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ABSTRACT

This document presents a comprehensive set of high school graduation and college entry outcomes and competencies in language arts, mathematics, science, and history for Oklahoma students as developed by college faculty from Oklahoma's higher education system. Each curriculum area's two sections detail recommended topics and skills for high school graduation and recommended outcomes and competencies for college entry. In language arts the outcomes for high school graduation cover language arts, reading, and information skills. The mathematics outcomes include such process outcomes as problem solving, communication, reasoning, and connections as well as content outcomes such as algebra, geometry, functions, statistics, probability, trigonometry, and calculus. Recommended outcomes in science include skills in observing and measuring, classifying, experimenting, interpreting, communicating, modeling, and safety. College entry science outcomes include the same skills as well as knowledge in biology, chemistry, and physics. History outcomes for high school graduation and college entry cover Oklahoma and United States history. Each section lists the faculty who helped develop the competencies for that subject. Appendixes contain correspondence establishing the project, statement of project goals, and an agenda from the meeting that launched the project. (JB)

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STUDENT COMPETENCIES for COLLEGE SUCCESS

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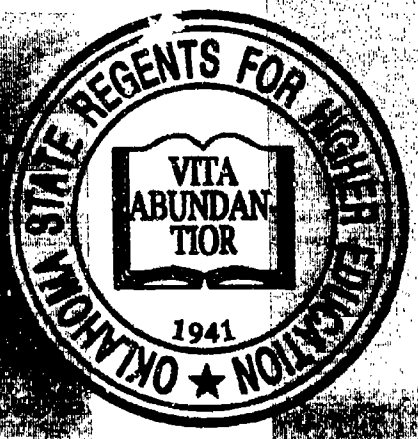

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STUDENT COMPETENCIES FOR COLLEGE SUCCESS

C O N T E N T S

STUDENT COMPETENCIES FOR COLLEGE SUCCESS

Introduction:

The academic preparation a student receives in high school correlates with success in college. Research indicates that students who prepare academically in high school by completing core subjects with strong academic content tend to earn better grades in college and are more likely to persist in college to graduation; in short, student success.

There are several major factors at work which either presently or in the future will affect student academic preparation for college. Together these factors have generated considerable interest in higher education to identify those skill and content competencies which are needed for student success in college. These factors are:

1) **A Study of the Desirability of Increasing the Number of High School Core Curricular Units Required for College Entry:**

Beginning in 1988, students entering the Oklahoma Higher Education System were required to complete an 11-unit high school core curriculum consisting of English, mathematics, history, and lab sciences. Currently, the State Regents are formally studying the need to strengthen the high school core curricular requirements for college entry.

2) **Implementation of House Bill 1017's Outcomes-Based Education:**

House Bill 1017 established the Oklahoma Curriculum Committee which developed student learner outcomes in the respective courses/disciplines. Once implemented, these outcomes will guide teacher instruction and student learning in high school. Given higher education's limited involvement in the development of the learner outcomes, it is important that college and university faculty review the outcomes to evaluate both the content and rigor, particularly as they relate to college entry.

3) **Remedial Education:**

A recent study and preliminary student assessment results indicate that many students entering higher education are not prepared for college level work. Specifically, of all first time entering freshmen in the fall of 1991, overall 31 percent required at least one remedial course; 47 percent of remedial students met or exceeded the high school core curriculum requirement.

4) **Applied Courses:**

Applied courses (tech prep courses) are being developed and taught in the high schools. Applied courses are designed to teach students through practice using the knowledge of the subject matter. The State Department of Education requested that applied courses be accepted as meeting the respective high school course requirements for college entry.

Although high school courses required for college entry have been specified, the courses do not necessarily assure that the college-bound student will have the knowledge and skills needed to succeed in college. There are currently varying levels of content and rigor in the high school core courses taught across the state. This has resulted in many students being underprepared for college level work, and college faculty faced with classrooms filled with students of widely varying skills and abilities.

For these reasons, a comprehensive study conducted by higher education faculty was initiated to review the learner outcomes identified by the Oklahoma Curriculum Committee via H. B. 1017 and to compare these outcomes with the skill and content competencies required for college success. Faculty have now finished their work. The report that follows reflects the faculty's efforts and identifies for college bound students, their parents, teachers, counselors, and common school administrators those skill and content competencies that are required for adequate college preparation.

Process:

The institutional presidents submitted names of faculty members from the disciplines of English, mathematics, science, and history to evaluate the learner outcomes as developed by the Oklahoma Curriculum Committee (see Appendix A). The faculty were also asked to specify those discipline competencies required for entering students to successfully complete the respective introductory college-level courses.

The faculty's efforts were kicked off at a general meeting in July (see Appendices B and C). Faculty received copies of the learner outcomes and were informed about the process by which the outcomes were developed. During the afternoon session, members divided into the four disciplines, identified their respective chairmen, and set out a plan for addressing the charge including subcommittee assignments. The faculty worked through the fall semester and submitted the reports which follow in December, 1992.

Thanks:

The faculty members participating in the project invested their time, expertise, and resources, and they did so voluntarily, without remuneration. The importance of this project cannot be overstated. Students coming into college without these competencies identified by faculty will be required to complete high school level courses before being allowed to enroll for college credit in those areas deemed deficient. Simply put, this will amount to an unfortunate, but necessary duplication of student effort and a waste of the parents' money and sparse tax dollars. On the other hand, the faculty's efforts to identify the needed competencies will encourage better student preparation for college and will reduce the unacceptable costs of remedial education at our colleges and universities. The ultimate result will be a more effective and efficient learning process at all levels of education. Thanks are extended to each faculty member participating in this project.

OKLAHOMA
CURRICULUM
COMMITTEE

LANGUAGE ARTS

Learner Outcomes for High School Graduation

LANGUAGE ARTS

Introduction

Language is a primary medium for thinking and communicating thought. We use language to express ideas by speaking and by writing, and to receive ideas by listening and by reading the literary works of others. As we grow, we become more skilled in the use of receptive and expressive language. In using language receptively, we comprehend the ideas expressed by others through listening and reading. In using language expressively, we comprehend and compose meaning from our own thoughts through speaking and writing.

The mission of the language arts program is to enable students to be fluent, effective communicators and lifelong learners who have an understanding of themselves and the world around them. This curriculum document, a guide rather than a mandate, is designed to enable school districts to accomplish this mission through the study of language and literature.

Current research indicates that it is essential for students to learn language in a holistic, meaning-centered environment which integrates all of the language arts (listening, speaking, reading, and writing). This curriculum document suggests an integrated approach to teaching language though interactive, interdependent processes. The focus is on the development of students' language proficiency through the *use* of as well as the *study* of language.

The Program Outcomes highlight the terminal goals for twelve years of study of English language arts by identifying the knowledge and skills that high school graduates should demonstrate. Directly derived from the Program Outcomes, the Course Outcomes present the major areas of knowledge and skills that students should accomplish during a grade or cluster of school years. For example, the Course Outcomes for Grades 6-8 list outcomes which are appropriate for students completing the eighth grade. The last grade of each cluster is a check-point designed to assist educators in selecting developmentally appropriate instruction in language arts. Outcomes are listed for Grades 1-5, individually, and clustered at Grades 6-8 and 9-12.

Consistent with the holisitic approach, the Course Outcomes require that students *use* language rather than merely *study* language; consequently, students need to write frequently. Using the stages of the writing process helps students achieve a level of competency in language use. Because writing is recursive, the stages may not always occur in a linear sequence, but the writer may revert to an activity characteristic of an earlier stage. These stages of the writing process generally include (1) prewriting, (2) drafting, (3) revising, (4) editing, and (5) publishing, which are described below.

Prewriting

Prewriting is the process that helps writers get ready to write. Students gather ideas and organize them. This stage accounts for 70% to 85% of the total time spent in the writing process. During prewriting, students consider audience, purpose, and modes of discourse. Activities may include observing, thinking, reading, remembering, listing, clustering, and keeping journals.

Drafting

During drafting, the writer puts ideas down on paper with a focus on content. Consideration of spelling and mechanics should not occur during drafting. An error-free paper is not the goal of this stage. Momentum and withholding of critical judgment contribute to the drafting stage.

Revising

Revising is the refining of content, not mechanics. Revision ("to see again") begins during the prewriting activities and continues through the final draft. It is best achieved in an interactive setting with the teacher or a group of peers. During revision, writers critically read their own writing and become their own readers. Since it is mostly internal and unobservable, revising skills can be taught by modeling the questions asked by a critical reader.

Editing

Editing is the correcting of spelling and mechanical errors. Positive reinforcement is more effective than corrective comments to improve the quality of student writing. Peer editing in writing groups helps the students learn to proofread. Students will care about proofreading and correcting their writing when they value their writing.

Publishing

Publication of students' work is essential to the composition program. An authentic audience, one with whom the students want to communicate, is necessary for effective writing. Often it is the peer group. Rarely can the teacher serve as an authentic audience. The teacher will be more successful serving in the role of collaborator and co-writer. Since the perception of audience and of purpose shapes decisions made during the writing, students want and need the audience feedback.

LANGUAGE ARTS LEARNER OUTCOMES

GRADES NINE THROUGH TWELVE

By the end of the twelfth grade, students will

I. Use higher order thinking skills to acquire and process written and auditory information for a variety of purposes

A. Expand strategies to comprehend oral and written material
(listen and read analytically, explicate text . . .)

B. Analyze, evaluate, and explain the thinking or behavior represented in a work of literature from or about another culture
(Native American, other countries' literatures . . .)

C. Access information from a variety of sources
(reference materials, primary sources, media, computer technology, on-line searches . . .)

D. Produce multiparagraph assignments with a thesis, supporting paragraphs, and a conclusion, either on paper or on a computer screen
(narrative, descriptive, expository, persuasive, creative . . .)

E. Write a documented essay using research methods, incorporating the techniques of APA, MLA , or similar styles
(research paper, reports . . .)

F. Demonstrate essay test-taking techniques
(addressing the question, comparison/contrast, analysis, exposition, persuasion, timed writing . . .)

G. Demonstrate critical and analytical skills in writing essays evaluating literature
(plot, character, setting, theme, point of view . . .)

H. Write personal experience compositions that are coherent and unified
(thesis, methods of development, conclusion, continuity of purpose, logical organization, sentence variety, word choice, mechanics . . .)

I. Given a literary prompt, such as a question about theme, write a well-developed composition discussing one or more literary elements from previously read literature
(describe, compare or contrast: two plots, two characters who . . . , settings which . . . ; works with similar themes, similar point of view; a character with qualities like . . . , a character most resembling you . . .)

J. Demonstrate critical thinking skills in their listening, speaking, reading, and writing
(focusing, gathering information, organizing, analyzing, synthesizing, generating, evaluating print and nonprint information . . .)

II. Effectively express ideas and feelings in oral and written modes to satisfy a variety of purposes and audiences

A. Expand vocabulary through word study, literature, and class discussion
(connotation/denotation, etymology, levels of usage . . .)

B. Utilize the writing process to develop and refine composition skills
(prewriting, drafting, revising, editing, publishing, coherence, unity, logical organization, development of a thesis, word choice, sentence variety, usage, mechanics, spelling . . .)

C. Produce multiparagraph assignments with a thesis, supporting paragraphs, and a conclusion, either on paper or on a computer screen
(narrative, descriptive, expository, persuasive, creative . . .)

D. Write a documented essay using research methods, incorporating the techniques of APA, MLA, or similar styles
(research paper, reports . . .)

E. Demonstrate essay test-taking techniques
(addressing the question, comparison/contrast, analysis, exposition, persuasion, timed writing . . .)

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G. Write personal experience compositions that are coherent and unified
(thesis, methods of development, conclusion, continuity of purpose, logical organization, sentence variety, word choice, mechanics . . .)

H. Given a literary prompt, such as a question about theme, write a well-developed composition discussing one or more literary elements from previously read literature
(describe, compare or contrast: two plots, two characters who . . . , settings which...; works with similar themes, similar point of view; a character with qualities like . . . , a character most resembling you . . .)

I. Demonstrate critical thinking skills in their listening, speaking, reading, and writing
(focusing, gathering information, organizing, analyzing, synthesizing, generating, evaluating print and nonprint information . . .)

III. Recognize major literary and cultural traditions as a body of knowledge and use them as a foundation for effective communication

A. Expand vocabulary through word study, literature, and class discussion
(connotation/denotation, etymology, levels of usage . . .)

B. Identify and use figurative language and sound devices
(metaphor, simile, personification, rhythm, rhyme, alliteration, onomatopoeia, hyperbole, analogy . . .)

C. Demonstrate knowledge of literary elements and techniques and how they affect the development of a literary work
(plot, character, setting, theme, conflict, symbolism, point of view, allusion . . .)

D. Demonstrate knowledge and appreciation for various forms (genres) of literature
(essay, short story, novel, drama, narrative and lyric poetry . . .)

E. Recognize human universals (archetypes) represented in literature and apply them to their lives
(initiation, death-rebirth, light-dark, quest themes or motifs . . .)

F. Demonstrate critical and analytical skills in writing essays evaluating literature
(plot, character, setting, theme, point of view . . .)

G. Given a literary prompt, such as a question about theme, write a well-developed composition discussing one or more literary elements from previously read literature
(describe, compare or contrast: two plots, two characters who . . . , settings which . . . ; works with similar themes, similar point of view; a character with qualities like . . . , a character most resembling you . . .)

H. Demonstrate critical thinking skills in their listening, speaking, reading, and writing
(focusing, gathering information, organizing, analyzing, synthesizing, generating, evaluating print and nonprint information . . .)

IV. Values, appreciate, and understand themselves and those from other cultures through the study of language and literature

A. Analyze, evaluate, and explain the thinking or behavior represented in a work of literature from or about another culture
(Native American, other countries' literatures . . .)

B. Recognize human universals (archetypes) represented in literature and apply them to their lives
(initiation, death-rebirth, light-dark, quest themes or motifs . . .)

C. Demonstrate positive concepts of self and others, modeling respect and tolerance and asserting rights for all people
(cooperative learning; resist bias or derision, desire to learn about other cultures . . .)

D. Demonstrate critical thinking skills in their listening, speaking, reading, and writing
(focusing, gathering information, organizing, analyzing, synthesizing, generating, evaluating print and nonprint information . . .)

V. Recognize, analyze, and evaluate the functions of and changes in language

A. Identify some major influences on language and how language changes
(patterns of change: vowel shift, fewer inflections; political: glasnost, apartheid; technology: byte, laser . . .)

B. Expand vocabulary through word study, literature, and class discussion
(connotation/denotation, etymology, levels of usage . . .)

C. Write a documented essay using research methods, incorporating the techniques of APA, MLA, or similar styles
(research paper, reports . . .)

D. Demonstrate critical thinking skills in their listening, speaking, reading, and writing
(focusing, gathering information, organizing, analyzing, synthesizing, generating, evaluating print and nonprint information . . .)

READING LEARNER OUTCOMES

GRADES NINE THROUGH TWELVE

I. The student exhibits positive reading habits and views reading as important.

A. Demonstrates a positive attitude toward self as a reader

B. Chooses to read during free time

C. Reads a variety of materials for different purposes such as for information and for entertainment

D. Exhibits a maturity of interest through a wide range of reading choices

E. Locates and uses information to increase knowledge of content areas and topics of personal interest

F. Demonstrates use of functional print to accomplish tasks (schedules, letters, catalogs, directories, charts, maps, graphs, directions)

G. Demonstrates appropriate use of informational sources (trade books, almanacs, atlases, encyclopedias, dictionaries, thesauruses, magazines, newspapers)

H. Reads for social interaction (discussion of books and other materials)

II. The student reads with fluency attending to the meaning of what is read rather than focusing on figuring out words.

A. Knows that the goal of reading is constructing meaning

B. Uses a variety of strategies to identify words (prediction, context, syntax, structural analysis)

C. Expands vocabulary, including technical and specialized terms and words with multiple meanings

D. Locates and interprets specific information by using text organization to skim and scan for reference

E. Previews the material and activates prior knowledge

F. Determines the purpose for the specific reading activity

G. Makes, verifies, and/or revises predictions while reading

III. The student uses prior knowledge to interact actively with the reading material and extends, elaborates, and critically judges the meaning of what is read.

A. Identifies and interprets both narrative and expository reading materials

B. Uses story structure to organize, recall, and make inferences about the story (setting, characters, goal, plot, conflict, resolution)

C. Constructs a statement of the main idea or theme of a story, poem, or expository passage

D. Identifies details that support or describe a main idea

E. Evaluates and responds to reading materials through discussion, writing, and further reading

F. Recognizes and interprets relationships in text such as compare/contrast, cause/effect, problem/solution, and sequential order

G. Analyzes the author's opinion, purpose, and point of view to evaluate source credibility and reliability

H. Interprets meaning from the author's use of figurative language

I. Makes inferences and draws conclusions from the evidence presented in the reading materials

J. Identifies the author's style (irony, humor)

K. Uses background knowledge and questioning to evaluate controversial issues and propaganda

IV. The student plans and monitors own progress while reading and uses effective strategies to aid understanding.

A. Views reading as a meaning-getting process; therefore, self-corrects when meaning is not clear, revises thinking when predictions are unsatisfactory, and generates clarifying questions

B. Uses appropriate strategies for studying and learning from the text such as outlining, webbing/clustering, skimming, and summarizing

C. Develops questions as a study guide for reading and studying expository text

D. Adjusts reading rate according to the purpose for reading

E. Summarizes text by deleting irrelevant and repetitious material and by substituting a general term for specific items (classification or categorization)

F. Relates dictionary definitions to prior experiences and the context of the reading in order to aid understanding

INFORMATION SKILLS LEARNER OUTCOMES

GRADES NINE THROUGH TWELVE

I. **Locate Information**

The student will identify and locate a variety of information sources.

A. The student will design a range of possible areas for investigation.

B. The student will develop search strategies.

C. The student will locate all types of pertinent information.

II. **Select, Evaluate, and Interpret Information**

The student will sort and use information in various formats.

A. The student will distinguish opinion and inference.

B. The student will judge information for stereotyping, bias, and prejudice.

C. The student will recognize techniques of persuasion and propaganda in information sources.

III. **Record and Organize Information**

The student will record and organize information to meet the stated need.

A. The student will organize information for unity, coherence, and emphasis.

B. The student will evaluate to determine validity of the main ideas.

C. The student will credit sources accurately.

IV. **Present Information**

The student will communicate information effectively in various formats.

A. The student will choose a reporting format appropriate to the conclusion and audience.

B. The student will evaluate information presented according to predetermine need.

V. **Literature**

The student will recognize literature as an essential base of cultural and practical knowledge.

A. The student will incorporate the use of quality literature in specific areas of the curriculum.

B. The student will recommend recreational reading materials.

C. The student will identify and compare major literary awards.

D. The student will differentiate unique qualities of various formats of literature.

E. The student will create a story using illustrations.

COLLEGE AND
UNIVERSITY
FACULTY
COMMITTEE

LANGUAGE ARTS

Learner Outcomes for College Entry

LANGUAGE ARTS LEARNER OUTCOMES

Because the State Regents have specified the high school courses that are required for college entry but have not indicated what a student must be able to do and know to succeed in the first collegiate level courses, it is imperative that higher education faculty designate skill and content competencies required for college level work. In turn, these competencies must be formally and systematically communicated to the common schools and the public. Oklahoma higher education English faculty have been asked to specify those discipline competencies required for first-time entering students to successfully complete introductory college-level course work.

The Oklahoma Curriculum Committee has devoted considerable effort to the development of the Language Arts Learner Outcomes for high school graduates. The Committee's goals are quite similar to those which higher education faculty have long sought for first-year college students. The English faculty, therefore, endorse the outcomes as set forth by the Oklahoma Curriculum Committee.

Nonetheless, the English faculty have recommended that certain minimum competencies be more specifically detailed. In the areas of mechanical and grammatical outcomes, the faculty have listed additional competencies which they believe college-aspiring students should possess. The student must:

1. Possess sound fundamental grammatical structure (allowing for inherent understanding of comma usage, pronoun choice, and sentence boundaries);

2. Write in complete sentences, avoiding sentence fragments, fused sentences, and comma splices;

3. Demonstrate knowledge of subject-verb agreement, pronoun-antecedent agreement, and appropriate use of tense, number, person, case, and mood in sentence, paragraph, and composition writing; and

4. Capitalize and punctuate sentences correctly; use apostrophes correctly.

To be successful in entry level English, additional competencies in composition are required. The student should be able to do the following:

1. Employ appropriate language and syntax in constructing sentences;

2. Utilize topic sentences in paragraph writing, along with unity, coherence, and inclusion of specific details;

3. Employ transitional phrases or other devices of cohesion;

4. Be able to identify the audience for whom they are writing;

5. Be able to identify the purpose for which they are writing;

6. Be aware of and avoid fallacies in logic;

7. Show ability to generate something to write about in a variety of situations (with varying levels of formality);

8. Demonstrate ability to write standard English essays which meet the needs of college and other professional writing tasks;

9. Paraphrase and summarize short selections without inadvertent plagiarism; and

10. Synthesize information from several different sources to write a library-researched paper.

To achieve additional needed competencies in reading, students should demonstrate the following abilities:

1. Identify main ideas and sub-ideas of a reading selection at a minimum of the 10.3 grade level sufficient to outline the selection; and

2. Read from a supplemental reading list of traditional English and American canons that includes multiple genre and periods.

Other additional desirable academic skills include:

1. Developing typewriting/computer capabilities adequate for submission of coursework; and

2. Developing ability to take notes on lectures.

Additionally, the English faculty are concerned that the outcomes as identified by the Oklahoma Curriculum Committee represent a "wish list" more than actual knowledge and abilities likely attainable by high school graduates. It is questioned whether high school teachers, with their heavy teaching loads, have the time or the resources to teach widely disparate students these higher-level thinking and writing skills. While the Learner Outcomes are desirable, they may not be possible without extensive reform in public schools statewide.

The English faculty also raise questions about the assessment procedures which will be used to measure these skills and abilities. Measuring a student's ability to focus thought and language in a well developed piece of writing will require a portfolio of work and demonstrated development; objective tests are not suitable. Unless assessment tools are carefully planned and implemented, students will appear to be mastering the abilities, when, in actuality, they are not.

The English faculty realize that these several reservations raise issues not easily resolved. Indeed, fundamental structural reforms in the public schools would be required: smaller classes, fewer preparations, novel approaches to assessing the quality of a student's work, etc. The faculty also realize that colleges and universities will need to do their part in better preparing teachers of English who are capable of producing in their students the competencies being proposed. Should these things occur, however, the English faculty are

confident that students will be more adequately prepared to do college-level work and that they, as instructors, will be able to dramatically reduce the amount of time they spend on remedial needs.

LANGUAGE ARTS COMMITTEE

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OKLAHOMA
CURRICULUM
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MATHEMATICS

Learner Outcomes for High School Graduation

INTRODUCTION

GRADES NINE THROUGH TWELVE

The learner outcomes for grades nine through twelve establish a framework for a curriculum that reflects the needs of all students, explicitly recognizing that they will spend their adult lives in a society increasingly dominated by technology and quantitative methods.

The curriculum is intended to provide a common body of mathematical ideas accessible to all students. It is recognized that students entering high school differ in many ways, including mathematical achievement, but it is believed these differences are best addressed by enrichment and extensions of the proposed content rather than by deletions. The mathematics curriculum must set high, but reasonable expectations for all students.

A school curriculum in line with these outcomes should be organized to permit all students to progress as far into the mathematics proposed here as their achievement with the topic allows. This material does not constitute an outline for specific courses; numerous possibilities exist for integrating the topics discussed here. Schools should use these outcomes to create a curriculum most beneficial to their students. For example, the outcomes may be met with classes entitled Math 1, 2, 3, and 4, or with courses divided by content area as in Algebra I, Algebra II, Geometry, etc. During the first two years students should study the mathematics designated in the core outcomes except for calculus.

The increasing role of technology in instruction will alter the teaching and learning of mathematics. As computers and calculators become accessible to more educators and students, the appropriate technology will transform the mathematics classroom into a laboratory setting where students will investigate, conjecture, and verify their findings. Calculators and computers must be integrated throughout the curriculum so that students will concentrate on the problem-solving process rather than on the calculations associated with problems.

A broadened view of mathematics will include the traditional topics of algebra, geometry, trigonometry, and functions, but it must also include the mathematical processes of problem solving, communication, reasoning, and connections. Although they are stated separately here for emphasis, these process outcomes will be integrated throughout the high school core curriculum.

MATHEMATICS LEARNER OUTCOMES

GRADES NINE THROUGH TWELVE

PROCESS OUTCOMES

I. Mathematics as Problem Solving

The student will incorporate mathematical problem-solving strategies to solve problems from within and outside mathematics.

A. The student will generalize problem-solving strategies to other disciplines and real world situations. The student will identify the problem from a described situation, determine the necessary data, and apply the appropriate problem-solving strategy.

II. Mathematics as Communication

The student will use mathematical language and symbols to read and write mathematics and to converse with others about it.

A. The student will demonstrate mathematical ideas orally and in writing.

B. The student will decipher mathematical definitions and infer generalizations discovered through investigations.

III. Mathematics as Reasoning

The student will use logical reasoning skills in mathematical contexts and real-world situations.

A. The student will prepare and evaluate conjectures and arguments.

B. The student will draw generalizations and identify counterexamples.

C. The college-intending student will compose formal proofs, including indirect proofs and proofs by mathematical induction.

IV. Mathematics as Connections

The student will appraise mathematics as an integrated whole and use mathematical concepts in other disciplines.

A. The student will use concepts learned in mathematics classes and demonstrate their use in related classes, jobs, and lifelong skills.

B. The student will recognize and use connections within the various mathematical topics and recognize equivalent representations of the same mathematical concept.

CONTENT OUTCOMES

V. ALGEBRA

The student will use algebraic concepts, symbols, and skills to analyze, represent, and solve a variety of problems.

Core

A. **The student will communicate effectively using algebraic vocabulary.**

B. **The student will differentiate between expressions, equations, and inequalities, and perform the appropriate operation to evaluate or implement a solution.**

C. **The student will represent situations that involve variable quantities with expressions, equations, inequalities, and matrices.**

D. **The student will be able to use tables and graphs as tools to interpret expressions, equations, and inequalities.**

E. **The student will be able to use calculators, computers, and other technology to investigate and generalize algebraic concepts.**

F. **The student will apply algebraic processes to become a creative mathematical problem solver in real-life situations.**

G. **The student will use and value the connections between algebra, other mathematics, and other disciplines.**

H. **The student will use appropriate number systems to discover, formulate counterexamples, and test reasonableness.**

Note: The college-intending student should demonstrate depth, breadth, and sophistication in each of the algebra outcomes.

VI. GEOMETRY

The student will learn the fundamentals of geometry from several perspectives and select the appropriate form or forms to model situations and solve problems.

Core

A. **The student will use common geometric figures and their properties in solving problem situations by:**

1. **identifying two dimensional figures;**
2. **drawing and analyzing two- and three-dimensional figures;**
3. **using properties of two- and three-dimensional figures to determine unknown values;**
4. **determining and using the relationships of congruency and similarity;**
5. **deducing properties and relationships of figures from given assumptions and information;**
6. **applying geometric models in problem situations.**

B. The student will use algebraic methods in coordinate and transformational geometry to:

1. translate between noncoordinate and algebraic geometry;
2. deduce properties of figures;
3. identify congruent and similar figures.

Extended Core

C. The college-intending students will incorporate vectors into the study of geometry by:

1. deducing properties of figures using vectors;
2. using transformations, coordinates, and vectors in problem solving.

D. The college-intending student will develop an understanding of an axiomatic system through investigation and comparison of various geometries.

VII. FUNCTIONS

The student will identify the important mathematical role which functions perform and use functions to model and solve real-world problems.

Core

A. The student will recognize functions as an expression of relationships between different quantities by:

1. using tables, verbal rules, equations, and graphs to represent and analyze relationships;
2. interpreting information among tabular, symbolic, and graphical representations of functions;
3. predicting the effects of parameter changes on the graphs of functions.

B. The student will use functions to visualize real-world problems by:

1. describing real-world phenomena with a variety of functions;
2. recognizing that a variety of problem situations can be modeled by the same type of function.

Extended Core

C. The college-intending student will apply functions in a variety of contexts.

D. The college-intending student will perform operations on classes of functions, and describe the general properties and the behavior of classes of functions.

VIII. STATISTICS

The student will use statistical methods to analyze, represent, and design experiments for investigation of real-world problems.

Core

A. The student will sample, organize, and interpret data, recognizing the role these play in making statistical claims.

B. The student will design a statistical experiment to investigate a problem, conduct the experiment, interpret and communicate the outcomes using appropriate technology.

C. The student will use various models to describe real-world data.

D. The student will solve real-world problems utilizing measures of central tendency, variability, and correlation.

E. The student will use appropriate statistical methods to test hypotheses and make predictions.

IX. PROBABILITY

The student will use probability to represent and solve problems involving chance.

Core

A. The student will use experimental or theoretical probability, as appropriate, to represent and solve problems involving chance.

B. The student will use simulations to estimate probabilities.

C. The student will recognize real-world situations which can be modeled by a random variable.

D. The student will generate and interpret probability distributions.

E. The student will interpret and restate real-world applications of probability.

X. TRIGONOMETRY

The student will demonstrate a variety of techniques and technology in applying trigonometry to solve mathematical and real-world problems.

Core

A. The student will use trigonometric relations and functions to solve problems involving right triangles.

Extended Core

B. The student will relate periodic real-world phenomena to sine and cosine functions.

C. The student will recognize the connections between trigonometry, geometry, and algebra by:

1. demonstrating the connection between trigonometric and circular functions;
2. using circular functions to model period real-world phenomena;

3. using the laws of sine and cosine to solve problem situations involving oblique triangles;
4. graphing trigonometric functions;
5. solving trigonometric equations and verifying trigonometric identities;
6. illustrating the connections between trigonometric functions and polar coordinates, complex numbers, and series.

XI. CALCULUS

The student will interpret the mathematics involving the study of change to model real-world relationships.

Core

A. The student will survey areas, volumes, sequences, series, logarithmic, and exponential functions by the limiting process.

B. The student will recognize the conceptual foundations of limit, and their applications.

C. The student will recognize the conceptual foundations of derivatives.

D. The student will recognize the conceptual foundations of integrals.

E. The student will interpret the graphs of polynomial, rational, radical, and transcendental functions.

Extended Core

F. The student will demonstrate a δ-ϵ proof of a limit.

G. The student will use vector functions, parametrically defined functions, and polar coordinates.

H. The student will interpret a function as an infinite series.

COLLEGE AND
UNIVERSITY
FACULTY
COMMITTEE

MATHEMATICS

Learner Outcomes for College Entry

MATHEMATICS LEARNER OUTCOMES

INTRODUCTION

The Mathematics Committee was comprised of college and university mathematics and mathematics education faculty. Over forty faculty members from across the state were divided into five subcommittees, each with the charge to address the Expected Learner Outcomes (ELOs) in specified content areas: Algebra, Geometry, Probability and Statistics, Functions, and Trigonometry and Calculus. Although each of the committees interpreted their charge differently, there was general agreement that satisfactory achievement of the ELOs would adequately prepare most students for entry level college mathematics. There was some general discussion concerning which specific course should be considered as the traditional entry level college mathematics course. It was agreed that most students should enter college ready for a college algebra/pre-calculus course. We realize that this assumption may not be true at the current time, especially for students attending junior colleges, but we also view the purpose of this document to be one of articulating and achieving a vision for mathematics education which includes the realization of the goals and objectives of the ELOs and coordination and cooperation, both in terms of content and pedagogy, among secondary and post-secondary mathematics teachers and college professors.

Although the subcommittee reports focus on the content outcomes, the process and attitudinal outcomes are incorporated within the content focus. The importance of a problem centered curriculum which provides opportunities for the articulation and exploration of mathematical ideas, creativity in problem solving, and connections among mathematical as well as non-mathematical content cannot be over emphasized. Likewise, when viewed as an integrated whole, a problem centered curriculum allows integration of content and problem solving methodology so that, rather than being viewed as add-ons, content not traditionally taught can be incorporated into the curriculum in a meaningful way. Furthermore, the appropriate use and incorporation of technology in secondary mathematics is important for the preparation of advanced study in mathematics. Students should be exposed to and, where possible, have available for their classroom use, scientific graphing calculators. Many problem solving explorations and conceptual development opportunities can be expanded by the use of the graphing calculator.

Finally, although not an official charge of the mathematics committee, we would like to emphasize the importance of a shift in assessment strategies both at the classroom level as well as the state level which encourage and support a problem solving focus for the teaching and learning of mathematics. Writing and speaking are to take on an increased role in the teaching and assessment of mathematical understanding and reasoning, as communicating mathematically includes being able to articulate and represent mathematical ideas using the language and symbols of mathematics. One must also be able to describe the procedures and processes by which problems are solved. A reality of teaching is that testing communicates what is perceived to be important and ultimately affects what is taught in the classroom. If rote skills are tested, then the curriculum becomes skill driven rather than conceptually focused.

MATHEMATICS LEARNER OUTCOMES

ALGEBRA

The following section lists the Learner Outcomes that a state committee of higher education mathematics professionals expects students to know after completing their courses in algebra.

Nowhere is it more important for students to experience the unity of mathematics than in the subject of algebra. The student should be able to use logical, symbolic-algebraic, geometric, graphical, and numerical approaches to formulate concepts and solve problems. The student should realize that algebra is a reasoned scientific analysis of real world problems, rather than a game of meaningless symbol manipulations. We therefore suggest that the current practice of combining the teaching of algebra, trigonometry, sets, functions, and science be continued. The committee likewise advocates the appropriate use of technology for the exploration and solving of algebraic equations and inequalities and encourages the incorporation of graphing calculators into the teaching and exploration of algebraic concepts driven by problem solving opportunities. Finally, the ELOs for algebra should be combined with those for functions and trigonometry stated below for a thorough treatment of algebraic concepts and reasoning.

Although following is a list of topics to be mastered, the committee wishes to emphasize the view of algebra as a powerful tool for problem solving and in no way desires to portray mathematics as a collection of isolated topics. In problem solving situations, the student should develop an understanding of the meaning and purpose of algebraic representations and manipulations.

I. VARIABLES

Upon completing the curriculum in algebra, the student should be able to:

A. Use variables to stand for values of unknown quantities in equations expressing relationships derived from real world phenomena and specify the kind, range, and accuracy of possible values of such a variable;

B. Use variables to stand for values of quantities which make an identity valid and identify those values for which the identity does not hold;

C. Apply arithmetic operations to variables and numbers to obtain expressions;

D. Derive expressions for quantities from real world phenomena and give in words the meaning of constructed expressions; and

E. Simplify expressions.

II. LINEAR EQUATIONS, RELATIONS, FUNCTIONS, AND INEQUALITIES IN ONE AND TWO VARIABLES

Upon completing the curriculum in algebra, the student should be able to:

A. Solve linear equations in one variable, verify their validity, and interpret the answers in a real world context;

B. Derive and solve equations of direct and inverse proportionality for real world problems and investigate the behavior of the dependent variable as the independent variable changes (applications from science are encouraged);

C. Solve linear equations and inequalities in two variables, express the answers algebraically and graphically, and show that the answers correspond to regions and boundaries thereof;

D. Define the absolute value of a number, interpret the absolute value as the magnitude of a number, and use absolute values to express the distance between points on a line;

E. Solve equations and inequalities containing absolute values and express solutions both algebraically and graphically;

F. Graph the absolute value function and express translations both graphically and algebraically; and

G. Graph and solve systems of linear equations in two variables, graph and solve systems of inequalities in two variables, and solve linear programming problems algebraically and graphically.

III. POLYNOMIALS

Upon completing the curriculum in algebra, the student should be able to:

A. Simplify and evaluate expressions containing integral exponents;

B. Graph polynomials in one and two variables from algebraic expressions as well as derive algebraic formulas for given graphs of polynomials;

C. Add, subtract, multiply and divide polynomials, simplify results, and estimate products and quotients of polynomial expressions;

D. Use expansion formulas such as squares and cubes of binomials and use and explain the binomial theorem;

E. Derive one-variable polynomial equations from practical problems, investigate possible solutions, approximate answers numerically (bisection method), and

solve by factoring, completing the square, and other algebraic methods; and

F. Factor polynomials to solve equations.

IV. RATIONAL EXPRESSIONS AND COMPLEX NUMBERS

Upon completing the curriculum in algebra, the student should be able to:

A. Apply arithmetic operations to rational expressions, graph rational functions, and study their properties;

B. Derive equations containing rational expressions from practical problems and solve them algebraically, being aware of unacceptable solutions;

C. Solve inequalities involving rational expressions in one variable and express the answers algebraically and graphically;

D. Define root functions, express meaning of root in words, and find approximations to roots using Newton's bisection and secant method.

E. Form new functions by addition, subtraction, multiplication, division, and composition of given functions, interpret rational powers as composition of roots and integral powers, and find numerical values;

F. Simplify and solve expressions containing roots and powers;

G. Derive and solve quadratic equations from real world phenomena and use algebraic and numerical methods (e.g. completing the square) to eliminate unacceptable and determine real solutions;

H. Use complex numbers in rectangular and polar coordinate form to solve and derive equations from practical problems, and explain the need for and meaning of complex numbers as solutions to equations; and

I. Transform quadratic functions algebraically to power functions and graph.

V. GENERAL PROBLEM SOLVING STRATEGIES

Upon completing the curriculum in algebra, the student should be able to:

A. Use scientific notation to give values for the wide range of quantities in nature and estimate approximate values of complex numerical expressions;

B. Solve systems of linear and non-linear equations algebraically, graphically, and numerically and evaluate the solutions for correctness and appropriateness;

C. Graph expressions appearing on both sides of an equation and find solutions as the intersections of curves;

D. Use exponents, understanding the meaning of the symbols in terms of arithmetic operations, and use the laws of exponents;

E. Understand the concept of vectors and the applications of vectors in physical science, use rectangular and polar forms to represent vectors and solve real world problems, and express complex numbers as vectors;

F. Construct arrays and matrices for real world problems and perform operations on matrices to solve systems of linear equations and linear programming problems;

G. Use coordinate geometry to solve algebraic equations;

H. Solve equations involving powers of variables employing strategies such as simplification and intersecting curves, and express solutions both algebraically and graphically; and

I. Use algebra to demonstrate reasoning or constitute proofs.

MATHEMATICS LEARNER OUTCOMES

FUNCTIONS

The following section lists the Learner Outcomes that a state committee of higher education mathematics professionals expects students to know. The following materials should be integrated into other studies such as algebra and trigonometry.

The student will understand, use, and be able to communicate with the following terms and phrases:

amplitude
bar graph
closed interval
complement
compose
composite
composition
coordinate
cubic function
dependent variable
direct proportion
domain
doubling time
even function
exponential function
extremum
finite
function
graph
half closed interval
half-life
histogram
increasing
independent variable
intercept
intersection
interval
inverse function
inverse proportion
inverse center
invert
local extremum
local maximum
maximum
minimum
odd function
ordered pair
open interval
parameter
period
phase
pictogram
piecewise linear
point
polynomial
power
power function
quadratic function
range
rate of change
rational function
reflect
reflection line
rigid motion
root
root function
rotation
set
slope
stem-and-leaf
straight line
symmetry
table
transformation
translation
trigonometric function
union
variable
zero of a function

I. SETS

Upon completing the curriculum in functions, the student should be able to:

A. Have a good intuitive grasp of the notion of a set; possess examples of both finite and infinite sets;

B. Specify sets by considering one or more properties that its members possess;

C. Use set notation;

D. Combine sets by union and intersection and find complements in a universe;

E. Use Venn diagrams to solve real world problems; and

F. Use De Morgan's Laws to solve problems.

II. FUNCTIONS IN GENERAL

Upon completing the curriculum in functions, the student should be able to:

A. Have an intuitive grasp of the notion of a function derived from experience with familiar quantities;

B. Use functions composed of a finite set of ordered pairs;

C. Think of variable quantities and use letters to represent them;

D. Use the concept of independent and dependent variables (both algebraically and geometrically/graphically);

E. Draw graphs of functions and use the vertical line test;

F. Read and interpret graphs of functions;

G. Determine the domain and range of a function;

H. Read tables of functions;

I. Use functions defined by a mathematical formula;

J. Use calculators and computers to evaluate functions;

K. Use calculators and computers to produce and interpret graphs;

L. Determine intervals over which functions are increasing and decreasing from graphs and from algebraic formulas;

M. Find local and absolute maxima and minima of functions;

N. Select graphs which represent real world scenarios and draw graphs of functions given by the scenarios; and

O. Draw and interpret bar graphs, histograms, stem-and-leaf graphs, and pictograms.

III. LINEAR FUNCTIONS

Upon completing the curriculum in functions, the student should be able to:

A. Draw graphs of linear functions from real world data and linear relationships;

B. Use slope of straight line graphs to determine constant rate of change;

C. Study families of concurrent lines and use the notion of parameterization;

D. Determine intercepts of a graph of a function;

E. Use intercept form of a line;

F. Parameterize families of parallel lines by intercept;

G. Use point-slope and two point representations of lines;

H. Use piecewise linear functions and step functions to represent real world phenomena; and

I. Use the concept of direct proportionality for real world problems.

IV. POLYNOMIALS

Upon completing the curriculum in functions, the student should be able to:

A. Use positive integral power functions, find the intervals where they increase and decrease as well as the local extrema, and compare their rates of growth and find their intersections with one another;

B. Study translations of graphs and relate the effect of a translation of a graph to the corresponding change in the formula of the function;

C. Reflect and invert a graph or portion of it, and relate the effect of these transformations to the corresponding change in formula of a function;

D. Generate a graph by using transformations on a fundamental domain;

E. Describe a family of power functions parameterized by constant multipliers, and relate rates of change of members of graphic families;

F. Combine different powers by addition and subtraction, graphically and numerically;

G. Plot quadratic polynomials of all types, find zeros algebraically and graphically, and determine symmetry and maxima or minima;

H. Graph simple cubic polynomial functions, and find approximate zeros using numerical methods (bisection, secant and Newton's methods);

I. Estimate maximum error and speed of convergence numerically for an approximation method; and

J. Determine the behavior of quadratic and cubic functions as the independent variable approaches a (finite or infinite) limit.

V. RATIONAL FUNCTIONS

Upon completing the curriculum in functions, the student should be able to:

A. Master the properties of negative integral power functions, and find their domains, locate their parts, compare their rates of growth, and examine behavior at limiting values;

B. Use the concept of inverse proportionality to treat real world problems;

C. Develop graphs of simple rational functions from formulas, find domains and ranges, examine the rates of growth, locate zeros, determine behavior near asymptotes; and

D. Exhibit real world behavior governed by rational functions and solve real world problems both graphically and algebraically.

VI. EXPONENTIAL FUNCTIONS

Upon completing the curriculum in functions, the student should be able to:

A. Characterize exponential functions by growth rate;

B. Solve population growth and decay problems;

C. Use initial values, half-lives, and doubling times to define exponential functions; and

D. Compare relative growths of power and exponential functions graphically and numerically, and predict asymptotic behavior of products and quotients of power and exponential functions.

VII. TRIGONOMETRIC FUNCTIONS

Upon completing the curriculum in functions, the student should be able to:

A. Represent trigonometric functions graphically;

B. Use the concepts of period, amplitude, and phase of trigonometric functions and relate them to real world problems;

C. Describe symmetry properties of trigonometric functions, determine graphically and numerically which are even and odd;

D. Study and compare transformations of graphs with corresponding changes in the algebraic representation; and

E. Use graphs to demonstrate simple identities.

VIII. INVERSE FUNCTIONS

Upon completing the curriculum in functions, the student should be able to:

A. Determine whether a graph or formula represents a one-to-one function;

B. Solve a formula algebraically to find the inverse of a function;

C. Produce the graph of the inverse of a function by reflection;

D. Relate the algebraic and graphical properties of a function and its inverse;

E. Use the logarithmic functions as inverse to solve exponential equations;

F. Display the graphs of inverse trigonometric functions;

G. Show that roots function are inverses of powers, and compare the behavior of root functions; and

H. Determine the graphical relationships between a function and its inverse.

IX. COMPOSITE FUNCTIONS

Upon completing the curriculum in functions, the student should be able to:

A. Compose algebraically and numerically evaluate two functions;

B. Relate the behavior of rational powers to the functions composing them;

C. Compare composition of functions in different orders; and

D. Compose different types of functions, for example power and trigonometric functions as well as linear functions.

MATHEMATICS LEARNER OUTCOMES

GEOMETRY

It has been assumed that most students will enter college ready for a course in college algebra/pre-calculus mathematics. Many of the secondary geometry ELOs are important for success in the entry level college mathematics course including geometric models for solving algebraic equations. Although the process standards (problem solving, reasoning, communication, and connections) are not specifically addressed in this section, the committee would like to stress the importance of using geometric modeling, spatial visualization, and geometric reasoning as problem solving approaches likely to enhance student success in and appreciation for college mathematics. In accordance with the recommendations of the National Council of Teachers of Mathematics (NCTM) Standards[1], the geometry committee would also like to encourage the de-emphasis of two column proofs in geometry while encouraging the development of geometric reasoning and spatial sense with regard to estimation of area, length, and angles. The extended core of the Oklahoma ELOs is especially vital for the college intending student to appreciate and fully utilize the problem solving power of geometry. Although specific features of non-Euclidean geometries are not vital to the success of the college bound student in entry level college courses, explorations in non-Euclidean geometries can enhance understanding of and appreciation for axiomatic systems and deductive mathematical reasoning.

The student will understand, use, and be able to communicate effectively with the following tools, terms, and phrases:

angle
angle bisector
arc length
area
chord
circumference
circumscribed polygons
compass
degree
diameter
distance formula
equilateral triangle
fractals
graphing calculator
inscribed polygons
isosceles triangle
law of cosines
law of sines
midpoint
obtuse
perimeter
polygon
polyhedrons (tetrahedron, etc.)
protractor
Pythagorean theorem
radian
radius
ratio/proportion
similarity
slope
surface area
symmetry
tangent
tesselation
transformations (rotations, etc.)
triangle
volume

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[1] National Council of Teachers of Mathematics. (1989). Curriculum and Evaluation Standards for School Mathematics. Reston, VA: NCTM

I. PROBLEM SOLVING IN TWO DIMENSIONS

Upon completing the curriculum in geometry, the student should know the following:

A. Parallel and intersecting lines/congruent angles problems (e.g. corresponding, supplementary, complementary, and alternate interior angles);

B. Area and perimeter of two-dimensional objects including graphical as well as algebraic representation of area and perimeter and hands-on explorations to develop a sense of the relationship between area and perimeter;

C. Approximation techniques for area of circles (e.g. inscribed and circumscribed regular polygons);

D. Properties of two-dimensional figures (parallelogram, etc.);

E. Circle geometry to solve real world problems including hands-on experiences to develop an understanding of the relationship among area, circumference, diameter, and radius of a circle;

F. Types and properties of symmetry as problem solving tools (e.g. reflection, translation, point and line symmetry to represent relations);

G. Symmetry as it appears in nature as in tesselations and fractals;

H. Pythagorean theorem and right triangle trigonometry;

I. Law of sines and cosines; and

J. Geometric interpretation of algebraic equations.

II. PROBLEM SOLVING IN THREE DIMENSIONS

Upon completing the curriculum in geometry, the student should know the following:

A. Polyhedrons (properties, calculating volume and surface area, problem solving);

B. Solids with curved surfaces (cylinders, cones, spheres, etc.);

C. Scientific applications of geometric measures (e.g. density = M/V, rate = D/t, trigonometric ratio and proportion, mass, specific gravity = V/M); and

D. Geometric interpretation and algebraic calculation of the golden ratio with applications in art and nature.

III. GEOMETRIC MODELING

Upon completing the curriculum in geometry, the student should be able to:

A. Use networking as a problem solving/decision making tool;

B. Use coordinate geometry to solve real world problems; and

C. Apply geometric probability.

MATHEMATICS LEARNER OUTCOMES

PROBABILITY/ STATISTICS

Perhaps more than any other branches of mathematics and science, probability and statistics offer the most flexibility as far as integration with other mathematical and science content areas. The skills and reasoning used in probabalistic problem solving are especially relevant to future success in higher mathematics. Likewise, the organizational and representational aspects of statistics greatly enhance the problem solving potential of students in a variety of mathematics classes. It is not necessary for college bound students to have a separate course in probability and/or statistics. A comprehensive high school mathematics program, however, should infuse many of the problem solving and organizational features of these two mathematics disciplines into the mathematics curriculum.

The student will understand, use, and be able to communicate effectively with the following tools, terms, and phrases:

bias
binomial theorem
box plots
certainty
complementary events
correlation
data analysis
expected value
experiment
experimental vs. theoretical probability
factorial
fair game
frequency table/chart
fundamental counting principle
impossible event
mean
median
mode
mutually exclusive events
outcomes
random
random sample
range
sample space
sampling
standard deviation
tree diagram
variance

I. PROBABILITY

A. Determining probabilities
frequency ratios, multistage experiments, fair games, conditional probability, expected value

B. Methods of counting (permutations, combinations)
problem solving and reasoning activities that develop understanding of principles of counting are to be stressed

C. Problem solving strategies
tree diagrams, geometric models, simulations

II. STATISTICS

A. Graphs

1. Appropriate and inappropriate uses (when to use a pie graph, lying with statistics, etc.)

2. Types of graphs (line, bar, circle, double line, etc.)

3. Used for organizing and interpreting data

B. Data analysis and organization

1. Frequency tables (and grouped data)

2. Stem-and-leaf and box plots

3. Sampling techniques

4. Used in problem solving and decision making

C. Measures of central tendency (mean, median, mode) with a focus on problem solving and reasoning

D. Measures of variation (range, variance, standard deviation, correlation) for decision making and problem solving

MATHEMATICS LEARNER OUTCOMES

CALCULUS

Although the committee has assumed the entry level college mathematics student will be taking College Algebra/Pre-calculus, many students enter college ready for calculus. The following section lists the learner outcomes that a State committee of higher education mathematics instructors expects students to know after completing a course in calculus. The committee encourages that high school calculus classes follow a rigorous treatment of calculus as suggested by the Educational Testing Service Advanced Placement Calculus preparation materials.

Prior to taking a course in calculus the student should understand algebra, trigonometry, and functions.

The student will understand, use, and be able to communicate effectively with the following terms and phrases:

acceleration
antiderivatives
applied maximum-minimum problem
area under the graph
Average Value Theorem
chain rule
circumscribe rectangular polygon
composite function continuity
composition of functions
concave-downward
concave-upward
continuity of rational functions
continuity of polynomial functions
continuity of a function
critical points
decreasing functions
definite integral
definition of the derivative
derivatives of the sine
differential dy
first derivative test
fundamental theorem of calculus
generalized power rule
graphing of polynomials
higher derivatives
horizontal asymptote
implicit differentiation
implicitly defined functions
increasing functions
increment y
indefinite integrals
infinite limits
inflection points
inflection point test
inscribed rectangular polygonal
integration by substitution
intermediate value property
inverse functions
limit laws
limit of f(x) as x approaches
limits as x
linear approximation
linear interpolation
local extrema
local maxima
local minima
lower Riemann sums
mathematical induction
Mean Value Theorem
method of bisection
midpoint approximation
Newton's Method
normal lines
partition of (a,b)
power rule
product rule
properties of area
quotient rule

related rates problem
Riemann sum
right-hand limits
Rolle's theorem
second derivative test
Simpson's approximation
summation notation
tangent lines
test for concavity
trapezoidal approximation
upper Riemann sums
velocity
vertical asymptotes
vertical tangent lines

I. THE RATE OF CHANGE OF A FUNCTION

Upon completing the curriculum in calculus, the student should be able to:

A. Understand the concept of function;

B. Determine the values of the domain and range of a given function;

C. Given a function, define the slope of the secant line;

D. Given a function, define the slope of the tangent line;

E. Relate the slopes of the secant and tangent lines above to the first derivative;

F. Use the following rules for limits: Sum, Difference, Product, and Quotient;

G. Demonstrate that the limit of f(x) as x approaches x_0 is the number L if given any radius e>0 about L, there exists a radius d>0 about x_0 such that $0 < | x - x_0 | < d$ implies $| f(x) - L | < e$;

H. Evaluate the limits of algebraic functions if they exist;

I. Identify and evaluate right and left hand limits;

J. Calculate the derivative of a third degree polynomial using the difference quotient; and

K. Evaluate limits involving infinity.

II. DERIVATIVES

Upon completing the curriculum in calculus, the student should be able to:

A. Write the equation for the velocity and acceleration, when given an equation for displacement as a function of time;

B. Calculate the first and second derivative of y with respect to x, when given an equation where y is a polynomial in x;

C. Determine the equations of lines that are tangent and normal to a curve at a given point, when given the equation of the curve and the coordinates of the point;

D. Write the equations of the lines tangent to a curve that have a given slope, when given the equation of the curve and the slope of the lines;

E. Find the derivative of (1) the product of two differentiable functions, (2) a differentiable function raised to a power, and (3) the quotient of two differentiable functions;

F. Calculate the derivative of the six trigonometric functions;

G. Calculate the first and second derivatives of a function by implicit differentiation;

H. Use the concept of linearization to estimate a function and determine error;

I. Use the chain rule to find dy/dx when given y as a function of x or when given y as a function of w when w is a function of s;

J. Determine the differential of y when given an equation in x and y; and

K. Determine if a function is continuous when given the equation of the function.

III. APPLICATIONS OF DERIVATIVES

Upon completing the curriculum in calculus, the student should be able to:

A. Write the equations of the tangent and normal to a curve at a point, when given the equation of the curve and the coordinates of the point;

B. Find the measure of the angle between two curves when given the equations of the curves;

C. Use Newton's method to estimate the roots of a given equation;

D. Determine the following when given the equation of a function:

1. the first and second derivatives;

2. the interval on x where the graph of the curve is rising;

3. the interval on x where the graph of the curve is falling;

4. the coordinates of the critical points;

5. Vertical and Horizontal or Oblique Asymptotes;

6. the interval on x where the curve is concave downward;

7. the interval on x where the curve is concave upward; and

8. the graph of the function showing maximum, minimum, and critical points;

E. Solve related rate problems;

F. Solve maximum (optimization) problems;

G. Understand the Mean Value Theorem and Rolle's Theorem; and

H. Understand L'Hopital's Rule.

IV. INTEGRATION

Upon completing the curriculum in calculus, the student should be able to:

A. Approximate an integral using rectangular boxes;

B. Evaluate polynomial integrals;

C. Evaluate an integral as a sum of signed areas;

D. Evaluate an integral as a limit;

E. Apply the fundamental theorem of calculus relating integrals and derivatives;

F. Evaluate integrals involving trigonometric functions;

G. Evaluate definite integrals involving polynomials and trigonometric functions; and

H. Use the trapezoidal rule to estimate the value of a definite integral for a given value of n.

V. APPLICATIONS OF DEFINITE INTEGRALS

Upon completing the curriculum in calculus, the student should be able to:

A. Find the area between two curves when given their equations;

B. When given the velocity of a function of time and a time interval;

1. sketch the graph of v versus t;

2. find the time interval when the velocity is positive;

3. find the time interval when the velocity is negative; and

4. find the total distance traveled during the time interval;

C. Find the volumes generated when the areas bounded by given curves or lines are rotated about the x-or y-axis;

D. Calculate the length of a segment of curve when given the equation of the curve and the interval;

E. Calculate the surface area by rotating curves about an axis;

F. Determine the center of mass of a thin homogeneous plate in the x-y plane;

G. Find the centroid of an area bounded by given curves and/or lines; and

H. Find the center of gravity of a solid formed by rotating an area about a given axis.

VI. TRANSCENDENTAL FUNCTIONS

Upon completing the curriculum in calculus, the student should be able to:

A. Calculate the derivative of:

1. trignometric functions;

2. inverse trigonometric functions;

3. natural logarithmic functions; and

4. exponential function;

B. Calculate the derivative of a function using logarithmic differentiation; and

C. Evaluate integrals involving logarithmic and exponential functions.

MATHEMATICS LEARNER OUTCOMES

TRIGONOMETRY

The following document lists the learner outcomes that a State committee of higher education mathematics instructors expects students to know after completing a course in trigonometry.

CORE CURRICULA

The student will understand, use, and be able to communicate effectively with the following trigonometric terms and phrases:

acute angle
adjacent side
adding ordinates
addition law
ambiguous case
amplitude
angle
angle between two lines
angle of depression
angle of elevation
angle of inclination
angular velocity
arc
arc length
arccosecant
arccosine
arccotangent
arcsecant
arcsine
arctangent
argument
asymptotes
axis
bearing
Cartesian coordinate system
central angle
chord length
circle
circular functions
circumference
cofunction identities
complementary
composition of functions
conditional equation
conjugates
coordinate
coordinates
cosecant
cosecant curve
cosine
cosine curve
cotangent
cotangent curve
coterminal angles
counterexamples
degree measure
dependent variable
direction angle
distance formula
domain
double-angle identities
exact values
function
fundamental identities
f(x) notation
graph
half-angle identities
horizontal line test
hypotenuse
identity
identity function
independent variable
initial side
inverse function
law of cosines
law of sines
law of tangents
negative angle
negative angle identities
number line
oblique triangle
obtuse angle

odd and even function
one-to-one function
opposite angle
opposite side
ordered pairs
period
periodic function
phase shift
positive angle
product identities
Pythagorean identities
quadrant
quadrantal angle
radian
radian measure
radius
range
ratio identities
real axis
reciprocal identities
rectangular coordinate
reduction identity
reduction principle
reference angle
relation
right angle
secant
secant curve
similar triangles
sine
sine curve
slope
slope-intercept
solved triangle
solving a triangle
standard-position
standard-position angle
sum and difference identities
sum and product identities
sum identities
system
tangent
tangent curve
terminal angle
translation
translation equation
triangle
trigonometric functions
unit circle
vertical line test

I. DEFINITION OF THE CIRCULAR TRIGNOMETRIC FUNCTIONS

Upon completing the curriculum in trigonometry, the student should be able to:

A. Generalize the definition of the circular trignometric functions in terms of any point on the terminal side of the angle;

B. Draw angles in degree and radian measure;

C. Evaluate trigonometric functions using reference angles;

D. Evaluate trigonometric functions of real numbers by calculator; and

E. Know the exact values for trigonometric functions of $0, \pi/6, \pi/4 \ldots, 3\pi/2$.

II. PROVING IDE. :TIES

Upon completing the curriculum in trigonometry, the student should be able to:

A. Differentiate between conditional equations and identities;

B. Know the eight fundamental trigonometric identities;

C. Prove trigonometric identities by using a variety of techniques;

D. Prove or disprove that an equation is an identity; and

E. Prove trigonometric identities by using the cofunction and opposite-angle identities, the addition laws, the double-angle and half-angle identities, and the product and sum identities.

III. GRAPHING TRIGONOMETRIC FUNCTIONS

Upon completing the curriculum in trigonometry, the student should be able to:

A. Graph from memory the cosine, sine, and tangent curves;

B. Graph the general trigonometric curves; and

C. Identify the domain, range, period, amplitude, and equations of asymptotes of trigonometric function curves where appropriate.

IV. RELATIONSHIPS BETWEEN TRIGONOMETRIC FUNCTIONS AND INVERSE TRIGONOMETRIC FUNCTIONS

Upon completing the curriculum in trigonometry, the student should be able to:

A. Evaluate the inverse trigonometric functions by knowing quadrants for principle values;

B. Define inverse trigonometric functions, including the domain and the range;

C. Sketch the graphs of inverse trigonometric functions; and

D. Evaluate inverse trigonometric functions.

V. SOLVING TRIGONOMETRIC EQUATIONS

Upon completing the curriculum in trigonometry, the student should be able to:

A. Solve trigonometric equations in linear form;

B. Solve trigonometric equations by factoring;

C. Solve trigonometric equations by using the quadratic formula;

D. Solve trigonometric equations by using trigonometric identities; and

E. Solve trigonometric equations with multiple angles.

VI. SOLVING TRIANGLES

Upon completing the curriculum in trigonometry, the student should be able to:

A. Solve right triangles and applied right triangle problems;

B. Know the Law of Cosines and the Law of Sines; and

C. Solve SSS, SAS, AAA, ASA, AAS, and SSA triangles and related applied problems.

EXTENDED CORE CURRICULA

Extended core is a list of additional topics that the student should be exposed to once the core topics have been mastered.

I. Vectors

II. Polar equations

III. Complex trigonometric functions

IV. Areas of triangles

V. Series

MATHEMATICS COMMITTEE

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University of Oklahoma

Mathematics Committee Co-Chairman: Professor Phillip Schapiro
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OKLAHOMA
CURRICULUM
COMMITTEE

SCIENCE

Learner Outcomes for High School Graduation

SCIENCE LEARNER OUTCOMES

SUMMARY OF STATE DEPARTMENT LEARNER OUTCOMES

I. OBSERVING AND MEASURING

Upon completing the curriculum in science, the student should be able to:

A. Given objects, organisms, or events, identify the characteristics that are similar or different;

B. Given an organism or object, select qualitative (descriptive) or quantitative (numerical) observations;

C. Given conditions before, during, and after an event, identify qualitative and quantitative changes; and

D. Given an organism, object, or event, select the appropriate unit of measurement, using S.I. (System International) units when applicable.

II. CLASSIFYING

Upon completing the curriculum in science, the student should be able to:

A. Given objects, organisms, or events, identify the properties by which they could be ordered;

B. Given a set of objects, organisms, or events, select a serial order for each property;

C. Given a classification system, identify the properties on which the classification is based;

D. Given a set of objects, organisms, or events, use observable properties to classify them; and

E. Place an object, organism, or event into a classification system.

III. EXPERIMENTING

Upon completing the curriculum in science, the student should be able to:

A. Given a science problem requiring a sequence of steps, arrange the steps in proper order;

B. Given an experimental set-up, identify the independent variables, dependent variables, and control;

C. Given a set of observations, use mathematics to show relationships among the observations; and

D. Given a problem, identify a hypothesis.

IV. INTERPRETING

Upon completing the curriculum in science, the student should be able to:

A. Interpret line, bar, and circle graphs;

B. Given a graph, predict data points not shown;

C. Select the appropriate predictions based on observed patterns of evidence;

D. Given experimental data, select the most logical conclusion;

E. Identify data which support stated hypothesis;

F. Identify discrepancies between stated hypothesis and actual results;

G. Given results of investigations, accept or reject a hypothesis; and

H. Collect and report data in appropriate method.

V. COMMUNICATING

Upon completing the curriculum in science, the student should be able to:

A. Given a table of numerical data, select the graph which shows the relationship of variables;

B. Given a written description of data, select a corresponding graph;

C. Given a diagram, select the appropriate written description of events depicted;

D. Describe the properties of an object or event in sufficient detail so another person can identify it; and

E. From collected data, complete or create an appropriate graph or chart.

VI. MODELING

Upon completing the curriculum in science, the student should be able to:

A. Given a set of observations, select a model which explains it;

B. Select predictions based on models; and

C. Given a model, relate the model to the real world.

VII. SAFETY IN THE SCIENCE CLASSROOM

Upon completing the curriculum in science, the student should be able to:

A. Recognize potential hazards within a given activity; and

B. Practice safety procedures in all science activities.

COLLEGE AND
UNIVERSITY
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COMMITTEE

SCIENCE

Learner Outcomes for College Entry

SCIENCE LEARNER OUTCOMES

INTRODUCTION

The learner outcomes needed to be successful in the entry-level college science courses are detailed below. The college and university faculty divided the outcomes into the respective disciplines because there are unique areas in each which could not be addressed from a general perspective. It is important to note that the Oklahoma Curriculum Committee's learner outcomes are more general in nature, while the outcomes identified by the college faculty are more specific and discipline based.

Of the learner outcomes established by the college science faculty, the biology learner outcomes match up reasonably in both structure and wording. The faculty biology outcomes do, however, include specific activities not included on the Oklahoma Curriculum Committee's list. The faculty physics outcomes are similar in structure as well, but are more detailed than those of the Oklahoma Curriculum Committee. The faculty chemistry outcomes differ drastically and should be understood as the most dramatic example of the college faculty's desire to see high school graduates master specific competencies tied to particular fields of knowledge.

High school students achieving the faculty established competencies in the respective disciplines should be prepared to do successful work in college-level science courses.

SCIENCE LEARNER OUTCOMES

BIOLOGY

GLOBAL

Reading with comprehension
Writing with clarity
Basic math
Metric system
How to take observations and measurements
Ability to take notes and organize information
Ability to think abstractly
Maintain open mind

SPECIFIC

I. OBSERVING AND MEASURING

Upon completing the curriculum in biology, the student should be able to:

A. Understand and be able to use the metric system;

B. Recognize and express differences and similarities in observable characterics of living things; and

C. Be acquainted with microscopically observable cells and cell structures and their major functions.

II. CLASSIFYING

Upon completing the curriculum in biology, the student should be able to:

A. Understand levels of hierarchy in biological classification;

B. Recognize interrelationships between similarities and differences; and

C. Use a dichotomous key.

III. EXPERIMENTING

Upon completing the curriculum in biology, the student should be able to:

A. Design a controlled experiment and list the required steps in order;

B. Be acquainted with pertinent historical experiments;

C. Use the scientific method to arrive at a supportable solution to a common problem/question; and

D. Differentiate between hypothesis and theory.

IV. INTERPRETING (This is not always involved with experimenting.)

Upon completing the curriculum in biology, the student should be able to:

A. Given experimental data, select the most logical conclusion; and

B. Given a table of numerical data, select the graph which shows the relationship of variables.

V. COMMUNICATING

Upon completing the curriculum in biology, the student should be able to:

A. Write a scientific report on an experiment;

B. Describe the properties of an object or an event in sufficient detail that another person can identify it;

C. From data, construct an appropriate graph or chart; and

D. Identify basic biological concept/principles involved in an experiment.

VI. MODELING

Upon completing the curriculum in biology, the student should be able to:

A. Given a set of observations, select a model which explains it.

VII. SAFETY

Upon completing the curriculum in biology, the student should be able to:

A. Recognize potential hazards within a given activity;

B. Be acquainted with basic safety precautions; and

C. Practice safety procedures in activities.

SCIENCE LEARNER OUTCOMES

CHEMISTRY

I. OBSERVING AND MEASURING

Upon completing the curriculum in chemistry, the student should possess the following knowledge and skills:

KNOWLEDGE	SKILL
A. Basic metric system;	Interconversion of metric to metric and English to metric with dimensional analysis;
B. Phases of matter and energy;	Observation of matter and energy and their interconversion, and calculations involving gas laws and colligative properties;
C. Definition of accuracy-precision; and	Measure and delineate between accuracy and precision including use of significant figures; and
D. Understanding mole concept.	Be able to interconvert moles, molecular weight, masses, atoms, and molecules and be able to do basic stoichiometry.

II. CLASSIFICATION

Upon completing the curriculum in chemistry, the student should possess the following knowledge and skills:

KNOWLEDGE	SKILL
A. Know the common elements, symbols, and location on periodic chart;	Properly write symbols of the elements, formulas of compounds, nomenclature and how properties vary in periodic chart;
B. Classify changes as to chemical or physical;	Be able to identify if a change is chemical or physical;

C.	Classify mixtures; and	Recognize homogeneous-nonhomogeneous mixtures, solutions, and colloids; and
D.	Chemical Classifications.	Distinguish between ionic, polar and non-polar covalent materials and understand acids, bases, salts, and neutralizations.

III. SCIENTIFIC METHOD IN EXPERIMENTATION

Upon completing the curriculum in chemistry, the student should possess the following knowledge and skills:

	KNOWLEDGE	SKILL
A.	Understand scientific method; and	Be able to define operationally, identify variables, and apply it to designing experiments; and
B.	Fundamental chemical methods.	Be able to understand basic chemical lab skills and directions and carry out lab operations.

IV. SCIENTIFIC METHOD IN INTERPRETATION OF COLLECTED DATA

Upon completing the curriculum in chemistry, the student should possess the following knowledge and skills:

	KNOWLEDGE	SKILL
A.	Evaluation of data; and	Be able to analyze data for similarities, differences, and agreement with stated principles;
B.	Mathematical expressions of experiments and relationships.	Be able to graphically represent data and reduce it (data manipulation) utilizing isolation of variables (changing only one variable at a time).

V. COMMUNICATION

Upon completing the curriculum in chemistry, the student should possess the following knowledge and skills:

KNOWLEDGE	SKILL
A. Chemical terms, symbols, abbreviations, and conventions used in chemistry.	Summarize chemical phenomena in equation form; and Balance chemical equations, Verbalize reported data with proper pronounciation and understanding, and Give written description of chemical phenomena based on chemical equations.

VI. DEVELOPING MODELS

Upon completing the curriculum in chemistry, the student should possess the following knowledge and skills:

KNOWLEDGE	SKILL
A. Know the Bohr Atom; and	Utilization of the Bohr Atom to explain spectra, valence, and oxidation state; and
B. Know Atomic Orbital Theory.	Prediction of variable valence and oxidation state, Prediction of molecular shape via hybridization, and Dependence of physical properties based upon shape.

VII. SAFETY

The student will practice safety in activities, recognize potential hazards, and be acquainted with basic safety precautions.

SCIENCE LEARNER OUTCOMES

PHYSICS

I. OBSERVATION AND MEASUREMENT

Upon completing the curriculum in physics, the student should be able to:

A. Weigh and measure objects using the metric system;

B. Make conversions within and between the metric and the U. S. system of units;

C. Roughly estimate the sizes and masses of objects using the metric system;

D. Accurately make linear graphs from data and interpret the results; and

E. Be familiar with and appreciate very large and very small numbers.

II. CLASSIFICATION

Upon completing the curriculum in physics, the student should be able to:

A. Know and compare basic constants in nature such as pi and e;

B. Select the proper formula and apply it correctly to calculate results of perimeters, areas, and volumes;

C. Given simple information in story problem form, label the variables, select the proper formula, solve for the unkown, substitute the appropriate numbers, and obtain the answer for work involving distance, rate, and time; force, mass, and acceleration; and acceleration, change of velocity, and time;

D. Compare the major minerals and rocks and classify them as igneous, metamorphic, or sedimentary;

E. Compare the planets in the solar system and classify them as jovian or terrestrial planets; and

F. Investigate, classify, and compare alternative energy sources and means of electrical energy production, and perform dimensional analysis on various problems to determine the units for an unknown quantity or value.

III. EXPERIMENTATION

Upon completing the curriculum in physics, the student should be able to:

A. Receive as much hands-on laboratory work as possible to gain confidence in lab work;

B. State the scientific method and apply it to designing and conducting an experiment;

C. Use measuring instruments such as balances, stopwatches, and meter sticks, and competently operate a pocket calculator; and

D. Investigate energy forms and changes in the laboratory.

IV. INTERPRETATION

Upon completing the curriculum in physics, the student should be able to:

A. State the number of digits which are significant in an experimental result;

B. Examine, compare, and discuss the major sources of error in an experiment;

C. State whether their experimental results are reasonable;

D. Given data from an experiment s/he has performed, relate the data to the appropriate equation;

E. Given a table of numerical data, select the graph which shows the correct relationship between the variables; and

F. Interpret current information from space exploration based on his/her knowledge of the solar system.

V. COMMUNICATION

Upon completing the curriculum in physics, the student should be able to:

A. Develop and apply reading, writing, and mathematical skills to understand and solve scientific problems;

B. Write a brief report explaining an experiment and discussing the results;

C. Given a diagram, select the appropriate written descriptions of events depicted;

D. Communicate fluently in mathematics at the highest level possible, at least at Algebra I; and

E. Given a simple story problem, translate the written information into an appropriate diagram, list the variables given, identify the variable sought, select

the appropriate formula from those discussed in class, substitute the given information, and obtain the correct solution.

VI. MODELING

Upon completing the curriculum in physics, the student should be able to:

A. Draw and label a model of the solar system;

B. Sketch and discuss the Bohr model of the atom;

C. Appropriately scale numbers on a graph;

D. Calculate the sizes for a scale model of an object of given size;

E. Identify the causes and effect of forces acting on the earth's atmosphere, hydrosphere, and lithosphere;

F. Develop a model of convection and show how convection affects the weather;

G. Practice mathematical modeling using a computer;

H. Kinetic-Molecular theory as a model and predictor of behavior;

I. Models of light and evidence to support one or the other;

J. Draw a simple free-body diagram relating a mass with forces acting on it;

K. Work with Newton's Universal Law of Gravitation;

L. Work simple problems in mechanics involving conversion laws (energy, momentum);

M. Define "pressure" and solve simple problems involving Charles Law, Boyles Law, and Universal Gas Law;

N. Describe how velocity is related to displacement, and how acceleration is related to velocity;

O. Work with force, velocity, and displacement vector diagrams (Though trigonometry is not a prerequisite course, the student should be introduced to the three basic trigonometry functions of sine, cosine, and tangent.); and

P. Work simple angular motion and displacement problems.

VII. SAFETY

Upon completing the curriculum in physics, the student should be able to:

A. Appreciate the hazards of electric shock in the lab and in the home; and

B. State how to make safe use of all laboratory materials, equipment, and activities s/he experiences.

SCIENCE COMMITTEE

Science Committee Chairman: Professor Stuart Burchett
Southwestern Oklahoma State University

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Professor Ann Cavallo
Professor Michael Abraham

Oklahoma State University
Professor Jerry Wilhm
Professor Elizabeth Holt

University of Central Oklahoma
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OKLAHOMA
CURRICULUM
COMMITTEE

HISTORY

Learner Outcomes for High School Graduation

OKLAHOMA HISTORY

I. Students will demonstrate a knowledge of the interrelationships among individuals and their environment in the state of Oklahoma, the United States, and the world, in the past, present, and future.

A. The student will trace the economic development of Oklahoma's natural and human resources.

1. The student will describe the environment, locate landforms, and recognize the major natural resources within the state.

2. The student will trace the development of the cattle and farming industries in Oklahoma.

3. The student will explain the evolution of the market economy in Oklahoma.

4. The student will recognize the impact of the "boom and bust" cycle on the economic development of Oklahoma.

B. The student will describe significant aspects of Oklahoma's social and cultural development of the state.

1. The student will recognize and describe the history of the performing, visual, and literary arts of Oklahoma.

2. The student will trace the growth and influence of social and religious groups in Oklahoma.

3. The student will explore the history and culture of Oklahoma by using community and family resources.

4. The student will identify important individuals in Oklahoma's social and cultural heritage.

II. Students will analyze the fundamental beliefs which resulted in the Declaration of Independence, the United States Constitution, and the Bill of Rights, and which form the basis of the constitutional system of government of the United States.

A. The student will describe the development of constitutional government in Oklahoma.

1. The student will trace the development of constitutional government among the Indian tribes of Oklahoma and the movement for the all-Indian state of Sequoyah.

2. The student will explain the movement for single statehood and the impact and influence of the Constitutional Convention.

III. Students will use the knowledge, beliefs, and skills such as thinking, decision making, and problem solving, learned in the social studies as a basis for action in a democratic society.

A. The student will evaluate the impact citizens have had in shaping the political and social events in Oklahoma.

1. The student will analyze the major issues that have shaped state politics since 1907.

2. The student will identify political trends, major events, and personalities affecting the development of Oklahoma.

IV. Students will analyze the diversity and commonality among nations, races, cultures, and institutions.

A. The student will evaluate the social, economic, and political development of American Indians from prehistoric settlement through modern times.

1. The student will identify and describe significant phases of prehistoric cultures.

2. The student will trace the movement of tribal groups into Oklahoma.

3. The student will describe the contrasting cultural values of American Indians and Euro-Americans.

4. The student will trace the transition of the Indian Territory from communally-owned land to privately-owned land.

5. The student will describe current tribal organizations.

6. The student will identify the contributions of individual American Indians to Oklahoma's economic, political, and cultural development.

B. The student will identify major ethnic groups and minorities and trace their contributions throughout the history of Oklahoma.

1. The student will describe both European and American exploration of and claims to the territory that would become Oklahoma.

2. The student will describe the role of women in the economic, political, and social development of the state.

3. The student will trace immigration, settlement patterns, and cultural, political, and economic contributions of African-Americans, Hispanic-Americans, Asian-Americans, and other distinctive ethnic groups in Oklahoma.

4. The student will identify ethnic and minority individuals who have contributed to the economic, political, and social development of the state.

UNITED STATES HISTORY

I. Students will demonstrate a knowledge of the interrelationships among individuals and their environment in the state of Oklahoma, the United States, and the world, in the past, present, and future.

A. The student will identify and describe the characteristics and major factors contributing to the growth of the American economy.

1. The student will recognize the economic conflict between the industrial North and the agrarian South which led to the Civil War.

2. The student will describe the growth of the West and analyze its effect on the American way of life.

3. The student will explain the impact of the Industrial Revolution on the United States.

4. The student will analyze the causes and effects of the Great Depression.

5. The student will trace the changing role of government through New Deal policies.

B. The student will identify the political growth, major events, and personalities affecting the development of the United States.

1. The student will identify and analyze major events, causes, effects, and the role of significant personalities of the Revolutionary War.

2. The student will trace the growth of sectional conflict between 1820 and the Civil War: Missouri Compromise, the Compromise of 1850, the Kansas-Nebraska Act, and the Dred Scott Decision.

3. The student will analyze the significance of the Civil War and Reconstruction.

C. The student will analyze events and identify personalities that influenced the development of United States foreign policy.

1. The student will compare and contrast the early development of foreign relations with England and France.

2. The student will explain how Manifest Destiny determined the territorial expansion of the United States in the Louisiana Purchase, the Texas Annexation, the Mexican Cession, and the Oregon Territory.

3. The student will identify and analyze the major events leading to America's emergence as a world power.

4. The student will recognize the events leading to American involvement in World War I and analyze the effects of the war.

5. The student will analyze the causes and effects of World War II.

6. The student will analyze international tensions in postwar America.

7. The student will describe American involvement in major international incidents and military conflicts of the postwar era.

II. Students will analyze the fundamental beliefs which resulted in the Declaration of Independence, the United States Constitution, and the Bill of Rights, and which form the basis of the constitutional system of government of the United States.

A. The student will analyze the creation and judicial interpretations of the historical documents on which our government is founded.

1. The student will examine documents which contributed to the establishment and growth of the United States government.

2. The student will analyze major Supreme Court decisions which have shaped our constitutional system of government.

III. Students will use the knowledge, beliefs, and skills such as thinking, decision making, and problem solving, learned in the social studies as a basis for action in a democratic society.

A. The student will analyze the actions taken by the United States in its domestic and foreign policies.

1. The student will examine the impact of domestic and foreign policy decisions.

2. The student will evaluate the major energy and environmental issues facing society including governmental intervention policies.

IV. Students will analyze the diversity and commonality among nations, races, cultures, and institutions.

A. The student will identify and describe events, trends, and movements which shaped American social and cultural development.

1. The student will describe and evaluate the cultures, contributions, and achievements of the Native Americans.

2. The student will identify the reasons for French, Spanish, and English colonization of North America.

3. The student will describe the differences among New England, Middle, and Southern colonies emphasizing the government, culture, religion, and economy of each.

4. The student will analyze social reform movements which began during the late nineteenth century.

5. The student will describe social events and identify significant personalities which contributed to the advancement of civil and human rights.

6. The student will identify all major ethnic groups in the United States (including African-Americans, American Indians, Hispanic-Americans, and Asian-Americans) and trace their political, economic, and cultural contributions throughout the history of the United States.

7. The student will describe the role of women in the development of the United States.

8. The student will recognize American contributions in the fine arts and humanities.

COLLEGE AND
UNIVERSITY
FACULTY
COMMITTEE

HISTORY

Learner
Outcomes for
College Entry

HISTORY LEARNER OUTCOMES

OKLAHOMA HISTORY

I. The student will demonstrate a knowledge of the interrelationships among individuals and their environment in the State of Oklahoma, the United States, and the world, in the past, the present, and the future.

A. ECONOMIC DEVELOPMENT OF OKLAHOMA'S NATURAL AND HUMAN RESOURCES

Upon completing the curriculum in Oklahoma history, the student should be able to:

1. Describe the environment, locate land forms, and recognize the major natural resources within the state;

2. Trace the development of the cattle and farming industries in Oklahoma;

3. Describe the impact of government spending, industrialization, natural resource exploitation, tourism, and transportation in the Oklahoma economy; and

4. Recognize the impact of the "boom and bust" cycle on the economic development of Oklahoma.

B. SIGNIFICANT ASPECTS OF OKLAHOMA SOCIAL AND CULTURAL DEVELOPMENT

Upon completing the curriculum in Oklahoma history, the student should be able to:

1. Recognize and describe the history of the performing, visual, and literary arts of Oklahoma;

2. Trace the growth and influence of social and religious groups in Oklahoma;

3. Explore the history and culture of Oklahoma by using community and family resources; and

4. Identify important individuals in Oklahoma's social and cultural heritage.

II. The student will analyze the fundamental beliefs which resulted in the Declaration of Independence, the Unites States Constitution, and the Bill of Rights, and which form the basis of the constitutional system of government of the United States.

A. THE DEVELOPMENT OF CONSTITUTIONAL GOVERNMENT IN OKLAHOMA

Upon completing the curriculum in Oklahoma history, the student should be able to:

1. Trace the development of constitutional government among the Native American tribes and the movement for the State of Sequoyah;

2. Explain the movement for single statehood and the impact and influence of the Constitutional Convention.

B. NATIVE AMERICAN GOVERNMENT

Upon completing the curriculum in Oklahoma History, the student should be able to:

1. Identify modern forms of Native American tribal government.

III. The student will use the knowledge, beliefs, and skills such as thinking, decision making, and problem solving, learned in the social studies as a basis for action in a democratic society.

A. APPLIED STUDIES

Upon completing the curriculum in Oklahoma History, the student should be able to:

1. Choose the right map for a particular purpose, i.e., elevation map to determine altitude; rainfall map in studying climate;

2. Judge a region's trade after study of maps, i.e., showing transportation routes, manufacturing areas, forest, grazing areas;

3. Use a variety of maps successfully--political, physical, economic, and special feature maps;

4. Transfer abstract knowledge to concrete places and things while taking field trips to museums and historic sites; and

5. Conduct primary research, utilizing local sou materials, i.e., oral history and newspapers.

B. IMPACT OF CITIZENS ON SHAPING POLITICAL AND SOCIAL EVENTS IN OKLAHOMA

Upon completing the curriculum in Oklahoma History, the student should be able to:

1. Identify the major issues that have shaped state politics since 1907; and

2. Identify political trends, major events, special interest groups, and personalities affecting the development of Oklahoma.

IV. The student will analyze the diversity and commonality among nations, ethnic groups, cultures, and institutions.

A. SOCIAL, ECONOMIC, AND POLITICAL DEVELOPMENT OF NATIVE AMERICANS

Upon completing the curriculum in Oklahoma History, the student should be able to:

1. Identify and describe significant phases of prehistoric cultures;

2. Trace the movement of tribal groups into Oklahoma;

3. Describe the contrasting values of Native American cultures with those of African Americans, Asian Americans, as well as those of European Americans;

4. Trace the transition of the Indian Territory from predominantly communally-owned land to increased amounts of privately-owned land;

5. Describe current tribal organizations; and

6. Identify the contribution of individual Native Americans to Oklahoma's economic, political, and cultural development.

B. CONTRIBUTIONS OF MAJOR ETHNIC GROUPS AND MINORITIES THROUGHOUT OKLAHOMA HISTORY

Upon completing the curriculum in Oklahoma History, the student should be able to:

1. Describe both European and American exploration of and claims to the territory that would become Oklahoma;

2. Describe the role of women in the economic, political, and social development of the state;

3. Trace immigration, settlement patterns, and cultural, political, and economic contributions of African Americans, Hispanic Americans, Asian Americans, and other distinctive ethnic groups in Oklahoma; and

4. Identify ethnic and minority individuals who have contributed to the economic, political, and social development of the state.

HISTORY LEARNER OUTCOMES

UNITED STATES HISTORY

Synthesis of Proposed Corrections to Learner Outcome Survey

INTRODUCTION

The following revisions should not be interpreted to mean that we expect detailed knowledge of all of these objectives, but that there should be enough awareness of this information so that the student will be able to expand and deepen his/her knowledge in our American history survey courses.

Also concerning the outcomes, it would be better if they were given a thoughtful chronological organization from the Age of Discovery to the present, and that important personalities and political, economic, social, and cultural matters be discussed chronologically. This way students will be able to grasp the continuity of American history and the evolutionary nature of change in America. It is for this reason that some of our revisions are repetitive, because we tried to use the existing format.

SECTION I

A. Either in this section, or in I.B.2, explicit mention should be made of the economic and political effects of the institution of slavery, and the ideological conflict which developed over slavery's expansion as a causal factor in the Civil War. Slavery should be studied as a social and cultural institution with emphasis on the impact of racism on American thought.

Objective I.A.2 should be sharpened. For example: "Analyze U.S. policies and conduct in the conquest of the Native American and Hispanic people in the West. Also evaluate federal policies relative to land, railroad construction, and the use of natural resources."

The student should have a knowledge of the role of state and federal government intervention in the industrialization process.

The student should understand the major factors contributing to the rise of industrial capitalism in the U.S. from 1865 on and be familiar from a conceptual standpoint with the various social, political, and cultural responses to this economic transformation. S/he should grasp the negative impact of early industrialism on the urban poor, consumers and farmers and their response in Populism and Progressivism, etc.

The student should have an understanding of the factors leading to the rise of labor unions and the role of the labor movement in the development of modern society.

The student should have a knowledge of major economic, political, social, and cultural trends characterizing life in the 1920s, and be familiar with the underlying economic flaws in the period that led to the Great Depression.

The student should have a knowledge of the major developments of the New Deal period, including the far reaching political realignments that took place during the Depression era.

The student should understand the impact of the New Deal policies on American economic development.

A section should be added to list important issues of the post-New Deal era, including controversies over taxing and spending, the impact of the Federal Reserve system in recent years in dealing with inflation and inducing inflation in some cases, and on the impact of regulation on economic growth.

The student should have a knowledge of the 1950s as a consumer decade and the accompanying social, political and economic, and cultural changes which established the character of the "post-industrial society."

This section should discuss the causes and effects of the "Great Society" programs of the 1960s. Also, the details of the Civil Rights Movement of the 1950s and 1960s should be highlighted.

B. The student should have a knowledge of the political, social, economic, and intellectual aspects of the "Age of Discovery."

The student should have a knowledge of the significant events, trends, and developments in the thirteen original colonies--especially the development of religious pluralism among the thirteen colonies.

The student should be familiar with the background factors leading to the American Revolution, and the ideas that influenced the colonists. The social, political, economic, and cultural impact of the revolution on the developing new nation should be understood. The student should understand the motivations of the Founding Fathers and the nature of the Constitution.

The student should have a knowledge of the major events of the Federalist Era (1789-1801) with particular attention to the development of the two-party system.

Analyze the beliefs of the major political parties throughout their history and the reasons behind their beliefs. Understand the positive and negative roles they have played in American political life from independence to the present.

Respondents recorded concerns that this section should cover events and changes in the nation throughout the period from the "Virginia Dynasty" through the "Age of Jackson," with awareness of the growing concern over slavery and women's rights.

The student should have an understanding of the tremendous human cost of the Civil War by relating the casualties in terms of present day population figures.

I.B.3 should emphasize the impact of the Civil War Reconstruction period, particularly the multitude of issues coming out of the period that influenced the nation for generations to come.

The student should have a knowledge of the significant events of the Progressive Era, a familiarity with the various reforms that constituted that movement, and the major contributions of the three progressive presidents. The student should also recognize the emergence of women's rights as a major issue.

The student should have knowledge of the political, economic, and social developments of the 1970s, especially the pervasive impact of Watergate on the American psyche.

The student should have a knowledge of the significant societal changes at all levels which characterized American society in the 1980s and be able to make some connection with those changes and earlier developments since the end of World War II.

C. Objective I.C.2 should read, "The student will explain and evaluate the ways in which the concept of 'Manifest Destiny' was used to justify the territorial expansion of the U.S. in the nineteenth century," so as not to appear to "legitimize Manifest Destiny" ideology.

The student should have an understanding of the development of Imperialism, and the political controversy which developed in the country around the issue of the U.S. having taken colonies in the Spanish-American War. The student should also be aware of the major periods of U.S. - South American relations, i.e., the age of intervention, Good Neighbor policy, etc.

The student should have a knowledge of the U.S. role in World War I, both before and during intervention, and its subsequent role in the peace talks that followed.

The student should have a knowledge of the role played by the U.S. in World War II, the war's impact on American society, and the nation's emergent role as an active global power.

The student should be familiar with significant events, trends, and developments between 1945 and 1950 which turned the U.S. from a passive stance to an active one in global affairs.

The student should be able to demonstrate the basic contrast in American foreign policy between the post-World War I and post-World War II periods, so as to understand how the nation learned from earlier mistakes.

The student should have a knowledge of the internal political and economic effects of the Cold War on American society.

The student should have a knowledge of the U.S. involvement in the Vietnam War and its overwhelming impact on American society.

SECTION II

A. The student should understand the prevalent European philosophical movements (particularly the Enlightenment) which influenced the thinking of the leading figures of the American Revolution and thus influenced the development of American republican institutions.

The student should have a knowledge of the Confederation period and its connection to the events leading up to the Constitutional Convention.

The student should be familiar with the major events, ideas, and compromises of the Constitutional Convention and know the specific powers invested in each branch of the government.

The student should understand how the colonial experience of religious conflict and intolerance affected the thinking of the framers of the Constitution.

The student should understand the limitations on majority rule implicit in the Bill of Rights, and the importance this has had on the development of American democracy.

SECTION III

The student will analyze the conflicting ideas associated with economic, political, social, and cultural conflict throughout American history.

SECTION IV

A. Section should be revised to include specific reference to European-Americans, including the debates about assimilation and ethnic pride associated with immigrants from southern and eastern Europe who arrived after 1890. Students should understand the discrimination that these immigrants often endured and the role that they played in industrial development.

IV.A.7 should be made more specific so as to include a number of outstanding female personalities and an awareness of the contrasting perspectives of radical and moderate feminists as well as anti-feminists.

The student should be familiar with the major trends and developments of the Civil Rights Movement of the 1950s and 1960s including gains, losses, and the movement's impact on the women's rights movement as well as other minority rights struggles.

The student should have a knowledge of the role of religion, populism, and other movements on the political reforms of the late nineteenth and early twentieth centuries.

BASIC LEARNING SKILLS

Beyond the informational base, it was suggested that outcomes should include the learning of the following fundamental skills:

A. To read critically and analytically;

B. To acquire information by listening and taking notes;

C. To use a library to locate and acquire information;

D. To write a short synopsis of an oral or written body of information;

E. To interpret and use pictures, charts, graphs, tables, maps, time lines, and primary resources;

F. To evaluate and synthesize information on the same subject from several different sources;

G. To distinguish history and biography from historical and biographical fiction;

H. To recognize and understand the meaning and significance of historical interpretations;

I. To organize information in a logical and consistent manner;

J. To communicate ideas and information clearly and effectively in both written and oral form; and

K. To work effectively within a group to set and achieve group goals.

ATTITUDINAL VALUES

The student should demonstrate an acquaintance with and personal evaluation of the following attitudes and values.

A. An objective, critical view toward political, economic, and social problems and issues;

B. An openness and sensitivity toward and toleration of other cultural and ethnic groups;

C. An appreciation of the natural environment of the United States;

D. An informed participation in the affairs of the student's community, state, nation, and world;

E. An objective understanding of the role of philosophies and ideas, including religious, political, economic, and societal philosophies and ideas of the United States;

F. An understanding of basic human and personal needs and dignity;

G. Cultivation of intellectual curiosity and independence; and

H. An understanding of the importance of the Constitution, the Bill of Rights, political parties and organizations, and other fundamental documents and institutions of American federal (local, state, and national) governments.

HISTORY COMMITTEE

History Committee Chairman: Professor John Chiodo
University of Oklahoma

University of Oklahoma
Professor Vivien Ng

Oklahoma State University
Professor Roger Biles
Professor Ronald Petrin

University of Central Oklahoma
Professor James Baker
Professor Diane Kremm

East Central University
Professor Marvin Kroeker
Professor Francis Stackenwalt

Northeastern State University
Professor William Corbett
Professor Brad Agnew

Northwestern Oklahoma State University
Professor Donovan Reichenberger
Professor Walter Johnson

Southeastern Oklahoma State University
Professor Ingrid Westmoreland
Professor Ed Byrd

Southwestern Oklahoma State University
Professor Roger Bromert
Professor Sara Chapman

Cameron State University
Professor Charles Smith
Professor Ralph Blodgett

Langston University
Professor James Showalter
Professor Lawrence Grear

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Professor Raymond Knox
Professor Harrell Bright

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Professor Ronnie Robison
Professor Chris Butler

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Professor Rex Morrell
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Professor Rod Kramer
Professor George Largent

Northern Oklahoma College
Professor Ray Shreck
Professor Roy Chaney

Oklahoma City Community College
Professor Ray McCullar
Professor Peter Wright

Rogers State College
Professor Gary Easley

Rose State College
Professor Phil Vaughan
Professor Lee Carter

Seminole Junior College
Professor Jim Fowler
Professor Richard Wood

Tulsa Junior College
Professor Gary Thompson
Professor Virginia Bellows

Western Oklahoma State College
Professor Mickey Graham
Professor George Graham

APPENDICES

OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION

500 Education Building
State Capitol Complex
Oklahoma City, Oklahoma
73105-4503

April 3, 1992

To: Presidents of Institutions in the State System

Dear Presidents:

Re: Faculty Nominees to Serve on Curriculum Committees

Recently two related core curriculum issues have surfaced which need faculty expertise. The Council on Instruction High School Core Curriculum Committee and the joint common school and college faculty committee studying the use of applied courses to meet the high school core curriculum requirements for college entry both indicate that those of us in higher education have specified the high school courses that are required for college entry, but have not indicated what a student must be able to do and know to succeed in the first collegiate level course. This lack of knowledge specificity has resulted in varying levels of content and rigor in these core courses as they exist in high schools across the state. Higher education needs to clearly communicate to the public schools what academic competencies it requires for admission to state colleges and universities. A similar problem exists in higher education in some of the basic core curriculum areas. It appears that in some disciplines the course objectives may vary considerably from institution to institution.

Thus, you are asked to nominate two faculty members from the following disciplines to serve on the respective committees: English, mathematics, history, and science.

The respective charges of the committees will be as follows:

1) Beginning with the discipline of mathematics, faculty members will be asked to convene for a conference (length will be one to one and one-half days), for the purpose of developing the student learning objectives for college algebra. It is hoped that at the end of the conference, faculty will have come to consensus on what all students who successfully complete college algebra should know and be able to do. Assuming such agreement and the implementation of such course objectives in each college algebra course, student success in college algebra should increase. It should also facilitate transfers between institutions. It is important to note that faculty will not be asked to use the same textbooks, supplemental materials, course syllabus, etc. Only the general learning outcomes will be identified.

   If possible, please identify mathematics faculty members who will be available during the months of June and/or July.

Depending on the success of this first effort, your faculty nominees in the other three disciplines will be asked to meet during the fall semester to develop common student learning objectives for the first college-level course in the respective disciplines. This initiative has the support of the Council on Instruction.

2) A smaller committee will be formed from each of the four disciplinary groups to develop written competencies for students entering college algebra, freshman composition, and one of the early collegiate science courses. The faculty committee's work will also include reviewing the respective discipline's learning competencies which have been adopted by the State Board of Education consistent with H.B. 1017. This review will be for the purpose of determining their respective levels of content and rigor, particularly as it relates to college admission requirements.

Please submit the faculty nominees by **Monday, April 27**. Both of these faculty committees have extraordinary opportunities for impacting what our students are taught and how well they succeed. Your cooperation and support of these committees are most appreciated.

Sincerely,

Hans Brisch
Chancellor

HB/sh

Systemwide Faculty Meeting
Learner Outcomes Review
July 16, 1992

GOAL: *H.B. 1017 established the Oklahoma Curriculum Committee which developed student learner outcomes in the respective courses/disciplines. Once implemented, these outcomes will guide teacher instruction and student learning in high schools. Given higher education's limited involvement in the development of the learner outcomes, it is important that college and university faculty review the outcomes to evaluate both the content and rigor, particularly as it relates to college entry. Additionally, recent studies and preliminary student assessment results indicate that many students entering higher education are not prepared for college-level work. Thus, it is imperative that higher education faculty designate those subject matter competencies required for college work, and that, in turn, those competencies be formally and systematically communicated to the common schools and the public.*

PROCESS: *The institutional presidents submitted names of faculty members from the disciplines of English, mathematics, science, and history to evaluate the learner outcomes as developed by the Oklahoma Curriculum Committee. The faculty are also asked to specify those discipline competencies required for entering students to successfully complete introductory college-level work.*

Systemwide Faculty Meeting
Learner Outcomes Review

Oklahoma State Regents for Higher Education
State Capitol, Oklahoma City

Oklahoma State Regents for Higher Education

Systemwide Faculty Meeting
Learner Outcomes Review

Thursday, July 16, 1992
University of Oklahoma Health Sciences Center • College of Health Building
Oklahoma City, Oklahoma

8:30 - 9:30 a.m.	Arrival *Shuttle running from parking lot D to the College of Health Building*
9:00 a.m.	Registration
9:30 a.m.	Welcome Dr. Hans Brisch, Chancellor *Oklahoma State Regents for Higher Education*
9:45 a.m.	Opening Comments Dr. John Feaver, Chairman *Council on Instruction* Vice President, Academic Affairs *University of Science and Arts of Oklahoma*
10:00 a.m.	Outlining Process for the Day's Events Dr. Cindy Ross, Associate Vice Chancellor *Oklahoma State Regents for Higher Education*
10:15 a.m.	Break
10:30 a.m.	Development of High School Learner Outcomes Dr. Nancy O'Brian, Chairman *Oklahoma Curriculum Committee*

11:30 a.m.	Lunch (See reverse) *Shuttle running between College of Health Building and parking lot D*
1:00 p.m.	Faculty Break-Out Groups by Discipline • English - Auditorium • Science - Room 220 • Math - Room 320 • History - Room 420
3:20 p.m.	Break
3:35 p.m.	Group Reports, Wrap-Up, and Closing Remarks
4:00 p.m.	Departure *Shuttle running between College of Health Building and parking lot D*