to reading, writing, speaking, viewing, and listening. It is through applying literacy skills in a number of content areas that students learn to integrate these skills and strategies into life experience. Teachers who make literacy a priority understand that learning involves making meaning.

Because literacy is fundamental to learning, support for literacy development at the secondary level is key to students' success (Meltzer, et al, 2001). Prominent throughout the literature on secondary school reform is the importance of literacy development in ensuring one's success in high school, post-secondary education, the workplace, and in life. A student who becomes thoughtful and deliberate in his or her approach to a specific learning experience is said to be "a strategic learner" (Irvin, et al, 1995). Strategic learners are actively engaged in using literacy strategies to process information, construct knowledge, and make judgments. Effective and efficient application of literacy strategies increases students' ability to internalize content knowledge and develop conceptual understanding of all subject matter.

A number of documents were significant resources in developing these Essential Concepts and Skill Set of the Model Core Curriculum in Literacy:

- International Reading Association/National Council of Teachers of English *Standards for English Language Arts*. These standards were developed through a collaboration of these two significant professional organizations in the field of English Language Arts and represent the current consensus among literacy teachers and researchers about what students should learn in the English language arts.
- *New Standards Performance Standards*. New Standards is a collaborative project between the Learning Research and Development Center at the University of Pittsburgh and the National Center on Education and the Economy. New Standards, founded by Lauren Resnick, Director of the Learning Research and Development Center, and Marc Tucker,

President of the National Center on Education and the Economy, are a set of internationally competitive performance standards.

- National Assessment of Educational Progress' *Reading Framework* and *Writing Framework.* The National Assessment of Educational Progress (NAEP), also known as "the Nation's Report Card," is the only national representative and continuing assessment of what America's students know and can do in various subject areas. Reviewed were the most recent frameworks available, the 1998 NAEP Writing Framework and the 2009 Reading Framework.
- Reports from the Alliance for Excellent Education. Two reports, *Reading Next: A Vision for Action and Research in Middle and High School Literacy* and *Adolescents and Literacy: Reading for the 21st Century* were used in defining the essential concepts and skill sets in a reading curriculum.
- Other state curriculum strands and frameworks and local district standards and benchmarks. States with high performance in NAEP assessments in reading and writing were reviewed, particularly the Massachusetts English Language Art Framework. Also reviewed were the standards and benchmarks developed by a number of Iowa districts.
- Research and best practice information. The Literacy Work Team also reviewed a number of research articles that had been identified as part of the curriculum for an in-depth study to be conducted next year by the Statewide Adolescent Literacy Research and Development Team.

Curricular Area	Essential Concept or Skill Set
Reading	Independently reads a significant number of books and texts each year. This reading should include both fiction and nonfiction in a variety of genres.
	Reads for a variety of purposes and across content areas.
	Uses a variety of skills and strategies to comprehend complex non-fiction and informational text.
	Uses a variety of strategies and skills to comprehend and interpret complex literature.
	Reads with fluency silently and aloud to support comprehension.
	Uses a variety of strategies to understand unfamiliar vocabulary found in narrative text, technical reading, and literary text.

Illustration of ***Uses a variety of skills and strategies to comprehend complex non-fiction and informational text*** in the ICLE's Rigor and Relevance Framework

Quadrant C Students locate and read multiple sources of information about a topic related to genetic engineering. Students listen to a lecture by a genetic engineer employed by a local seed corn company about implications of genetic engineering on corn. Then they develop hypotheses and a plan to prove or disprove the hypothesis using the information they've gathered. Students write an evaluative, annotated bibliography and research paper assessing hypotheses and posing proposals for refined research.	**Quadrant D** Students do research on national and world nutrition/food problems in collaborative groups. Students predict potential crises and pose solutions to these problems that could occur through genetic engineering of food products. Students present research information, hypothesis, and solutions through a multi-media presentation to a knowledgeable and critical audience. Students defend their proposals through answering questions posed by audience members.
Quadrant A Students read a chapter from a biology textbook about genetics and genetic engineering and write a five-sentence summary of what they've read. The teacher identifies key vocabulary words in the text and students use context clues or other resources to write definitions of the words.	**Quadrant B** After reading a chapter from a biology textbook about genetics and genetic engineering, students examine varieties of ears of corn from the Farmer's Market. Students group samples into categories and define the characteristics of the categories. Students interpret differences in corn samples based on information from the textbook.

Writing	Uses an effective writing process.
	Uses knowledge of purpose, audience, format, and medium in developing written communication.
	Applies writing skills and strategies to effectively communicate in a variety of genres with various audiences.
	Uses writing as a tool for learning.
	Engages in the information literacy process: accesses, evaluates, and communicates information and ideas.
	Is able to write on demand.
	Adheres to conventions generally established in spelling, punctuation, grammar, usage, syntax, and style.
	Incorporates technology as a tool to enhance writing.

Illustration of ***Applies writing skills and strategies to effectively communicate in a variety of genres with various audiences*** in the ICLE's Rigor and Relevance Framework	
Quadrant C Students brainstorm personal characteristics and find information about their career interests and schools and programs that prepare students for those careers. Then students engage in a writing process to create a post-secondary plan which would include educational and career goals, pathways to reach the goals, a resume, and an informational report on the educational training and career opportunities in the chosen field.	**Quadrant D** Students use a writing process to create a cover letter and resume for a specific job of interest. Students submit the materials to employers representing various career pathways. Students explain, defend, and discuss the letter and resume with these employers. Students are then given a prompt and required to write an essay in an on – demand situation. The employers also provide feedback for the on-demand essay based on the employer's hiring tools.
Quadrant A Teacher reviews the five-paragraph essay structure and the major considerations involving audience and purpose in writing. Teacher delivers a lesson on grammatical structures. As a prewriting activity, students brainstorm lists of positive and negative personal characteristics related to employment. Students write a five-paragraph essay about a potential career based on their personal goals and interests.	**Quadrant B** Based on their personal strengths and weaknesses related to employment, students choose an essay prompt from a list of 100 job and college application essay topics. Students write a five-paragraph essay to address the chosen essay prompt. Students submit the essay to the school's guidance counselor for review using a teacher-developed rubric.

Speaking	Considers audience and variables in the speaking situation.
	Produces a coherent message.
	Participates in a variety of communication situations.
	Uses appropriate content and conventions for purpose, audience, occasion, and context.
	Demonstrates control of delivery skills.
	Participates appropriately in one-on-one situations and group settings.
	Recognizes the role of evaluation in oral communication.
	Recognizes the role of response in oral communication.

Illustration of ***Uses appropriate content for purpose, audience, occasion, and context*** in the ICLE's Rigor and Relevance Framework

Quadrant C Students formulate a thesis for addressing an environmental concern. Students debate in small groups the strengths and weaknesses of their arguments and counter-arguments. Students record and analyze or critique their speech and debate deliveries, receiving feedback from their peers and the instructor.	**Quadrant D** Students write and verbally present a bill proposing a new law or law change for an environmental issue accompanied by a multi-media presentation. Students defend their position before three faculty members to simulate a legislative debate over the law proposals. Students revise bill proposals and submit them to their local officials for further consideration.
Quadrant A Students review elements of persuasive speech (attention-getter, thesis, development of argument/ideas, acknowledgement of counter-arguments, ethos, logos, pathos, etc.). As students listen to sample persuasive speeches, they discuss and identify effective speaking techniques, such as emphasis, rate, tone, and non-verbal communication.	**Quadrant B** Students conduct research through interviews with experts about environmental concerns. Students investigate and discuss how a bill becomes a law and the process of amending or repealing a law.

Listening	Listens for information and understanding.
	Listens for interpretation, analysis, and evaluation.
	Listens to establish, maintain, and enhance relationships.
Viewing	Analyzes the effects of visual media on society and culture.
	Uses a range of strategies to interpret visual media.
	Applies a variety of criteria to evaluate informational media.
	Understands how literary forms can be represented in visual narratives.

Essential Concepts and Skill Sets of a World-Class Curriculum

Mathematics

Recent results of national and international tests show that the United States is facing a crisis in mathematics education. American high school students score near the bottom on the international TIMSS and PISA tests. Analysis of this poor performance shows that the U.S. mathematics curriculum is “a mile wide and an inch deep,” trying to cover too many topics in not enough depth. All Iowa high school students must be better prepared in mathematics to successfully compete in the technology-rich, information-dense, global society. To achieve this we must redesign our mathematics curriculum so that it is focused on providing deep understanding of important mathematics.

In this document we identify the essential skills, content, and characteristics of the world-class mathematics curriculum that Iowa needs. This model core curriculum for high school mathematics is based on recommendations from the National Council of Teachers of Mathematics (NCTM, 2000), five years of experience with Iowa’s Every Student Counts mathematics initiative (ESC), and best practices identified from reviews of research conducted by the National Research Council (2001), the International Bureau of Education (2000), the National Council of Teachers of Mathematics (2003), the federal What Works Clearinghouse, and Iowa’s Mathematics Content Network project.

In addition, the essential skills and content recommended in this model core curriculum document have been informed by a careful review of many background resources, including the *Focal Points for K-8 Mathematics* from the National Council of Teachers of Mathematics (NCTM, in press), the Mathematics Framework for the National Assessment of Educational Progress (NAEP, 2005), mathematics standards recommended by Achieve (2003 and in press), mathematics standards recommended by the College Board (in press), ACT core curriculum recommendations (2005), the mathematics curricula of Japan and Singapore, the National Center for the Study of Mathematics Curricula, and recommendations from Iowa’s Model Core Curriculum Lead Team.

In order to provide effective guidance and technical assistance for Iowa’s schools, this document has drawn from the above resources to identify the essential skills, content, and characteristics of a world-class high school mathematics curriculum.

Characteristics of a World-Class Core Curriculum in Mathematics

A world-class mathematics curriculum should have the following essential characteristics:

- Teaching for Understanding
- Problem-Based Instructional Tasks
- Distributed Practice that is Meaningful and Purposeful
- Emphasis on Mathematical Modeling
- Focus on Deep Conceptual and Procedural Knowledge
- Rigorous and Relevant
- Effective Use of Technology
- Integrated and Connected

Essential Skills in a World-Class Core Curriculum in Mathematics

Students need powerful skills to be successful in the globally competitive workforce of the 21st century. Business and industry demand workers who can solve problems, work in teams, and are able to apply learning to new and changing situations, especially as workers change jobs and careers many times in their lifetimes. Therefore, students must acquire powerful, flexible, and widely applicable mathematical skills by the time they graduate from high school. Many such skills have

been discussed in surveys of businesses (e.g., the SCANS report) and in the NCTM Process Standards (NCTM, 2000).

Essential Skills in a World-Class Mathematics Curriculum (see tables below for more detail)

- Problem Solving
- Communication
- Reasoning and Proof
- Ability to make Connections
- Representation

Essential Content of a World-Class Curriculum in High School Mathematics

All students should acquire a deep and powerful understanding of mathematics. But which areas and topics of mathematics should be included in the high school curriculum? The most telling criticism of the U.S. mathematics curriculum is that it is “a mile wide and an inch deep.” We cannot continue to teach too many topics in too little depth. Long lists of recommended topics are symptomatic of and serve to exacerbate this problem. In order to provide effective guidance to Iowa’s high schools, this document identifies essential mathematical strands and essential focal points in each strand.

Essential Mathematical Strands in a World-Class High School Mathematics Curriculum

- Algebra
- Geometry
- Statistics and Probability
- Quantitative Literacy

Curricular Area	Essential Concept or Skill Set
Algebra	Understands, analyzes, represents, and applies functions.
	Understands, analyzes, solves, and applies equations and inequalities.
	Understands, analyzes, transforms, and applies algebraic expressions.
	Understands, analyzes, approximates, and interprets rate of change.
	Understands and applies recursion and iteration*.

**Recursion* and *iteration* are used to represent and solve problems related to sequential change. Sequential change is step-by-step change, such as population change year-by-year. *Recursion* is the method of describing a given step in a sequence in terms of previous steps. *Iteration* is the process of repeating the same procedure or computation over and over again.

Illustration of ***Understands, analyzes, solves, and applies equations and inequalities*** in the ICLE's Rigor and Relevance Framework

Quadrant C Students are given the following assignment: *Solve this equation:* *13 = 0.10(x-200) + 5* *Use different methods and different representations (including tables, graphs, analytical methods, symbolic reasoning, technology, etc). Analyze and evaluate each method and representation, including advantages and disadvantages of different methods and representations.*	**Quadrant D** Students are given the following assignment: *Conduct research on some text-messaging plans available in your area. Find a mathematical model that represents each plan. Given your text-messaging habits and using the mathematical models, evaluate these plans, and choose the one that is best for you. Explain how you made your choice and why you think it's the best plan for you.*
Quadrant A Students are given the following assignment: *Solve this equation:* *13 = 0.10(x-200) + 5* *Describe the process you used to solve the equation. Check your solution and explain what the solution means in terms* of the equation.	**Quadrant B** Students are given the following assignment: *Consider this text-messaging plan for your cell phone: You pay $5 per month for 200 text messages, then you are charged $0.10 for each additional message either sent or received. Find an equation that models this text-messaging plan. Use your equation to determine how many text messages you can send or receive in a month if you are willing to spend $13 that month on text messages.*

Geometry	Represents and solves geometric problems by specifying locations using coordinates.
	Understands and applies the basic principles of transformational geometry.
	Understands and applies properties and relationships of geometric figures.
	Uses trigonometry based on triangles and circles to solve problems about length and angle measures.
	Uses diagrams consisting of vertices and edges (vertex-edge graphs) to model and solve problems.

Statistics and Probability	Understands and interprets descriptive statistics.
	Understands and interprets inferential statistics.
	Understands and applies the basic ideas of probability.
Quantitative Literacy	Understands and applies number operations and properties.
	Understands and applies the basic mathematics of decision making in a democratic society *(social decision making*).*
	Understands and applies the basic mathematics of information processing and the Internet *(informatics**).*
	Understands and applies the mathematics of systematic counting *(combinatorics**).*
*Social decision-making includes the basic mathematics of voting and elections, apportionment, and fair division. **Definition will be added.	
Problem Solving	Builds new mathematical knowledge through problem solving.
	Applies and adapts a variety of appropriate strategies to solve problems in mathematics and other contexts.
	Monitors and reflects on the process of mathematical problem solving.
Communication Reading Writing Speaking Listening Viewing	Organizes and consolidates his/her mathematical thinking through communication.
	Communicates his/her mathematical thinking coherently and clearly to peers, teachers, and others.
	Analyzes and evaluates the mathematical thinking and strategies of others.
	Uses the language of mathematics to express mathematical ideas precisely.
Reasoning and Proof	Recognizes reasoning and proof as fundamental aspects of mathematics.
	Makes and investigates mathematical conjectures.
	Develops and evaluates mathematical arguments and proofs.
	Selects and uses various types of reasoning and methods of proof.
Representation	Creates and uses representations to organize, record, and communicate mathematical ideas.
	Selects, applies, and translates among mathematical representations to solve problems.
	Uses representations to model and interpret physical, social, and mathematical phenomena.

Connections	Recognizes and uses connections among mathematical ideas and how they build on one another to produce a coherent whole.
	Recognizes and applies mathematics in contexts outside of mathematics.

Addendums

Addendum A

Senate File 245

AN ACT

RELATING TO A SECONDARY SCHOOL CORE CURRICULUM, INCLUDING REQUIRING THE STATE BOARD OF EDUCATION TO DETERMINE A MODEL CORE CURRICULUM AND SET A STATEWIDE CORE CURRICULUM COMPLETION RATE GOAL, REQUIRING SCHOOL DISTRICTS TO DEVELOP A CORE CURRICULUM PLAN FOR EIGHTH GRADE STUDENTS AND TO REPORT STUDENT CORE CURRICULUM PROGRESS ANNUALLY, REQUIRING SCHOOL DISTRICTS AND SCHOOLS TO REPORT CORE CURRICULUM COMPLETION PERCENTAGES ANNUALLY, AND PROVIDING FOR THE COORDINATION OF AN EDUCATIONAL DATA DEFINITIONS WORKING GROUP.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF IOWA:

Section 1. Section 256.7, Code 2005, is amended by adding the following new subsection:

NEW SUBSECTION. 26. Develop a model core curriculum, taking into consideration the recommendations of the American college testing program, inc. The state board shall set a goal of increasing the number of students graduating from secondary school who have successfully completed a core curriculum, by July 1, 2009, to eighty percent of all students graduating from secondary schools in this state except that the goal shall be exclusive of students who have special or alternative means for satisfying graduation requirements under individualized educational plans developed for the students. For purposes of this section, "core curriculum" means the minimum number of specific high school courses that a student needs to take in preparation for advanced career and vocational purposes.

Sec. 2. Section 256.7, subsection 21, paragraph c, Code 2005, is amended to read as follows:

c. A requirement that all school districts and accredited nonpublic schools annually report to the department and the local community the district=wide progress made in attaining student achievement goals on the academic and other core indicators and the district=wide progress made in attaining locally established student learning goals. The school districts and accredited nonpublic schools shall demonstrate the use of multiple assessment measures in determining student achievement levels. The school districts and accredited nonpublic schools shall also report the number of students who enter ninth grade but do not graduate from the school or school district; ~~and~~ the number of students who are tested and the percentage of students who are so tested annually; and the percentage of students who graduated during the prior school year and who completed a core curriculum. The board shall

develop and adopt uniform definitions consistent with the federal No Child Left Behind Act of 2001, Pub. L. No. 107-110 and any federal regulations adopted pursuant to the federal Act. The school districts and accredited nonpublic schools may report on other locally determined factors influencing student achievement. The school districts and accredited nonpublic schools shall also report to the local community their results by individual attendance center.

Sec. 3. NEW SECTION. 279.60 STUDENT PLAN FOR PROGRESS TOWARD UNIVERSITY ADMISSIONS -- REPORT.

1. For the school year beginning July 1, 2006, and each succeeding school year, the board of directors of each school district shall cooperate with each student enrolled in grade eight to develop for the student a core curriculum plan to guide the student toward the goal of successfully completing, at a minimum, the model core curriculum developed by the state board of education pursuant to section 256.7, subsection 26, by the time the student graduates from high school.

2. For the school year beginning July 1, 2006, and each succeeding school year, the board of directors of each school district shall report annually to each student enrolled in grades nine through twelve in the school district, and to each student's parent or guardian, the student's progress toward meeting the goal of successfully completing the model core curriculum developed by the state board of education pursuant to section 256.7, subsection 26.

Sec. 4. EDUCATIONAL DATA DEFINITIONS WORKING GROUP.

1. FINDINGS. The general assembly finds that individuals whose educational endeavors end without the receipt of a high school diploma have a much higher rate of unemployment and are much more likely to need welfare or other forms of government assistance. The economic implications of students' failure to earn at a minimum a high school diploma are staggering, and increasingly so as our economy becomes more dependent on the service and information industries. To understand the current state of educational achievement and future likelihood of success for Iowa's students, it is vital that state and local school district data on graduation rates be collectively understood and accurate.

2. The department of education shall coordinate a working group to develop clear, accurate, meaningful, and unambiguous definitions for the key data areas relating to, but not limited to, attrition, completion, and attendance rates, which school districts shall use in compiling state and local report cards. The working group shall determine the baseline data necessary to report on these terms and shall develop a strategy to contact school districts to ensure that the school districts are applying the definitions and consistently submitting data in accordance with the definitions. The working group shall consist of the following members:

a. Two senators appointed by the president of the senate after consultation with the majority leader and the minority leader of the senate.

b. Two representatives appointed by the speaker of the house after consultation with the minority leader of the house.

c. Members representing minority populations.

d. A member representing the largest school district in Iowa.

e. A member representing a school district with an enrollment of more than one thousand one hundred ninety-nine students but not more than four thousand seven hundred fifty students.

f. A member representing a school district with an enrollment of one thousand one hundred ninety=nine students or less.

g. Other members representing the education community as needed.

3. The working group shall submit its findings and recommendations to the department of education and the chairpersons and members of the committees on education in the senate and the house of representatives not later than January 15, 2006.

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JOHN P. KIBBIE
President of the Senate

_____

CHRISTOPHER C. RANTS
Speaker of the House

I hereby certify that this bill originated in the Senate and is known as Senate File 245, Eighty-first General Assembly.

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MICHAEL E. MARSHALL
Secretary of the Senate

Approved _____, 2005

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THOMAS J. VILSACK
Governor

Addendum B: Characteristics of a World-Class Core Curriculum

As determined by Lead Team members

- Promotes working as a team
- Reflects the most recently developed knowledge and skills
- Is relevant and engaging to students
- Is problem based
- Is cross-curricular
- Promotes in-depth study of content
- Is rigorous
- Is accessible to all students
- Develops global perspectives
- Is articulated K-12
- Is application based
- Improves student achievement
- Is aligned with assessments that inform instruction and monitor student performance
- Offers authentic learning experiences to students
- Infuses core skills across the curriculum
- Incorporates current technology to enhance learning
- Changes to reflect the constantly changing world in which we live

Addendum C: Essential Skills of a World-Class Core Curriculum

As determined by Lead Team members

Teach students to be

- Leaders
- Communicators
- Team players
- Problem solvers
- Harder and smarter workers
- Detail oriented
- Progressive innovative thinkers
- Critical thinkers
- Self learners
- Delegators
- Community-minded
- Able to apply learning to new situations
- Information literate
- Technologically advanced
- Capable participants in a democracy
- Caring
- Data-based decision makers
- Confident
- Understanding of other cultures
- Empowered
- Higher-order thinkers
- Efficient, effective users of resources
- Responsible users of technology tools to access, manage, integrate and evaluate information

Addendum D: Essential Content of a World-Class Core Curriculum

As determined by Lead Team members

Language Arts

- Reading
- Writing
- Speaking
- Listening
- Viewing

Mathematics

- Statistics and Probability
- Algebra and Functions
- Geometry and Trigonometry
- Discrete Mathematics
- Number and Operations (including quantitative literacy)

Science

- Life Sciences
  - Biotechnology
  - Bio science
  - Scientific ethics
- Physical Sciences
- Earth and space sciences
- Environmental sciences
- Scientific ethics

Social Studies

- Economics
- Civics
- Ethics

Foreign Languages

Integrated into all content

- Careers
- Technology

Resources

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