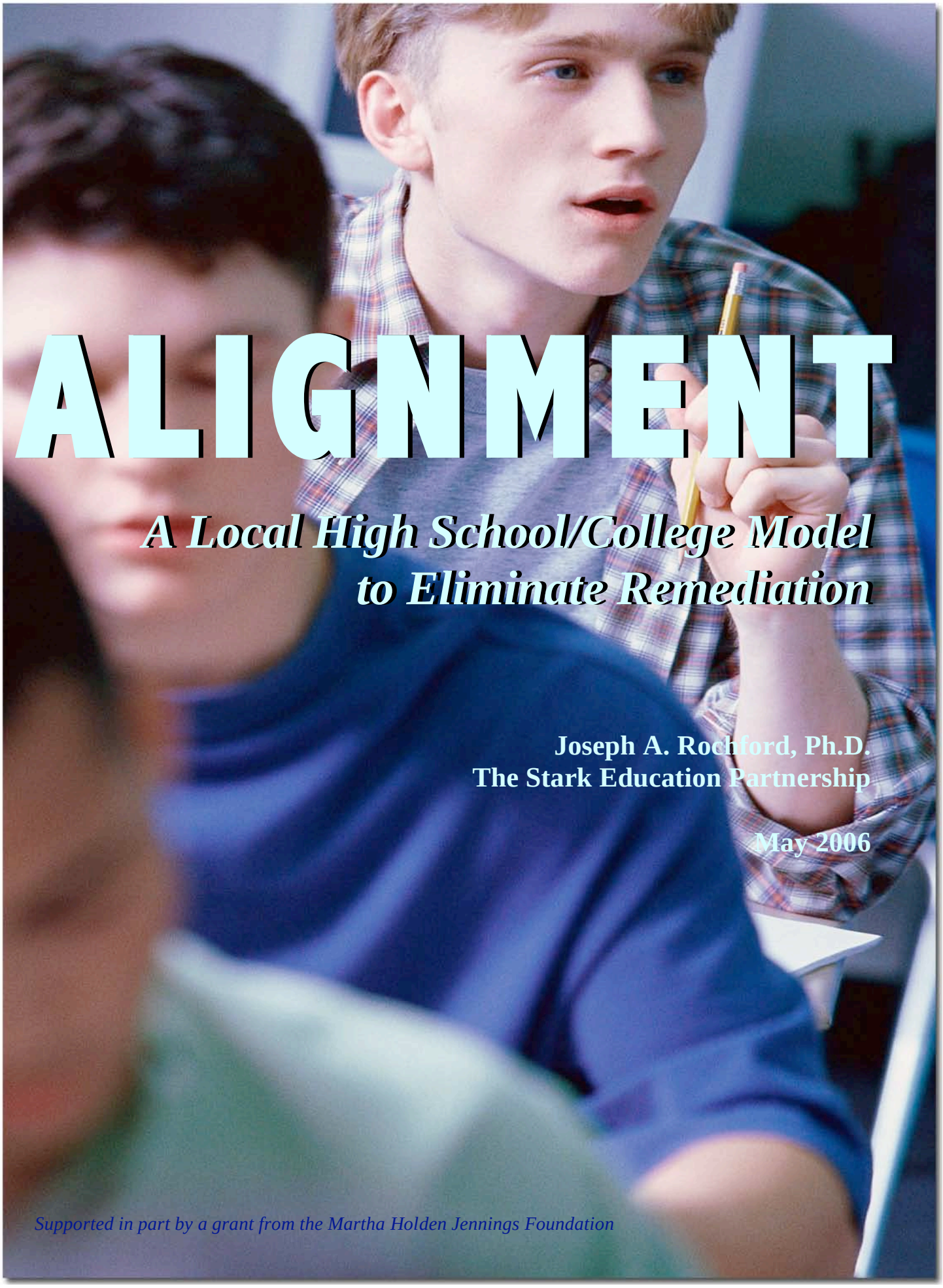

ALIGNMENT

A Local High School/College Model to Eliminate Remediation

Joseph A. Rochford, Ph.D.
The Stark Education Partnership

May 2006

Supported in part by a grant from the Martha Holden Jennings Foundation

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Supported in part by a grant from the Martha Holden Jennings Foundation *In cooperation with* ACT, Inc.

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Abstract and Executive Summary

This study sought to answer the following questions:

- To what extent does the COMPASS/ESL Test reflect Ohio Academic Content Standards in Math, English and Writing at the 7th through 12th grade level?
- To what extent does the COMPASS/ESL Test reflect the skills and competencies needed in entry level or first year coursework at Stark State College of Technology?
- What is the degree of alignment between Ohio Academic Content Standards and remedial and entry level or first year coursework at Stark State College of Technology?
- To what degree are both high school and college courses placing the same emphasis on those standards, i.e. the degree of alignment?

A team of faculty from both Stark State College of Technology (SSCT) and the Canton City Schools (CCS) reviewed their respective curricula opposite the Ohio Academic Content Standards, assisted by a crosswalk indicating which of those standards were measured by COMPASS/ESL a widely used college placement test.

This study found that the skills needed for first year SSCT courses in math and English language arts (ELA) and the CCS coursework from 7th to 12th grade, on the basis of Ohio Academic Content Standards indicators are more closely aligned to each other than what is reflected by the COMPASS/ESL test and diagnostics measures.

In ELA courses and math, the COMPASS/ESL measures far fewer indicators than are contained in either CCS or SSCT courses. The lone exception is in mathematics at the 11th and 12th grade where COMPASS/ESL measures more indicators than are reflected in either CCS or SSCT courses.

This project created what the researcher believes to be a viable charting and comparison measure to assist in future explorations. While the degree of alignment between CCS and SSCT courses proved to be promising and COMPASS/ESL showed to be a viable measure, this study indicates that high school teachers and college professors alike must continue to look at alignment issues together, determining what they mean to each respective institution. Findings of the Ohio Board of Regents on the efficiency of the complete academic core in eliminating high levels of remediation are also supported.

The next step in the process will involve the formation of joint professional development opportunities centered on this document for both CCS and SSCT faculty. This process will begin with the ECHS faculty, but will be open to all instructors at each institution.

It is believed that others throughout the state can replicate and benefit from this process. In this regard, a downloadable blank charting template, as well as this report, will be web posted at www.edpartner.org for use by other districts and colleges.

Introduction

After days of unseasonably mild weather, a late night snowfall had blanketed Columbus on January 18, 2006 as representatives from across the state had gathered for the annual ACT statewide conference. Today they would hear from a variety of speakers on issues of high school to college transition. To these representatives, drawn largely from Ohio's higher education community, there were few surprises left. Ohio's "bulldog" grip on 39th place in the union on the percentage of its population with a bachelor's degree had remained unchallenged for years. Everyone understood the problem. Yet, a presentation by Dr. Darrell E. Glenn, Director of Performance Reporting for the Ohio Board of Regents would cause some shudders. Glenn talked about what he termed "some rough plumbing: the leaky college pipeline in Ohio" and the results were not good:

- *Ohio has on average about 170,000 9th graders, of these, about 70% graduate high school*
- *Of these 120,000 high school grads, about 60% attend college*
- *Of the 72,000 college freshmen, about 50% earn a degree in 6 yrs (= 36,000 college graduates)*

The end result, according to Glenn is only about 21% of 9th graders are likely to earn a college degree within 10 years. A major contributing factor to this lack of success is college remediation rates, literally those non-credit bearing courses which students must take upon entering college to bring them up to speed to do college level work. In Ohio 41% of young first-time freshmen take remedial math or English; 33% take remedial math and 23% take remedial English.[1]

Glenn's comments came nearly six months after this project was first envisioned as an outgrowth of a discussion over a Memorandum of Understanding between Stark State College of Technology and the Canton City Schools during the establishment of a new Early College High School at the Timken Campus. Further prompting this was sizable growth in the number of other Timken High School students going on to college.

In 2002, Timken Senior High School graduated 162 seniors of whom 31 or 19% enrolled in college in the state of Ohio the following fall. The average ACT score was 20. Of these 31 students, 24 or 79% required remediation. In the fall of 2003, only 18 or 59% still persisted at any Ohio institution.[2] By comparison, the Timken High School ACT scores are higher than the state average of 19 for the Major City, Extremely High Poverty category in Ohio, yet has a far higher

[1] From: *Ohio's High School to College Transition Outcomes.* Columbus, Ohio: ACT State Organization 2006 Annual Conference January 18, 2006. A power point presentation by Dr. Darrell E. Glenn, Director of Performance Reporting Ohio Board of Regents.

[2] Making the Transition from High School to College in Ohio 2004. Columbus, Ohio: The Ohio Board of Regents

remediation rate than the state average of 57% in the same category. The persistence rate at the state level for this category is 71% which is likewise substantially higher.[3]

In 2005, however, Timken witnessed a substantial increase in the college going rate to approximately 37%. This was due to efforts by staff, coupled with an increased awareness in the Canton City Schools of the necessity to prepare all students for college. This increase was also aided by the presence of an Ohio College Access Network (OCAN) initiative supplying a post secondary advisor and by Timken's increased emphasis on the PSEO option with Stark State College of Technology.

Opening in June of 2005, two factors increased the college going rate of the Early College High School on the Downtown Campus of Stark State College of Technology on the Timken Campus (ECHS): Enrolling 98 Timken students, and an anticipated growth to 50 in the state's Post Secondary Enrollment Option (PSEO) for the 2005-06 academic year. ECHS itself will increase enrollment by 100 a year to 400.

Critical to these efforts is the passing of the COMPASS/ESL test. COMPASS/ESL is the "gatekeeper" both in terms of admission to ECHS and PSEO options and in eliminating the need for remedial courses. It will likely be the "gatekeeper" as well if the OhioCore is approved by the legislature.

Both CCS and SSCT faculties need a clear understanding of what the COMPASS/ESL test measures, how it reflects in entry level and first year college courses, and what Ohio Academic Content standards are reflected in both the test and the courses and what additional skills and competencies are warranted.

As students enter ECHS between 8th and 9th grade; PSEO students enter from 9th to 12th grade; and traditional seniors are targeted for admissions, these understandings need to include the spectrum of the content standards from 7th to 12th grades, literally from the beginning of middle school through high school. Our local situation parallels what has been a statewide concern.

> *No clear definition of "college-level" work exists. In the mathematics assessment, for example, a 40-point spread separates the college with the highest cut-off scores for developmental versus college-level courses from the college with the lowest cut-off score…Colleges and universities have yet to align their entrance standards with the new K-12 exit standards. With the upgrade in K-12 standards, whole new definitions of developmental versus college-level work may be needed.*[4]

There are no statewide standards for college placement in reading, writing, and math even though such a course of action was recommended to the Ohio Articulation and Transfer Council in 2003. This followed in the wake of a previous committee report in 1997[5] which found that not

[3] (2004) Making the Transition from High School to College in Ohio 2004: A Statewide Perspective, Columbus, Ohio: The Ohio Board of Regents.
[4] Ohio Board of Regents (2003*)* Repor**t** to the Ohio Articulation and Transfer Advisory Council: Review of the Ohio Articulation and Transfer Policy Submitted by the Policy Review Committee, p.10.
[5] Zimpfer, N. & Harris, G. (1997). A Total Approach Improving College Preparation in Ohio. Columbus, Ohio: Secondary and Higher Education Remediation Advisory Commission, Ohio Board of Regents**.**

only was there no agreement on placement standards but that institutions used a wide variety of placement mechanisms to determine the need for remedial coursework on the part of incoming students.

One of the chief mechanisms in use in Ohio, however, is standardized placement tests such as the COMPASS/ESL test or Accuplacer. Increasingly, such tests are being used in another role. The emergence of the Early College High School (ECHS) initiative in Ohio and the continuing use of the Postsecondary Enrollment Option (PSEO) have seen many institutions such as Stark State College of Technology mandate that students take the COMPASS/ESL test as a qualifier to take entry level, or first year, math and English courses. This requirement holds for all state institutions, particularly branch or regional campuses where open enrollment is the norm. Now Governor Taft's OhioCore proposal presents the real possibility of students earning up to twelve hours of college credit while in high school. This study seeks to answer the following questions:

- To what extent does the COMPASS/ESL Test reflect Ohio Academic Content Standards in Math, English and Writing at the 7th through 12th grade level?

- To what extent does the COMPASS/ESL Test reflect the skills and competencies needed in entry level or first year coursework at Stark State College of Technology?

- What is the degree of alignment between Ohio Academic Content Standards and remedial and entry level or first year coursework at Stark State College of Technology?

- To what degree are both high school and college courses placing the same emphasis on those standards, i.e. the degree of alignment?

In 2004 a stated goal of the Governor's Commission on Higher Education and the Economy (CHEE) was "to increase, by the year 2015, undergraduate and graduate enrollment in Ohio's public and private postsecondary institutions by 180,000…this would be an increase of 30 percent."[6]

Since this project was envisioned and a proposal was submitted to the Martha Holden Jennings Foundation, a great deal has happened in Ohio.

Currently at the state level, the Ohio Department of Education and the Ohio Board of Regents are working with Achieve Inc.'s American Diploma Project (ADP) to answer a fundamental question, "What does it take to align high school standards with 'college-ready' standards?" Further, ADP will work with the state to emerge "a clear, consistent definition of 'college ready' from state postsecondary institutions." In addition, ADP advocates that Ohio "administer a college- and work-ready assessment, aligned to state standards, to high school students so they get clear and timely information and are able to address critical skill deficiencies while still in high school".[7]

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[6] Pogue, R.W., Chairman (2004). *Building on Knowledge, Investing in People: Higher Education and the Future of Ohio's Economy*. Columbus, Ohio: Governor's Commission on Higher Education and the Economy

[7] Achieve, Inc. (2005) *Creating a High School Diploma that Counts: Presentation to the Ohio Partnership for Continued Learning*, Columbus, Ohio. September 14. Available at: http://www.pcl.ohio.gov/

The latest estimate by the Ohio Board of Regents is that the state expends $28 million per year, or approximately 2% of all state higher education funding, on remedial education, in essence, coursework for which students receive no credit. Even more disturbingly, students who do not successfully pass such remedial work during their first year of college largely fail to return. There are two ways in which Ohio students test out of the need to take remedial coursework. The first is to obtain scores high enough on the SAT or ACT test. The second is through scores on a college placement test. This placement test "gatekeeper" for determining remediation in often ACT's COMPASS/ESL Test.

Lack of alignment between K-12 exit standards and college admissions standards, as noted above, is often cited as a major reason for remedial work. As Ohio moves ahead to increase college enrollment, through the OhioCore proposal (if legislated) and the new Early College High School (ECHS) initiative, the COMPASS/ESL test will most likely be mandated for those in grades 10 through 12 as well.

While the recent efforts at the state level to define college readiness are commendable, this researcher believes that short of instituting a set of mandated standards for institutions of higher education with its commensurate threat to academic freedom, that the best alternative is to develop a model for local use. State definitions of college readiness run the risk of remaining generic in nature and non-specific in application. As any college professor knows, while similarities exist between a course like English Composition at college A and English Composition at college B, the essence of any college course draws largely on the experience and knowledge of the instructor and his, or her, determination of what content and skills are critical. The complexity of all of this is underscored by the fact that since 1989, the Ohio Board of Regents has been working on articulation and transfer with the operational assumption that "a common body of knowledge, comprising a subset of the general education curriculum, can be found at all institutions, and from this broader general education curriculum can be drawn a 'Transfer Module.'"[8] Recently, more detailed work, fueled by 514 faculty members on 38 panels, evolved additional transfer assurance guides for specific courses and disciplines. Now, nearly two decades later, work is just beginning on articulation of equivalent adult & career technical coursework based on industry standards. For the first time, some consideration will be given to articulation between high school (career tech) courses and college courses and measures. The progress in all of this has been agonizingly slow.

Insofar as determining how to measure college readiness, we do that already through admissions tests such as the ACT and SAT or through standardized placement tests, the cut scores of which are often determined institution by institution on the basis of departmental and faculty input.

At the November 14, 2005 meeting of Ohio's Partnership for Continued Learning two significant points were raised in discussion as to how Ohio should move forward with aligning high school graduation requirements with college and work readiness standards that underscore the purpose of this study.

[8] See the Ohio Board of Regents' Articulation and Transfer Policy at: http://www.regents.state.oh.us/transfer/policy.html

- Other states successfully use the ACT, SAT and COMPASS/ESL[9] as a common assessment to measure student readiness.

- Higher education faculty must raise questions about their curriculum and increase communication efforts with local districts about student expectations and requirements. Today, a giant gulf exists between institutions of higher education and high schools, according to Dr. Fred Pestello, of the University of Dayton. Dr. Zimpher suggested that the assessment instrument would serve as a natural vehicle to bring the two entities together.[10]

This study does precisely what both points indicate. Relying on the COMPASS/ESL Test as a common assessment, the study has brought together both Stark State College of Technology professors and Canton City Schools high school faculty to begin the process of raising questions about the curriculum and increasing local communication.

[9] While this comes directly from the minutes of the Ohio Partnership for Continued Learning, this researcher is unaware of any state in which COMPASS/ESL, per se, is used as a universal indicator of college readiness
[10] Ohio Partnership for Continued Learning**.** Office of Governor Bob Taft *Minutes of the 2nd Meeting of the Partnership* November 16, 2005, 1:00-4:00pm Columbus, OH – Riffe Center, 31st Floor

Methodology

Five Stark State College of Technology faculty and three high school teachers from the Canton City Schools were asked to review the document and charts in a document supplied by ACT, Inc. entitled "Ohio Academic Content Standards Compared with ACT's COMPASS/ESL." The charts contained within the document review content standards and grade level indicators in English Language Arts and Mathematics. Those content standards and grade-level indicators that are highlighted in the document are measured by the COMPASS/ESL Reading, Writing and Mathematics Tests.

COMPASS/ESL incorporates several placement measures. Mathematics, Reading, and Writing Skills, and e-Write are designed to assist institutions in placing students into appropriate college-credit courses or remedial/developmental courses. These measures result in a total of up to eight possible placement scores (one each in Writing Skills, e-Write, and Reading and up to five in Mathematics, including Numerical Skills/Prealgebra, Algebra, College Algebra, Trigonometry, and Geometry).

ACT, Inc. found that COMPASS/ESL met the following match with the Ohio Academic Content Standards and indicators:

> COMPASS/ESL Reading assessments provide a moderate match to the Ohio reading standards and their grade-level indicators. ACT staff examined content standards 2 through 5 and their respective grade-level indicators, which focus on the application of various reading skills to comprehend a variety of texts. The match ranged from 53% for grades 7–9, to 46% for grades 10–12. COMPASS/ESL Writing assessments provide a good match to the Ohio writing standards. The match ranged from 65% for grades 7–9, to 59% for grades 10–12.
>
> The COMPASS/ESL Mathematics Tests provide a strong match to the Ohio standards, 76% for grade levels 7–9, and 69% for grades 10–12. The content standards and grade-level indicators that affected the match rate for grades 10–12 were those that required students to demonstrate proficiencies best observed in a classroom environment.[11]

Professors were asked to chart existing first year and remedial courses in mathematics and English language arts against the ACT document and charts, indicating whether or not a particular indicator applied to these courses. Canton City Schools teachers were asked to do the same in the area of English language arts and mathematics. An additional component of high school science was added to view imbedded mathematics. Both groups of faculty received the following instruction:

[11] (2005) Ohio Academic Content Standards **Compared with** ACT's COMPASS/ESL. Iowa City, ACT, Inc. p. 14 & p. 90

To what extent are the required skills and competencies for the course (or courses) you are reviewing reflected in the Ohio Academic Content Standards and indicators, grades 8-12?

Writing directly on the crosswalk document, indicate next to each grade level indicator, the degree to which this is important:
H=High
M=Medium
L=Low
N=Not Important or Not Relevant to Course

SSCT Courses reviewed were as follows:

MTH101 INTRODUCTION TO ALGEBRA *Pre-Req CAL103* Topics are signed numbers and variable expressions, solving equations and inequalities, polynomials, factoring, algebraic fractions, graphs and linear equations.

MTH121 COLLEGE ALG AND TRIG I *Pre-Req MTH101* Topics are fundamental operations of algebra, functions and graphs, trigonometric functions, systems of linear equations, determinants, factoring, fractions, quadratic equations, functions of acute angles, solving right triangles and functions of any size angle.

MTH223 ANALYTIC GEOMETRY-CAL I *Pre-Req MTH122* Analytic geometry, limits, continuity, derivatives, tangent and normal lines, derivatives of trigonometric functions, related rates, Newton's method, Rolle's theorem, mean value theorem, extrema of functions, antiderivatives, definite integrals, indefinite integrals, areas, and volumes.

ENG101 INTRODUCTION TO WRITING *Pre-Req CAL105* An introductory writing course stressing effective essay composition skills (e.g. essay structure and development and editing and revision skills) while applying the basic rules of grammar and mechanics.

ENG102 RDG FOR CRITICAL ANALYSIS *Pre-Req CAL101* Reading for Critical Analysis teaches critical comprehension and analysis of technical reading material. The course includes advanced application of critical reading and thinking skills.

ENG124 COLLEGE COMPOSITION *Pre-Req ENG101* Students learn to write effective papers based on reading and discussing essays after a review of essay development and organization, grammar, and punctuation. Emphasis is on the process of prewriting, writing and revising to achieve clarity and development. A research report requires APA or MLA documentation.

CAL101 RDG TECH COMPREHENSION
A computer-assisted laboratory course designed to enhance students' performance in college-level course work. Included in the curriculum are units on effective note-taking, organizational skills, test-taking strategies, critical reading skills, speed reading, stress reduction strategies, library utilization skills, learning styles and other related topics. Placement based on score achieved on entrance assessment tests. Proficiency of 80% constitutes passing.

CAL102 INTRODUCTION TO GRAMMAR
A computer-assisted course that stresses basic rules of grammar, punctuation, spelling and sentence writing. Placement based on score achieved on entrance assessment tests. Proficiency of 80% constitutes passing.

CAL103 MATH FUNDAMENTALS
This course covers the fundamentals of arithmetic and basic algebraic concepts. Topics include arithmetic operations, fractions, decimals, percentages, ratios, proportions, metric system, areas, volumes, signed

CAL104 COMPUTER CONCEPTS This self-paced course is designed to familiarize the beginner with the personal computer. It addresses computer literacy, the Windows operating environment, program and file management, and introduces the Internet, web browsers, and e-mail. Placement is based on score achieved on entrance assessment tests. Proficiency of 80% constitutes passing.

CAL105 WRITING FUNDAMENTALS A course covering the fundamentals of grammar, punctuation and usage. This systematic review is incorporated within sentence and paragraph applications. Proficiency of 80% constitutes passing,

Limitations

- This study is based on the Ohio Academic Content Standards, as published, and further based on both teacher and professor perceptions of what those standards mean and how they are applied at various grade levels. No model curricula were used at the high school level and the same are virtually non-existent in higher education. To a degree, these standards repeat from one grade level to the next, varying in context, application and complexity. For instance, one will find the following standard, "use knowledge of Greek, Latin and Anglo-Saxon roots and affixes" from grades 7-12.

- The study is further based on ACT Inc.'s assessment of what specific standards applications and context are reflected in the COMPASS/ESL Test.[12]

- It is entirely possible that a different group of high school teachers and a different group of college professors might reflect substantial variation in their estimations of both the standards reflected in their respective courses and level of importance.

- The Research and Communications: Oral and Visual sections of the ELA standards were not used in this study as they are not subject to COMPASS/ESL measurement.

- ACT, Inc. reports the following limitations on the match process:

    1. The (ELA) match process will report an alignment between Standards 2 through 5, which address reading, and the COMPASS/ESL Reading Tests. The match will also describe the alignment between Standards 6 through 8, which address components of writing and the writing process, and the COMPASS/ESL Writing Tests and COMPASS/ESL E-Write . Ohio's first standard, Phonemic Awareness, Word Recognition and Fluency Standard, focuses on how to identify and decode words; these are foundational skills that apply to grades K–3 only. The last two standards, Research and Communication, require performance assessments, which are not included in the multiple-choice format of COMPASS/ESL. Therefore, not all English Language Arts standards are included in the match process.[13]

    2. The (math) match process will report an alignment across all 6 standards (note: the last standard, Mathematical Processes, is not a separate standard; it is integrated throughout the other 5 content standards). The Ohio mathematics standards present overarching goals or themes in the area of mathematics. The standards are broadly stated, identifying "what students should know and be able to do as a result of the K–12 program." Each standard is accompanied by a descriptive paragraph that provides a general explanation of student expectations. Like English Language Arts, the match was conducted with the grade-level indicators. The COMPASS/ESL Mathematics Tests are designed to

[12] (2005) Ohio Academic Content Standards **Compared with** ACT's COMPASS/ESL. Iowa City, ACT, Inc.
[13] Ibid, p. 12.

assess students' mathematical reasoning. These tests emphasize quantitative reasoning rather than memorization of formulas or computational skills. In particular, they emphasize the ability to solve practical quantitative problems both in real-world and in purely mathematical settings, plan and carry out solution strategies, and verify the appropriateness of solutions.[14]

[14] Ibid, p. 13.

General Findings and Observations

In order to facilitate a discussion of the research questions posed in the introduction, the following charts are offered to indicate the congruence of the COMPASS/ESL Test and diagnostics with CCS and SSCT coursework and the Ohio Academic Content Standards in each area.

ELA Benchmarks	Indicators	COMPASS/ESL Measurements	CCS Courses	SSCT Courses
7th Grade				
Acquisition of Vocabulary	8	4	8	8 (5) 8[15]
Reading Processes	9	4	9	9 (7) 9
Reading Applications, Tech & Persuasive	8	3	6	8 (8) 6
Reading Applications Literary	7	6	5	5 (5) 3
Writing Process	17	10	17	17 (17) 16
Writing Applications	6	2	3	5 (5) 2
Writing Conventions	8	7	8	8 (8) 8
Research				
Comm. Oral and Visual				
Total	***63***	***36***	***56***	***60***
8th Grade				
Acquisition of Vocabulary	7	3	7	7 (7) 7
Reading Processes	5	2	4	5 (5) 5
Reading Applications, Informational, Tech & Persuasive	9	6	9	9 (9) 8
Reading Applications Literary	9	6	6	3 (3) 1
Writing Process	17	9	17	17 (17) 16
Writing Applications	6	4	4	6 (6) 1
Writing Conventions	8	6	8	8 (8) 8
Research				
Comm. Oral and Visual				
Total	***61***	***36***	***55***	***55***
9th Grade				
Acquisition of Vocabulary	6	2	6	6 (6) 5
Reading Processes: Concepts of Print, Comp., Self-Monitoring Strategies	5	2	4	5 (5) 5
Reading Applications, Informational, Tech & Persuasive	8	5	6	8 (8) 6
Reading Applications Literary	11	8	8	6 (5) 3
Writing Processes	17	10	17	17 (17) 15

[15] On SSCT Courses first # equals total number of indicators matched in all first year courses ( ) indicates number of indicators matched by non-developmental courses; third # in CAL or developmental courses

ELA Benchmarks	Indicators	COMPASS/ESL Measurements	CCS Courses	SSCT Courses
Writing Applications	6	3	4	6 (6) 3
Writing Conventions	6	5	6	6 (6) 5
Research				
Comm. Oral and Visual				
Total	***59***	***35***	***51***	***54***
10th Grade				
Acquisition of Vocabulary	6	2	6	6 (6) 5
Reading Processes: Concepts of Print, Comp., Self-Monitoring Strategies	5	2	4	5 (5) 5
Reading Applications, Informational, Tech & Persuasive	8	3	4	8 (8) 5
Reading Applications Literary	11	7	6	5 (5) 0
Writing Processes	17	10	17	17 (17) 13
Writing Applications	6	2	4	6 (6) 3
Writing Conventions	5	3	5	5 (5) 4
Research				
Comm. Oral and Visual				
Total	***58***	***29***	***46***	***52***
11th Grade				
Acquisition of Vocabulary	5	1	5	5 (5) 4
Reading Processes: Concepts of Print, Comp., Self-Monitoring Strategies	5	2	4	5 (5) 5
Reading Applications, Informational, Tech & Persuasive	8	5	5	8 (8) 2
Reading Applications Literary	8	4	1	2 (2) 0
Writing Processes	17	10	17	17 (17) 15
Writing Applications	6	1	4	5 (5) 1
Writing Conventions	3	3	3	3 (3) 0
Research				
Comm. Oral and Visual				
Total	***52***	***26***	***39***	***45***
12th Grade				
Acquisition of Vocabulary	5	1	5	5 (5) 4
Reading Processes: Concepts of Print, Comp., Self-Monitoring Strategies	5	2	5	5 (5) 5
Reading Applications, Informational, Tech & Persuasive	8	5	5	8 (8) 1
Reading Applications Literary	8	4	4	2 (2) 0
Writing Processes	17	10	17	17 (17) 14
Writing Applications	6	2	1	5 (5) 1
Writing Conventions	3	3	3	3 (3) 3
Research				
Comm. Oral and Visual				
Total	***52***	***27***	***40***	***45***

Math Benchmarks	Indicators	COMPASS/ESL Measurements	CCS Courses	SSCT Courses
7th Grade				
Number, Number Sense and Operations	9	9	9	9 (9) 8
Measurement	9	4	9	9 (9) 5
Geometry and Spatial Sense	9	9	9	8 (8) 0
Patterns, Functions and Algebra	11	9	10	10 (10) 8
Data Analysis and Probability	8	3	5	7 (1) 7
Total	***46***	***34***	***42***	***43***
8th Grade				
Number, Number Sense and Operations	8	8	8	8 (8) 7
Measurement	10	6	10	10 (9) 9
Geometry and Spatial Sense	6	6	6	6 (5) 0
Patterns, Functions and Algebra	16	15	15	16 (16) 4
Data Analysis and Probability	11	4	11	9 (2) 7
Total	***51***	***39***	***50***	***49***
9th Grade				
Number, Number Sense and Operations	5	5	5	5 (5) 5
Measurement	5	2	4	3 (3) 3
Geometry and Spatial Sense	3	3	3	3 (3) 0
Patterns, Functions and Algebra	15	14	14	13 (13) 2
Data Analysis and Probability	10	2	10	2 (0) 2
Total	***38***	***26***	***36***	***26***
10th Grade				
Number, Number Sense and Operations	4	3	3	4 (3) 0
Measurement	5	1	5	3 (3) 1
Geometry and Spatial Sense	10	9	10	5 (5) 1
Patterns, Functions and Algebra	12	12	11	11 (11) 7
Data Analysis and Probability	8	1	8	2 (0) 2
Total	***39***	***26***	***37***	***25***
11th Grade				
Number, Number Sense and Operations	9	10	2	4 (3) 2
Measurement	5	4	4	5 (5) 3
Geometry and Spatial Sense	5	5	1	1 (1) 0
Patterns, Functions and Algebra	11	11	4	9 (8) 1
Data Analysis and Probability	11	0	8	0 (0) 0
Total	***41***	***30***	***19***	***18***

Math Benchmarks	Indicators	COMPASS/ESL Measurements	CCS Courses	SSCT Courses
12th Grade				
Number, Number Sense and Operations	2	0	0	0 (0) 0
Measurement	3	2	2	3 (3) 0
Geometry and Spatial Sense	4	4	0	3 (3) 0
Patterns, Functions and Algebra	10	9	0	5 (5) 0
Data Analysis and Probability	6	1	2	0 (0) 0
Total	***25***	***16***	***4***	***11***

- To what extent does the COMPASS/ESL Test and diagnostics reflect Ohio Academic Content Standards in Math, English and Writing at the 7th through 12th grade level?

Subject Area	Grade Level	Total Indicators	COMPASS/ESL Measures	Percentage
ELA	7th	63	36	**57%**
	8th	61	36	**59%**
	9th	59	35	**59%**
	10th	58	29	**50%**
	11th	52	26	**50%**
	12th	52	27	**52%**
	Total	***345***	***189***	***55%***
Math	7th	46	34	**74%**
	8th	51	39	**76%**
	9th	38	26	**68%**
	10th	39	26	**67%**
	11th	41	30	**71%**
	12th	**25**	**16**	**64%**
	Total	***240***	***171***	***71%***

- To what extent does the COMPASS/ESL Test reflect the skills and competencies needed in entry level or first year coursework at Stark State College of Technology, on the basis of the Ohio Academic Content Standards? (Total number of Ohio Academic Content Standards measured by COMPASS/ESL/Total number of Ohio Academic Content Standards relevant to course).

	Ohio Academic Content Standards ***Measured by COMPASS/ESL***	Total # Ohio Academic Content Standards ***Relevant to Course***
ENG 101	155	246
ENG 102	86	157
ENG 124	162	281
MTH 101	56	68
MTH 121	100	114
MTH 223	122	144

Here it is indicated that SSCT courses rely far more heavily on Ohio Academic Content Standards than can be measured by the COMPASS/ESL Test. The chief question centers on whether what the COMPASS/ESL measures are the "power standards".

- What is the degree of alignment between Ohio Academic Content Standards and remedial and entry level or first year coursework at Stark State College of Technology? (To what degree do SSCT courses use all indicators).

	Percent of All 7-12 Grade Indicators Used in Course
ENG 101	45%
ENG 102	25%
ENG 124	47%
MTH 101	23%
MTH 121	71%
MTH 223	51%
CAL 101[16]	48%[16]
CAL 102[17]	15%
CAL103[18]	34%/35%
CAL 104[19]	2%
CAL 105[20]	37%

The relationship of all standards to specific college courses is problematic. CAL courses, such as CAL 102 are specialized and might only be expected to use a certain percentage of the standards. CAL 101, 102, and 105 taken as a whole would equate to more substantial coverage of the standards indicators.

[16] Note CAL courses rated on ELA only, except CAL 103

- To what degree are both high school and college courses placing the same (instructional) emphasis on those standards, i.e. the degree of alignment?

A complete charting of results by benchmark and indicator, CCS/SSCT Standards Assessment Comparison, is located after this section.

The charts above reflect general matches across all grade levels and indicators. If one can argue, at least to a degree, that indicators at the 12th grade level represent cumulative attainment of skills and knowledge, then matches between college courses and upper level indicators may be more compelling. Some gaps are indicated.

One example, for instance, is at the 11th grade level all SSCT ELA courses place low to high emphasis on "analyze the rhetorical devices used in public documents, including newspaper editorials and speeches". The indicator is measured by COMPASS/ESL; yet, no emphasis is placed on this indicator in the CCS coursework reviewed. Neither SSCT or CCS coursework places emphasis on "compare and contrast motivations and reactions of literary characters confronting similar conflicts…". This indicator is measured by COMPASS/ESL.

At times, SSCT coursework will place emphasis on Ohio standards not measured by COMPASS/ESL or covered in CCS coursework, as the following 11th grade example once again indicates:

Write responses to literature that:

a. advance a judgment that is interpretative, analytical, evaluative or reflective;
b. support key ideas and viewpoints with accurate and detailed references to the text or to other works and authors;
c. analyze the author's use of stylistic devices and express an appreciation of the effects the devices create;
d. identify and assess the impact of possible ambiguities, nuances and complexities within text;
e. anticipate and answer a reader's questions, counterclaims or divergent interpretations; and
f. provide a sense of closure to the writing.

The charting process fully delineates these differences and indicates the level of importance assigned by SSCT and CCS faculty to each across the entire 7th to 12th grade set of indicators.

Conclusions and Recommendations

Taken as a whole, the skills needed for first year SSCT courses in mathematics and language arts and the CCS coursework from 7th to 12th grade, on the basis of Ohio Academic Content Standards indicators are more closely aligned than reflected by the COMPASS/ESL test and diagnostics.

In ELA courses the COMPASS/ESL measures far fewer indicators than are contained in either CCS or SSCT courses. In mathematics from the 9th grade on, COMPASS/ESL measures more indicators than are reflected in either CCS or SSCT courses.

The degree of alignment between CCS and SSCT courses is promising. Indeed, the level of alignment is higher between coursework at the two institutions than what the COMPASS/ESL test is able to reflect. However, it must be cautioned that this alignment is based on the Ohio Academic Content standards only. College faculty were not asked to reflect on the content of their courses aside from these standards. Therefore, the larger question of to what extent these standards alone reflect overall course content at the SSCT level was not answered in this study.

Grade Level	CCS ELA	SSCT ELA	COMPASS /ESL	CCS Math	SSCT Math	COMPASS /ESL
7th	56	60	36	42	43	34
8th	55	55	36	50	49	39
9th	51	54	35	36	26	26
10th	46	49	29	37	25	26
11th	39	45	26	19	19	30
12th	40	45	27	4	11	16

What this process has created is more a model than definitive science. What the process has created is a template of sorts that can be used by high school and college faculty to look at course design and to begin the process of mutual alignment.

While certain numbers and calculations (as reflected above) can be achieved through the charting exercise, substantial questions remain. The first of these lies in the area of emphasis. Do teachers and professors mean the same thing when they say that a certain indicator is of high or low importance in a course? Do we have a common understanding of what specific indicators mean? This also raises the question of relative rigor. This researcher believes that only extensive conversations between high school and college faculty can provide this answer; essentially do we mean the same thing?

Content knowledge, in and of itself, is only one indication of what students need to be able to know and do to succeed in higher education. Cognitive ability is yet another concern.

The process in this study focused on the Ohio Academic Content Standards as the basis for alignment. There is a presumption here that the standards themselves are valid indicators for what students need to be able to know and do to succeed at for college level work. This study was instituted on that premise. Is there another way?

One possible option is to conduct an intensive review of class documents, assignments and products, coupled with observation of instruction. Another possibility is to employ a different set of standards and indicators. Knowledge and Skills for University Success (KSUS) is a document that was developed by Standards for Success (S4S), a project at the Center for Educational Policy Research (CEPR) at the University of Oregon, as the result of a two-year study that engaged more than 400 faculty and staff members from twenty research universities who are members of the Association of American Universities (AAU). The project sought to identify what students must do to succeed in entry level courses at their institutions, similar to what we have done in this study. National academic content standards documents were analyzed and used for comparison.

> The faculty and staff members who participated in the process of developing these standards represent a wide range of academic viewpoints. One of the most dominant themes raised by participants is the importance of the habits of mind students develop in high school and bring with them to university studies. These habits are considered by many faculty members to be more important than specific content knowledge.[17]

The results of this project, conducted on a much broader scale, indicate some substantial departures in nuance from the Ohio Academic Content Standards and indicators in several domains. For instance, under reading applications in literature, the KSUS document states:

> "Successful students employ reading skills and strategies to understand literature. They… engage in an analytic process to enhance comprehension and create personal meaning when reading text. This includes the ability to annotate, question, agree or disagree, summarize, critique and formulate a personal response.[18]

The notion of creating a "personal meaning' is absent from the Ohio Academic Content Standards; yet, the notion of evaluation is heavily present from 7th grade to 12th as the following 12th grade indicator illustrates:

> "Evaluate ways authors develop point of view and style to achieve specific rhetorical and aesthetic purposes (e.g., through use of figurative language, irony, tone, diction, imagery, symbolism and sounds of language), citing specific examples from text to support analysis."

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[17] Conley, D.T., director (2003). *Understanding University Success : A report from Standards for Success*. Eugene, Oregon: Center for Educational Policy Research
A project of the Association of American Universities and The Pew Charitable Trusts, p.8
[18] Ibid, p. 22

How critical is this and other nuances? This underscores the problems inherent in alignment between state K-12 standards and newly emerging college readiness standards. There is a great deal yet to be known.

On the basis of the Ohio Academic Content Standards, there is very little measured by the COMPASS/ESL test in either ELA or mathematics that is not relevant to both CCS and SSCT coursework. The question then becomes why students still require remediation. The Ohio Board of Regents notes that of the CCS students enrolling at SSCT in the fall of 2003, 64% took remedial courses. While 62% had taken a minimum core, only 29% had taken a complete academic core.[19] As CCS is progressively increasing academic requirements for all students and if the proposed new OhioCore requiring four years of English and mathematics, including Algebra II, is enacted the need for remedial coursework should markedly decrease.[20]

[19] Note: this is based on a sample of 13 students only. To a degree, selectivity also seems to be in effect. For instance, only 6% required remedial coursework at Ohio State University. In that sample, 65% had taken a complete core. Figures from the 2005 publication by the Ohio Board of Regents, *Profile of Recent High School Graduates Enrolled as First Year College Students in Autumn 2003: Outcomes by College, within High School of Graduation.*

[20] For a complete breakdown on curricular requirements of the proposed OhioCore, see http://www.governor.ohio.gov/

Next Steps

The next step in this process will, of necessity, involve the notion of how to use these materials to begin the process of improving articulation. Here CEPR also is providing critical components. Partnering with the College Board and the Education Commission of the states, the center has received a 3 year FIPSE grant to utilize the information from KSUS:

> …develop and disseminate both a template and a process to create course frameworks in five disciplines that can be used to improve articulation and continuity between high schools, community colleges and universities at the local, system, or state level. The courses will provide a reference point for designing curriculum and will also generate placement data useful to instructors in entry-level general education courses.[21]

This researcher has been in contact with this project and has agreed to a joint sharing of information from this Jennings sponsored study and the project. It is anticipated that their templates, once developed, can be useful to both CCS and SSCT faculty.

This project has been an active first step in providing a model for the charting and subsequent understanding of both the relationship between CCS coursework and entry level and developmental courses at SSCT, juxtaposed with the Ohio Academic Content Standards and the COMPASS/ESL Test.

Clearly, coursework at both institutions bears a relationship to the Ohio standards. In turn, the COMPASS/ESL Test measures a portion of those standards and the degree of that measurement is critical to the placement of students in either developmental or entry level coursework. Institutions such as SSCT need to have a degree of faith in the validity of that test and ACT, Inc. has obviously maintained that faith over time.

Students entering SSCT and other Ohio public institutions of higher education are predominantly from schools where instructors and instruction have become increasingly governed by the Ohio standards. The degree to which both those standards and the measurement of those standards by the Ohio Graduation Test is indicative of college readiness has been debated. We do know that relationships exist between the complete academic core, ACT scores, the need for remedial or developmental coursework and college perseverance. This study has not established that mastery of the Ohio Academic Content Standards, in and of themselves, is indicative of future college success. What we have seen, however, is that a great many of the standards are critical to entry level coursework at SSCT.

While this might seem to be a logical inference, the reality is that few high schools and colleges to date have taken the time to look at alignment issues via the procedure outlined in this study or through any other means. This researcher contends that barring any future establishment of

[21] (2004) Project Abstract: Center for Educational Policy Research (CEPR) U.S. Department of Education Fund for the Improvement of Post-Secondary Education (FIPSE). Downloaded from: http://ceprnet.uoregon.edu/ April 24, 2006.

standards and standardized testing for public higher education institutions aligned to K-12 standards, that this discussion can only effectively take place at the local level.

High school teachers and college professors alike must look at alignment issues together, determining what they mean to each respective institution. Ultimately, it is not only standards that need to be aligned. Instruction and habits of mind, must follow as well.

The next step in the process will involve the formation of joint professional development opportunities for both CCS and SSCT faculty centered on this document. This process will begin with the ECHS faculty, but will be open to all instructors at each institution.

Additionally, the Stark Education Partnership will convene college presidents and academic vice-presidents, K-12 superintendents, curriculum directors and others to share this model and begin discussions on a county-wide basis. Figures for the class of 2003 indicate that fully 40% of high school graduates in Stark County who attend college start at local institutions. The need to study these findings as a prelude to further considerations on how to reduce remediation will greatly benefit the county and its institutions.

CCS/SSCT Standards Assessment Comparison

Key – RSPT: Reading Skills Placement Test VDT: Vocabulary Diagnostic Test RCDT: Reading Comprehension Diagnostic Test E-W: E-Write WSPT: Writing Skills Placement Test WDT: Writing Diagnostic Test		COMPASS/ESL	CCS – ELA	CCS – Sci ELA-	CCS – Sci MTH	CCS – Algebra	SSCT –ENG 101	SSCT –ENG 102	SSCT – ENG 124	SSCT MTH 101	SSCT MTH 121	SSCT MTH 223	SSCT CAL 101	SSCT CAL 102	SSCT CAL 103	SSCT CAL 104	SSCT CAL 105
OHIO Grade 7 English Language Arts Academic Content Standards																	
Acquisition of Vocabulary																	
1.	Define the meaning of unknown words through context clues and the author's use of comparison, contrast, definition, restatement and example.	RSPT, VDT	H	H			M	H	H				H		M		
2.	Apply knowledge of connotation and denotation to determine the meaning of words.	RSPT, VDT	M	H			M	H	M				H		L		
3.	Infer word meanings through the identification of analogies and other word relationships, including synonyms and antonyms.	RSPT	M				H	H	H				M				
4.	Interpret metaphors and similes to understand new uses of words and phrases in text.	RSPT	M					M	M				L				
5.	Recognize and use words from other languages that have been adopted into the English language.		L	H									M				
6.	Use knowledge of Greek, Latin and Anglo-Saxon roots and affixes to understand vocabulary.		L	H									M		L		
7.	Use knowledge of symbols and acronyms to identify whole words.		L										L		M		
8.	Determine the meanings and pronunciations of unknown words by using dictionaries, thesauruses, glossaries, technology and textual features, such as definitional footnotes or sidebars.		M	H			M	H	M				M		L		
Reading Processes: Concepts of Print, Comprehension Strategies and Self-Monitoring Strategies																	
1.	Establish and adjust purposes for reading, including to find out, to understand, to interpret, to enjoy and to solve problems.		M	M									M	H	H		
2.	Predict or hypothesize as appropriate from information in the text, substantiating with specific references to textual examples that may be in widely separated sections of text.	RSPT	H					M	H				M	H	L		
3.	Make critical comparisons across text, noting author's style as well as literal and implied content of text.	RSPT	M				L	H	M				M				
4.	Summarize the information in texts, using key ideas, supporting	RSPT, RCDT	H	L			M	H	H				H		M		

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	details and referencing gaps or contradictions.																
5.	Select, create and use graphic organizers to interpret textual information.		L	H									M		M		
6.	Answer literal, inferential, evaluative and synthesizing questions to demonstrate comprehension of grade-appropriate print texts and electronic and visual media.	RSPT	H	L			M	H	H				M		M		
7.	Monitor own comprehension by adjusting speed to fit the purpose, or by skimming, scanning, reading on, looking back, note taking or summarizing what has been read so far in text.		L	H			M	H	H				H		H		
8.	Use criteria to choose independent reading materials (e.g., personal interest, knowledge of authors and genres or recommendations from others).		M				M		H				L				
9.	Independently read books for various purposes (e.g., for enjoyment, for literary experience, to gain information or to perform a task).		M	L					H				L				
Reading Applications: Informational, Technical and Persuasive Text																	
1.	Use text features, such as chapter titles, headings and subheadings; parts of books, including index, appendix, table of contents and online tools (search engines) to locate information.			H			L	H	H				H		M		
2.	Analyze examples of cause and effect and fact and opinion.	RSPT, RCDT	M	L			L	H	H				L				
3.	Compare and contrast different sources of information, including books, magazines, newspapers and online resources, to draw conclusions about a topic.			M				M	H								
4.	Compare original text to a summary to determine the extent to which the summary adequately reflects the main ideas, critical details and underlying meaning of the original text.							M	H				L				
5.	Analyze information found in maps, charts, tables, graphs, diagrams, cutaways and overlays.			H				M	M				M		H		
6.	Assess the adequacy, accuracy and appropriateness of an author's details, identifying persuasive techniques and examples of bias and stereotyping.	RSPT	M	L			H	M	H				L				
7.	Identify an author's purpose for writing and explain an author's argument, perspective or viewpoint in text.	RSPT	M	L			M	H	H				M				M

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8.	Compare the treatment, scope and organization of ideas from different texts on the same topic.							M	H								
Reading Applications: Literary Text																	
1.	Explain interactions and conflicts (e.g., character vs. self, nature or society) between main and minor characters in literary text and how the interactions affect the plot.	RSPT	H						L								
2.	Analyze the features of the setting and their importance in a text.	RSPT	M						M				L				
3.	Identify the main and minor events of the plot, and explain how each incident gives rise to the next.	RSPT, RCDT	L														
4.	Identify and compare subjective and objective points of view and how they affect the overall body of a work.	RSPT	L				M	H	H				L				L
5.	Identify recurring themes, patterns and symbols found in literature from different eras and cultures.	RSPT	M					L	L								
6.	Explain the defining characteristics of literary forms and genres, including poetry, drama, myths, biographies, autobiographies, science fiction, fiction and non-fiction.																
7.	Interpret how mood or meaning is conveyed through word choice, figurative language and syntax.	RSPT	M				M	H	H				L				L
Writing Process																	
8.	Generate writing ideas through discussions with others and from printed material, and keep a list of writing ideas.			L			L	L	H								M
9.	Conduct background reading, interviews or surveys when appropriate.			L			L		H								
10.	Establish a thesis statement for informational writing or a plan for narrative writing.			M			H		H								H
11.	Determine a purpose and audience.	RSPT	H	L			H	H	H				M				H
12.	Use organizational strategies (e.g., rough outlines, diagrams, maps, webs and Venn diagrams) to plan writing.			L			M		H						M		H
13.	Organize writing with an effective and engaging introduction, body and a conclusion that summarizes, extends or elaborates on points or ideas in the writing.	E-W	H	M			H		H								H
14.	Vary simple, compound and complex sentence structures.	E-W	M				H		H					L			H

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15.	Group related ideas into paragraphs, including topic sentences following paragraph form, and maintain a consistent focus across paragraphs.	E-W	M	M			H		H								H
16.	Use precise language, action verbs, sensory details, colorful modifiers and style as appropriate to audience and purpose.	E-W	M				H		H					L			H
17.	Use available technology to compose text	E-W		H			H		H				L		L		M
18.	Reread and analyze clarity of writing.	E-W, WSPT	M	M			H	H	H				M	L	M		H
19.	Add and delete information and details to better elaborate on a stated central idea and to more effectively accomplish purpose.	E-W, WSPT	L	M			H		H				M		L		M
20.	Rearrange words, sentences and paragraphs, and add transitional words and phrases to clarify meaning.	E-W, WSPT	L	L			H		H						L		H
21.	Use resources and reference materials (e.g., dictionaries and thesauruses) to select more effective vocabulary.			L			H	H	H				M		L		L
22.	Proofread writing, edit to improve conventions (e.g., grammar, spelling, punctuation and capitalization) and identify and correct fragments and run-ons.	E-W, WSPT	M	M			H		H				L	H	L		H
23.	COMPASS/ESL E-Write, COMPASS/ESL Writing Skills Placement Test Apply tools (e.g., rubric, checklist and feedback) to judge the quality of writing.	E-W	H	M			H		H				L	L	L		L
24.	Prepare for publication (e.g., for display or for sharing with others) writing that follows a format appropriate to the purpose, using such techniques as electronic resources, principles of design (e.g., margins, tabs, spacing and columns) and graphics (e.g., drawings, charts and graphs) to enhance the final product.		M	M					M						L		H
Writing Applications																	
1.	Write narratives that maintain a clear focus and point of view and use sensory details and dialogue to develop plot, character and a specific setting.	E-W	M				H		H								M
2.	Write responses to novels, stories, poems and plays that provide an interpretation, a critique or a reflection and support judgments with specific references to the text.								H								
3.	Write business letters that are formatted to convey ideas, state			H													

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	problems, make requests or give compliments.																
4.	Write informational essays or reports, including research, that present a literal understanding of the topic, include specific facts, details and examples from multiple sources, and create an organizing structure appropriate to the purpose, audience and context.			H			L		H								
5.	Write persuasive essays that establish a clear position and include relevant information to support ideas.	E-W	M	L			H		H								
6.	Produce informal writings (e.g., journals, notes and poems) for various purposes						M		M				L		L	L	
Writing Conventions																	
1.	Spell high-frequency words correctly.	WDT	M	H			H	H	H				M	M	L		M
2.	Use commas, end marks, apostrophes and quotation marks correctly.	WSPT, WDT	M	H			H	H	H					M			H
3.	Use semicolons, colons, hyphens, dashes and brackets correctly.	WSPT, WDT	L				H	H	H					L	L		H
4.	Use correct capitalization.	WSPT, WDT	H	M			H	H	H				M	H			M
5.	Use all eight parts of speech (e.g., noun, pronoun, verb, adverb, adjective, conjunction, preposition, interjection).			L			H	H	H				L	M			H
6.	Use dependent and independent clauses.	WSPT, WDT	M	M			H	H	H					M			H
7.	Use subject-verb agreement with collective nouns, indefinite pronouns, compound subjects and prepositional phrases.	WSPT, WDT	L	L			H	H	H					L			H
8.	Conjugate regular and irregular verbs in all tenses correctly.	WSPT, WDT	L				H		H								M
Research		not measured		H			L	H	H				-	-	-	-	
Communication: Oral and Visual		not measured		H			H	H	H				-	-	-	-	

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OHIO Grade 8 English Language Arts Academic Content Standards																	
Acquisition of Vocabulary																	
1.	Define unknown words through context clues and the author's use of comparison, contrast and cause and effect.	RSPT, VDT	H	H			H	H	H							M	
2.	Apply knowledge of connotation and denotation to determine the meaning of words.	RSPT, VDT	M	H			H	H	H				H			L	L
3.	Identify the relationships of pairs of words in analogical statements (e.g., synonyms and antonyms) and infer word meanings from these relationships.			M			M	H	M				M				
4.	Infer the literal and figurative meaning of words and phrases and discuss the function of figurative language, including metaphors, similes and idioms.	RSPT, VDT	M				H	H	H				L				
5.	Examine and discuss the ways that different events (e.g., cultural, political, social, technological, and scientific events) impact and change the English language.			L				H	M								L
6.	Use knowledge of Greek, Latin and Anglo-Saxon roots, prefixes and suffixes to understand complex words and new subject-area vocabulary (e.g., unknown words in science, mathematics and social studies).			H			L	H	M				M			L	
7.	Determine the meanings and pronunciations of unknown words by using dictionaries, thesauruses, glossaries, technology and textual features, such as definitional footnotes or sidebars.			H			H	H	H				M			L	
Reading Processes: Concepts of Print, Comprehension Strategies and Self-Monitoring Strategies																	
1.	Apply reading comprehension strategies, including making predictions, comparing and contrasting, recalling and summarizing and making inferences and drawing conclusions.	RSPT, RCDT	H	H			M	H	H				H			L	
2.	Answer literal, inferential, evaluative and synthesizing questions to demonstrate comprehension of grade-appropriate print texts and electronic and visual media.	RSPT, RCDT	H	M			M	H	H				M		H	M	
3.	Monitor own comprehension by adjusting speed to fit the purpose, or by skimming, scanning, reading on, looking back, note taking or summarizing what has been read so far in text.			H			H	H	H				H			H	

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4.	Use criteria to choose independent reading materials (e.g., personal interest, knowledge of authors and genres or recommendations from others).								H				L				
5.	Independently read books for various purposes (e.g., for enjoyment, for literary experience, to gain information or to perform a task).			L					H				L				
Reading Applications: Informational, Technical and Persuasive Text																	
1.	Compare and contrast text features, including format and headers of various informational texts in terms of their structure and purpose.			H				H	H				H			M	
2.	Identify and use the organizational structure of a text, such as chronological, compare-contrast, cause-effect, problem-solution, and evaluate its effectiveness.	RSPT, RCDT	L					H	H				M			M	
3.	Compare and contrast the treatment, scope and organization of ideas from different sources on the same topic.			M					H								
4.	Analyze information found in maps, charts, tables, graphs, diagrams, cutaways and overlays.			H					M				M				
5.	Assess the adequacy, accuracy and appropriateness of an author's details, identifying persuasive techniques (e.g., bandwagon, testimonial and emotional word repetition) and examples of bias and stereotyping.	RSPT	M	L			M	H	H				L				
6.	Identify the author's purpose and intended audience for the text.	RSPT	M	L			M	H	H				L				
7.	Analyze an author's argument, perspective or viewpoint and explain the development of key points.	RSPT	M				M	H	H				L				M
8.	Recognize how writers cite facts, draw inferences and present opinions in informational text.		M	L			M	H	H				M			L	
9.	Distinguish the characteristics of consumer materials (e.g., warranties, product information, instructional materials), functional or workplace documents (e.g., job-related materials, memoranda, instructions) and public documents (e.g., speeches or newspaper editorials).	RSPT	L	L				M	M							L	

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Reading Applications: Literary Text																	
1.	Identify and explain various types of characters (e.g., flat, round, dynamic, static) and how their interactions and conflicts affect the plot.	RSPT	H														
2.	Analyze the influence of setting in relation to other literary elements.	RSPT	M														
3.	Explain how authors pace action and use subplots, parallel episodes and climax.																
4.	Compare and contrast different points of view (e.g., first person and third person limited, omniscient, objective and subjective), and explain how voice affects literary text.	RSPT	M				M	M	H								
5.	Identify and explain universal themes across different works by the same author and by different authors.																
6.	Explain how an author's choice of genre affects the expression of a theme or topic.																
7.	Identify examples of foreshadowing and flashback in a literary text.	RSPT	M														
8.	Explain ways in which the author conveys mood and tone through word choice, figurative language, and syntax.	RSPT	M				M						L				
9.	Examine symbols used in literary texts	RSPT	M				-	H	H				-				
Writing Process																	
1.	Generate writing ideas through discussions with others and from printed material, and keep a list of writing ideas.			L			M		M								M
2.	Conduct background reading, interviews or surveys when appropriate.			L					H								
3.	Establish a thesis statement for informational writing or a plan for narrative writing.			M			H		H								H
4.	Determine a purpose and audience and plan strategies (e.g., adapting focus, content structure and point of view) to address purpose and audience.	E-W	H	L			H		H				M				H
5.	Use organizational strategies (e.g., notes and outlines) to plan writing.			M			M		H							M	H
6.	Organize writing with an effective and engaging introduction, body	E-W	H	M			H		H								H

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	and a conclusion that summarizes, extends or elaborates on points or ideas in the writing.																
7.	Vary simple, compound and complex sentence structures.	E-W	M				H		H					L			H
8.	Group related ideas into paragraphs, including topic sentences following paragraph form, and maintain a consistent focus reinforced by parallel structures across paragraphs.	E-W	M	M			H		H								
9.	Use precise language, action verbs, sensory details, colorful modifiers and style as appropriate to audience and purpose.	E-W	M				H		H					L	M		H
10.	Use available technology to compose text.	E-W	H	H			H	M	H				L			L	M
11.	Reread and analyze clarity of writing and consistency of point of view.			M			H	H	H				M	L			H
12.	Add and delete information and details to better elaborate on a stated central idea and to more effectively accomplish purpose.	E-W, WSPT	L	M			H		H				M				M
13.	Rearrange words, sentences and paragraphs, and add transitional words and phrases to clarify meaning.	WSPT	L	L			H		H							L	H
14.	Use resources and reference materials (e.g., dictionaries and thesauruses) to select more effective vocabulary.			L			H	H	H							L	H
15.	Proofread writing, edit to improve conventions (e.g., grammar, spelling, punctuation and capitalization) and identify and correct fragments and run-ons.	WSPT	M	M			H	H	H				L	H		L	H
16.	Apply tools (e.g., rubric, checklist and feedback) to judge the quality of writing.			M			H		H				L	L		L	L
17.	Prepare for publication (e.g., for display or for sharing with others) writing that follows a manuscript form appropriate for the purpose, which could include such techniques as electronic resources, principles of design (e.g., margins, tabs, spacing and columns) and graphics (e.g., drawings, charts and graphs) to enhance the final product.			M			M		H							L	H
Writing Applications																	
1.	Write narratives that: a. sustain reader interest by pacing action and developing an engaging plot (e.g., tension and suspense);	E-W	M				M M		H H							L	H

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	b. use literary devices to enhance style and tone; and c. create complex characters in a definite, believable setting.						M		H								
2.	Write responses to literature that organize an insightful interpretation around several clear ideas, premises or images and support judgments with specific references to the original text, to other texts, authors and to prior knowledge.						M		H								
3.	Write business letters, letters to the editor and job applications that: d. address audience needs, stated purpose and context in a clear and efficient manner; e. follow the conventional style appropriate to the text using proper technical terms; f. include appropriate facts and details; g. exclude extraneous details and inconsistencies; and h. provide a sense of closure to the writing.						L L L L L										
4.	Write informational essays or reports, including research, that: i. pose relevant and tightly drawn questions that engage the reader; j. provide a clear and accurate perspective on the subject; k. create an organizing structure appropriate to the purpose, audience and context; l. support the main ideas with facts, details, examples and explanations from sources; and m. document sources and include bibliographies.	E-W	M				H H H H H		H H H H H								
5.	Write persuasive compositions that: a. establish and develop a controlling idea; b. support arguments with detailed evidence; c. exclude irrelevant information; and d. cite sources of information.	E-W, WSPT	M	L			H H H L		H H H H								
6.	Produce informal writings (e.g., journals, notes and poems) for various purposes.			H			H		H							L	L
Writing Conventions																	
1.	Use correct spelling conventions.	WSDT		H			H	H	H				M	M		L	H
2.	Use correct punctuation and capitalization.	WSPT, WSDT	M	H			H		H				M	H			H

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3.	Use all eight parts of speech (e.g., noun, pronoun, verb, adverb, adjective, conjunction, preposition, interjection).		M	M			H		H				M	M		L	H
4.	Use clauses (e.g., main, subordinate) and phrases (e.g., gerund, infinitive, participial).	E-W, WSPT, WSDT	M	L			H		H				L	M			H
5.	Use parallel structure to present items in a series and items juxtaposed for emphasis.	WSPT, WSDT	M	L			M		H								
6.	Use proper placement of modifiers.	WSPT, WSDT	L	M			H		H								L
7.	Maintain the use of appropriate verb tenses.	WSPT, WSDT	L	M			H		H								H
8.	Conjugate regular and irregular verbs in all tenses correctly.	WSPT, WSDT	L	L			L		H								M
Research		not measured					L		H								
Communication: Oral and Visual		not measured	-	-			H	H	H				-	-	-	-	-

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OHIO Grade 9 English Language Arts Academic Content Standards																	
Acquisition of Vocabulary																	
1.	Define unknown words through context clues and the author's use of comparison, contrast, and cause and effect.	RSPT, VDT	H	H			H	H	H				H		M		
2.	Analyze the relationships of pairs of words in analogical statements (e.g., synonyms and antonyms, connotation and denotation) and infer word meanings from these relationships.			L			L	H	H				H		L		
3.	Infer the literal and figurative meaning of words and phrases and discuss the function of figurative language, including metaphors, similes, idioms and puns.	RSPT, VDT	M				M	H	H				L				
4.	Examine and discuss ways historical events have influenced the English language.			L				M	L								
5.	Use knowledge of Greek, Latin and Anglo-Saxon roots, prefixes and suffixes to understand complex words and new subject- area vocabulary (e.g., unknown words in science, mathematics and social studies).			H			L	M	L				M		L		
6.	Determine the meanings and pronunciations of unknown words by using dictionaries, thesauruses, glossaries, technology and textual features, such as definitional footnotes or sidebars.			H			H	H	H				M		L		
Reading Processes: Concepts of Print, Comprehension Strategies and Self-Monitoring Strategies																	
1.	Apply reading comprehension strategies, including making predictions, comparing and contrasting, recalling and summarizing and making inferences and drawing conclusions.	RSPT, RCDT	H	H			M	H	H				H		L		
2.	Answer literal, inferential, evaluative and synthesizing questions to demonstrate comprehension of grade-appropriate print texts and electronic and visual media.	RSPT	H	M			M	H	H				M		M		
3.	Monitor own comprehension by adjusting speed to fit the purpose, or by skimming, scanning, reading on, looking back, note taking or summarizing what has been read so far in text.			H			H	H	H				H		H		
4.	Use criteria to choose independent reading materials (e.g., personal interest, knowledge of authors and genres or recommendations from others).						H	H	H				L				

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5.	Independently read books for various purposes (e.g., for enjoyment, for literary experience, to gain information or to perform a task).			L					H				L				
Reading Applications: Informational, Technical and Persuasive Text																	
1.	Identify and understand organizational patterns (e.g., cause-effect, problem-solution) and techniques, including repetition of ideas, syntax and word choice, that authors use to accomplish their purpose and reach their intended audience.	RSPT	L	M			H	H	H				M		M		
2.	Critique the treatment, scope and organization of ideas from multiple sources on the same topic.								H								
3.	Analyze information found in maps, charts, tables, graphs, diagrams, cutaways and overlays.			H				H	M				M				
4.	Assess the adequacy, accuracy and appropriateness of an author's details, identifying persuasive techniques (e.g., bandwagon, testimonial, transfer, glittering generalities, emotional word repetition, bait and switch) and examples of propaganda, bias and stereotyping.	RSPT	M	L			M	H	H				L				
5.	Analyze an author's implicit and explicit argument, perspective or viewpoint in text.	RSPT	M				M	H	H				L				M
6.	Analyze the author's development of key points to support argument or point of view.	RSPT	M	L			M	H	H				L				M
7.	Compare and contrast the effectiveness of the features (e.g., format, sequence, headers) used in various consumer documents (e.g., warranties, product information, instructional materials), functional or workplace documents (e.g., job-related materials, memoranda, instructions) and public documents (e.g., speeches or newspaper editorials).	RSPT	L					M	M						L		
Reading Applications: Literary Text																	
8.	Identify the features of rhetorical devices used in common types of public documents, including newspaper editorials and speeches.							M	M								
1.	Identify and explain an author's use of direct and indirect characterization, and ways in which characters reveal traits about themselves, including dialect, dramatic monologues and soliloquies.	RSPT	L														
2.	Analyze the influence of setting in relation to other literary elements.	RSPT	M											L			

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3.	Identify ways in which authors use conflicts, parallel plots and subplots in literary texts.	RSPT	H														
4.	Evaluate the point of view used in a literary text.	RSPT	H				M	M	H				L				
5.	Interpret universal themes across different works by the same author and different authors.																
6.	Analyze how an author's choice of genre affects the expression of a theme or topic.																
7.	Explain how foreshadowing and flashback are used to shape plot in a literary text.	RSPT	M														
8.	Define and identify types of irony, including verbal, situational and dramatic, used in literary texts.	RSPT	M				M	H	H								
9.	Analyze ways in which the author conveys mood and tone through word choice, figurative language and syntax.	RSPT	M				M	H	H				L				
10.	Explain how authors use symbols to create broader meanings.	RSPT	M				L	H	H								
11.	Identify sound devices, including alliteration, assonance, consonance and onomatopoeia, used in literary texts.								L								
Writing Process																	
1.	Generate writing ideas through discussions with others and from printed material, and keep a list of writing ideas.			L			M		M								
2.	Determine the usefulness of and apply appropriate pre-writing tasks (e.g., background reading, interviews or surveys).			L			M		H								
3.	Establish and develop a clear thesis statement for informational writing or a clear plan or outline for narrative writing.	E-W	H	M			H		H								H
4.	Determine a purpose and audience and plan strategies (e.g., adapting focus, content structure and point of view) to address purpose and audience.	E-W	H	L			H		H				M				H
5.	Use organizational strategies (e.g., notes and outlines) to plan writing.			M			M		H						M		H
6.	Organize writing to create a coherent whole with an effective and engaging introduction, body and conclusion, and a closing sentence that summarizes, extends or elaborates on points or ideas in the writing.	E-W	H	M			H		H								H

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7.	Use a variety of sentence structures and lengths (e.g., simple, compound and complex sentences; parallel or repetitive sentence structure).	E-W	M				H		H					L	H		
8.	Use paragraph form in writing, including topic sentences that arrange paragraphs in a logical sequence, using effective transitions and closing sentences and maintaining coherence across the whole through the use of parallel structures.	E-W	H	M			H		H								H
9.	Use precise language, action verbs, sensory details, colorful modifiers and style as appropriate to audience and purpose and use techniques to convey a personal style and voice.	E-W	M				H		H								L
10.	Use available technology to compose text	E-W	H	H			H	M	H				L		L	H	M
11.	Reread and analyze clarity of writing, consistency of point of view and effectiveness of organizational structure.			M			H	H	H				M	L			M
12.	Add and delete information and details to better elaborate on stated central idea and more effectively accomplish purpose.	E-W, WSPT	L	M			H		H				M				M
13.	Rearrange words, sentences and paragraphs, and add transitional words and phrases to clarify meaning and maintain consistent style, tone and voice.	E-W	L	L			H		H						L		M
14.	Use resources and reference materials (e.g., dictionaries and thesauruses) to select effective and precise vocabulary that maintains consistent style, tone and voice.			L			H	H	H				M		L		L
15.	Proofread writing, edit to improve conventions (e.g., grammar, spelling, punctuation and capitalization), identify and correct fragments and run-ons and eliminate inappropriate slang or informal language.	E-W, WSPT	M	M			H	H	H				L	H	L		H
16.	Apply tools (e.g., rubric, checklist and feedback) to judge the quality of writing			M			H		H				L	L	L		L
17.	Prepare for publication (e.g., for display or for sharing with others) writing that follows a manuscript form appropriate for the purpose, which could include such techniques as electronic resources, principles of design (e.g., margins, tabs, spacing and columns) and graphics (e.g., drawings, charts and graphs) to enhance the final product.			M			M		H				L	L	L	H	L

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Writing Applications																	
1.	Write narratives that: a. sustain reader interest by pacing action and developing an engaging plot (e.g., tension and suspense); b. use a range of strategies and literary devices including figurative language and specific narration; and, c. include an organized, well developed structure.	E-W	M H				M M M		H H H								M
2.	Write responses to literature that organize an insightful interpretation around several clear ideas, premises or images and support judgments with specific references to the original text, to other texts, authors and to prior knowledge.						M		H								
3.	Write business letters, letters to the editor and job applications that: a. address audience needs, stated purpose and context in a clear and efficient manner; b. follow the conventional style appropriate to the text using proper technical terms; c. include appropriate facts and details; d. exclude extraneous details and inconsistencies; and e. provide a sense of closure to the writing.						L L L L L										
4.	Write informational essays or reports, including research that: a. pose relevant and tightly drawn questions that engage the reader; b. provide a clear and accurate perspective on the subject; c. create an organizing structure appropriate to the purpose, audience and context; d. support the main ideas with facts, details, examples and explanations from sources; and e. document sources and include bibliographies.	E-W	H M M	H H H H H			H H H H H		H H H H H								H
5.	Write persuasive compositions that: a. establish and develop a controlling idea; b. support arguments with detailed evidence; c. exclude irrelevant information; and d. cite sources of information.	E-W	H H L	L L L L			H H H L		H H H H								
6.	Produce informal writings (e.g., journals, notes and poems) for various purposes.			H			L		H				M		L		L

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Writing Conventions																	
1.	Use correct spelling conventions.	WDT	H	H			H	H	H				M	M	M		H
2.	Use correct capitalization and punctuation.	E-W, WSPT, WDT	H	H			H	H	H				M	H			H
3.	Use clauses (e.g., main, subordinate) and phrases (e.g., gerund, infinitive, participial).	E-W, WSPT, WDT	M	L			H		H				L	L			M
4.	Use parallel structure to present items in a series and items juxtaposed for emphasis.			L			M		H								
5.	Use proper placement of modifiers.	E-W, WSPT, WDT	L	M			H		H								L
6.	Maintain the use of appropriate verb tenses.	E-W, WSPT, WDT	M	M			H		H					M			H
Research		not measured	-	-			L		H				-	-	-	-	-
Communication: Oral and Visual		not measured	-	-			M	H	H				-	-	-	-	-

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OHIO Grade 10 English Language Arts Academic Content Standards																	
Acquisition of Vocabulary																	
1.	Define unknown words through context clues and the author's use of comparison, contrast and cause and effect.	RSPT, VDT	H	H			M	H	H				H		M		
2.	Analyze the relationships of pairs of words in analogical statements (e.g., synonyms and antonyms, connotation and denotation) and infer word meanings from these relationships.			L			M	H	M				H		L		
3.	Infer the literal and figurative meaning of words and phrases and discuss the function of figurative language, including metaphors, similes, idioms and puns.	RSPT, VDT	M				H	H	H				L				
4.	Analyze the ways that historical events influenced the English language.			L				M	M								
5.	Use knowledge of Greek, Latin and Anglo-Saxon roots, prefixes and suffixes to understand complex words and new subject-area vocabulary (e.g., unknown words in science, mathematics and social studies).			H				M	M				M		L		
6.	Determine the meanings and pronunciations of unknown words by using dictionaries, glossaries, technology and textual features, such as definitional footnotes or sidebars.			H			H	H	H				M		L		
Reading Processes: Concepts of Print, Compre-hension Strategies and Self-Monitoring Strategies																	
1.	Apply reading comprehension strategies, including making predictions, comparing and contrasting, recalling and summarizing and making inferences and drawing conclusions.	RSPT, RCDT	H	H			M	H	H				H		L		H
2.	Answer literal, inferential, evaluative and synthesizing questions to demonstrate comprehension of grade-appropriate print texts and electronic and visual media.	RSPT, RCDT	H	M			M	H	H				M		M		
3.	Monitor own comprehension by adjusting speed to fit the purpose, or by skimming, scanning, reading on, looking back, note taking or summarizing what has been read so far in text.			H			H	H	H				H		H		
4.	Use criteria to choose independent reading materials (e.g., personal interest, knowledge of authors and genres or recommendations from others).								H				L				

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5.	Independently read books for various purposes (e.g., for enjoyment, for literary experience, to gain information or to perform a task).			L					H				L				
Reading Applications: Informational, Technical and Persuasive Text																	
1.	Identify and understand organizational patterns (e.g., cause-effect, problem-solution) and techniques, including repetition of ideas, syntax and word choice, that authors use to accomplish their purpose and reach their intended audience.	RSPT	L	M			H	H	H				M		M		
2.	Critique the treatment, scope and organization of ideas from multiple sources on the same topic.								H								
3.	Evaluate the effectiveness of information found in maps, charts, tables, graphs, diagrams, cutaways and overlays.			H			M	H	H				M		H		
4.	Assess the adequacy, accuracy and appropriateness of an author's details, identifying persuasive techniques (e.g., transfer, glittering generalities, bait and switch) and examples of propaganda, bias and stereotyping.	RSPT	M	L			M	H	H				L				
5.	Analyze an author's implicit and explicit argument, perspective or viewpoint in text.	RSPT	M				M	H	H				L				L
6.	Identify appeals to authority, reason and emotion.						M	H	H				L				
7.	Analyze the effectiveness of the features (e.g., format, graphics, sequence, headers) used in various consumer documents (e.g., warranties, product information, instructional materials), functional or workplace documents (e.g., job-related materials, memoranda, instructions) and public documents (e.g., speeches or newspaper editorials).							H	M						L		
8.	Describe the features of rhetorical devices used in common types of public documents, including newspaper editorials and speeches.							M	M								
Reading Applications: Literary Text																	
1.	Compare and contrast an author's use of direct and indirect characterization, and ways in which characters reveal traits about themselves, including dialect, dramatic monologues and soliloquies	RSPT															
2.	Analyze the features of setting and their importance in a literary text.	RSPT	M														
3.	Distinguish how conflicts, parallel plots and subplots affect the		H														

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	pacing of action in literary text.																
4.	Interpret universal themes across different works by the same author or by different authors.																
5.	Analyze how an author's choice of genre affects the expression of a theme or topic.																
6.	Explain how literary techniques, including foreshadowing and flashback, are used to shape the plot of a literary text.	RSPT	M														
7.	Recognize how irony is used in a literary text.	RSPT	M				M	M	H								
8.	Analyze the author's use of point of view, mood and tone.	RSPT	M				M	H	H								
9.	Explain how authors use symbols to create broader meanings.	RSPT	M				M	H	H								
10.	Describe the effect of using sound devices in literary texts (e.g., to create rhythm, to appeal to the senses or to establish mood).						M		M								
11.	Explain ways in which an author develops a point of view and style (e.g., figurative language, sentence structure and tone), and cite specific examples from the text.	RSPT					L	H	H								
Writing Process																	
1.	Generate writing ideas through discussions with others and from printed material, and keep a list of writing ideas.			L			M		M								
2.	Determine the usefulness of and apply appropriate pre-writing tasks (e.g., background reading, interviews or surveys).			L			M		H								
3.	Establish and develop a clear thesis statement for informational writing or a clear plan or outline for narrative writing.	E-W	H	M			H		H								
4.	Determine a purpose and audience and plan strategies (e.g., adapting focus, content structure, and point of view) to address purpose and audience.	E-W	H	L			H		H				M				H
5.	Use organizational strategies (e.g., notes, outlines) to plan writing.			M			M		H								H
6.	Organize writing to create a coherent whole with an effective and engaging introduction, body and conclusion, and a closing sentence that summarizes, extends or elaborates on points or ideas in the writing.	E-W	H	M			H		H								H
7.	Use a variety of sentence structures and lengths (e.g., simple, compound and complex sentences; parallel or repetitive sentence structure).	E-W	M				H		H					L			H

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8.	Use paragraph form in writing, including topic sentences that arrange paragraphs in a logical sequence, using effective transitions and closing sentences and maintaining coherence across the whole through the use of parallel structures.	E-W	H	M			H		H								H
9.	Use language (including precise language, action verbs, sensory details and colorful modifiers) and style as appropriate to audience and purpose, and use techniques to convey a personal style and voice.	E-W	M				H		H					L			L
10.	Use available technology to compose text.	E-W	H	H			H	H	H				L		L	H	M
11.	Reread and analyze clarity of writing, consistency of point of view and effectiveness of organizational structure.			M			H	H	H				M	L	L		M
12.	Add and delete information and details to better elaborate on stated central idea and more effectively accomplish purpose.	E-W, WSPT	L	M			H		H				M				M
13.	Rearrange words, sentences and paragraphs, and add transitional words and phrases to clarify meaning and maintain consistent style, tone and voice.	E-W	L	L			H		H						L		M
14.	Use resources and reference materials (e.g., dictionaries and thesauruses) to select effective and precise vocabulary that maintains consistent style, tone and voice.			L			H	H	H				M		L		L
15.	Proofread writing, edit to improve conventions (e.g., grammar, spelling, punctuation and capitalization), identify and correct fragments and run-ons and eliminate inappropriate slang or informal language.	E-W, WSPT	M	M			H		H								
16.	Apply tools (e.g., rubric, checklist and feedback) to judge the quality of writing.			M			H		H				L	L	L		L
17.	Prepare for publication (e.g., for display or for sharing with others) writing that follows a manuscript form appropriate for the purpose, which could include such techniques as electronic resources, principles of design (e.g., margins, tabs, spacing and columns) and graphics (e.g., drawings, charts and graphs) to enhance the final product.			M			M		H				L	L	L		L
Writing Applications																	
1.	Write narratives that: a. sustain reader interest by pacing action and developing an	E-W	M				M		H								

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	engaging plot (e.g., tension and suspense); b. use a range of strategies and literary devices including figurative language and specific narration; and, c. include an organized, well developed structure.		H				M H		H H								H
2.	Write responses to literature that organize an insightful interpretation around several clear ideas, premises or images and support judgments with specific references to the original text, to other texts, authors and to prior knowledge.						M		H								
3.	Write business letters, letters to the editor and job applications that: a. address audience needs, stated purpose and context in a clear and efficient manner; b. follow the conventional style appropriate to the text using proper technical terms; c. include appropriate facts and details; d. exclude extraneous details and inconsistencies; and e. provide a sense of closure to the writing.						L L L L L										
4.	Write informational essays or reports, including research that: a. pose relevant and tightly drawn questions that engage the reader. b. provide a clear and accurate perspective on the subject. c. create an organizing structure appropriate to the purpose, audience and context. d. support the main ideas with facts, details, examples and explanations from sources; and e. document sources and include bibliographies.		H M M	H H H H H			H H H H L		H H H H H								H
5.	Write persuasive compositions that: a. support arguments with detailed evidence; b. exclude irrelevant information; and c. cite sources of information.	E-W	H H L	L L L			H H L		H H H								
6.	Produce informal writings (e.g., journals, notes and poems) for various purposes.			H			L		H				M		L		L
Writing Conventions																	
1.	Use correct spelling conventions.		H	H			H	H	H				M	M			M

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2.	Use correct capitalization and punctuation.	WDT, WSPT	H	H			H	H	H				M	H			H
3.	Use clauses (e.g., main, subordinate) and phrases (e.g., gerund, infinitive, participial).	WDT, WSPT	M	L			M		H				L	L			M
4.	Use parallel structure to present items in a series and items juxtaposed for emphasis.			L			M		M								
5.	Use proper placement of modifiers.	WDT, WSPT	L	M			H		H					L			L
Research		not measured	-	-			L		H				-	-	-	-	-
Communication: Oral and Visual		not measured	-	-			M	H	H				-	-	-	-	-

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OHIO Grade 11 English Language Arts Academic Content Standards																	
Acquisition of Vocabulary																	
1.	Recognize and identify how authors clarify meanings of words through context and use definition, restatement, example, comparison, contrast and cause and effect to advance word study.	RSPT		M			M	H	H				M		M		
2.	Analyze the relationships of pairs of words in analogical statements (e.g., synonyms and antonyms, connotation and denotation) and evaluate the effectiveness of analogous relationships.			L			M	H	M				H		L		
3.	Examine and explain the influence of the English language on world literature, communications and popular culture.			L				M	M								
4.	Use knowledge of Greek, Latin and Anglo-Saxon roots, prefixes and suffixes to understand complex words and new subject-area vocabulary (e.g., unknown words in science, mathematics and social studies).			H			L	H	M				M		L		
5.	Determine the meanings and pronunciations of unknown words by using dictionaries, thesauruses, glossaries, technology and textual features, such as definitional footnotes or sidebars.			H			H	H	H				M		L		
Reading Processes: Concepts of Print, Comprehension Strategies and Self-Monitoring Strategies																	
1.	Apply reading comprehension strategies, including making predictions, comparing and contrasting, recalling and summarizing and making inferences and drawing conclusions.	RSPT	H	H			M	H	H				H		L		
2.	Answer literal, inferential, evaluative and synthesizing questions to demonstrate comprehension of grade-appropriate print texts and electronic and visual media.	RSPT	H	M			M	H	H				M		M		
3.	Monitor own comprehension by adjusting speed to fit the purpose, or by skimming, scanning, reading on, looking back, note taking or summarizing what has been read so far in text.			H			H	H	H				H		H		
4.	Use criteria to choose independent reading materials (e.g., personal interest, knowledge of authors and genres or recommendations from others).								H				L				

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5.	Independently read books for various purposes (e.g., for enjoyment, for literary experience, to gain information or to perform a task).			L					H				M		L		
Reading Applications: Informational, Technical and Persuasive Text																	
1.	Analyze the rhetorical devices used in public documents, including newspaper editorials and speeches.	RSPT					L	H	M								
2.	Analyze and critique organizational patterns and techniques including repetition of ideas, appeals to authority, reason and emotion, syntax and word choice that authors use to accomplish their purpose and reach their intended audience.	RSPT	L	L			M	H	H				L				
3.	Analyze the content from several sources on a single issue, clarifying ideas and connecting them to other sources and related topics.			L					H								
4.	Distinguish between valid and invalid inferences and provide evidence to support the findings, noting instances of unsupported inferences, fallacious reasoning, propaganda techniques, bias and stereotyping.	RSPT		M			M	H	H								
5.	Examine an author's implicit and explicit philosophical assumptions and beliefs about a subject.	RSPT	M				M	H	H								
6.	Evaluate the effectiveness and validity of arguments in public documents and their appeal to various audiences.	RSPT		L			M	H	H								
7.	Analyze the structure and features of functional and workplace documents, including format, sequence and headers, and how authors use these features to achieve their purposes and to make information accessible and usable.							H	M						L		
8.	Critique functional and workplace documents (e.g., instructions, technical manuals, travel schedules and business memoranda) for sequencing of information and procedures, anticipation of possible reader misunderstandings and visual appeal.							M	M								
Reading Applications: Literary Text																	
1.	Compare and contrast motivations and reactions of literary characters confronting similar conflicts (e.g., individual vs. nature, freedom vs. responsibility, individual vs. society), using specific examples of characters' thoughts, words and actions.	RSPT															

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2.	Analyze the historical, social and cultural context of setting.																
3.	Explain how voice and narrator affect the characterization, plot and credibility.	RSPT															
4.	Evaluate the author's use of point of view in a literary text.	RSPT	H					H	H								
5.	Analyze variations of universal themes in literary texts.																
6.	Recognize characteristics of subgenres, including satire, parody and allegory, and explain how choice of genre affects the expression of a theme or topic.																
7.	Analyze the characteristics of various literary periods and how the issues influenced the writers of those periods.																
8.	Evaluate ways authors develop point of view and style to achieve specific rhetorical and aesthetic purposes (e.g., through use of figurative language irony, tone, diction, imagery, symbolism and sounds of language), citing specific examples from text to support analysis.	RSPT					L	H	H								
Writing Process																	
1.	Generate writing ideas through discussions with others and from printed material, and keep a list of writing ideas.			L			M		M								
2.	Determine the usefulness of and apply appropriate pre-writing tasks (e.g., background reading, interviews or surveys).			L			M		H								
3.	Establish and develop a clear thesis statement for informational writing or a clear plan or outline for narrative writing.	E-W	H	M			M		H								H
4.	Determine a purpose and audience and plan strategies (e.g., adapting formality of style, including explanations or definitions as appropriate to audience needs) to address purpose and audience.	E-W	H	L			H		H				M				H
5.	Use organizational strategies (e.g., notes and outlines) to plan writing.			M			M		H								H
6.	Organize writing to create a coherent whole with an effective and engaging introduction, body and conclusion, and a closing sentence that summarizes, extends or elaborates on points or ideas in the writing.	E-W	H	M			H		H								H
7.	Use a variety of sentence structures and lengths (e.g., simple, compound and complex sentences; parallel or repetitive sentence structure).	E-W	M				H		H					L			H

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8.	Use paragraph form in writing, including topic sentences that arrange paragraphs in a logical sequence, using effective transitions and closing sentences and maintaining coherence across the whole through the use of parallel structures.	E-W	H	M			H		H								H
9.	Use precise language, action verbs, sensory details, colorful modifiers and style as appropriate to audience and purpose, and use techniques to convey a personal style and voice.	E-W	M				H		H								L
10.	Use available technology to compose text.	E-W	H	H			H		H				L		L	L	
11.	Reread and analyze clarity of writing, consistency of point of view and effectiveness of organizational structure.			M			H	H	H				M	L	L		M
12.	Add and delete examples and details to better elaborate on a stated central idea, to develop more precise analysis or persuasive argument or to enhance plot, setting and character in narrative texts.	E-W, WSPT	L	M			H		H				M				M
13.	Rearrange words, sentences and paragraphs, and add transitional words and phrases to clarify meaning and achieve specific aesthetic and rhetorical purposes.	E-W	L	L			H		H						L		M
14.	Use resources and reference materials (e.g., dictionaries and thesauruses) to select effective and precise vocabulary that maintains consistent style, tone and voice.			L			H	H	H				M		L		
15.	Proofread writing, edit to improve conventions (e.g., grammar, spelling, punctuation and capitalization), identify and correct fragments and run-ons and eliminate inappropriate slang or informal language.	E-W, WSPT	M	M			H		H				L	L	L		H
16.	Apply tools (e.g., rubric, checklist and feedback) to judge the quality of writing.			M			H		H				L	L	L		L
17.	Prepare for publication (e.g., for display or for sharing with others) writing that follows a manuscript form appropriate for the purpose, which could include such techniques as electronic resources, principles of design (e.g., margins, tabs, spacing and columns) and graphics (e.g., drawings, charts and graphs) to enhance the final product.			M			M		H				L	L	L	M	L
Writing Applications																	
1.	Write reflective compositions that:																

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	a. use personal experiences as a basis for reflection on some aspect of life;		H				H		H								
	b. draw abstract comparisons between specific incidents and abstract concepts;	E-W					H		H								
	c. maintain a balance between describing incidents and relating them to more general, abstract ideas that illustrate personal beliefs; and						H		H								
	d. move from specific examples to generalizations about life.						H		H								
2.	Write responses to literature that:																
	a. advance a judgment that is interpretative, analytical, evaluative or reflective;						M		H								
	b. support key ideas and viewpoints with accurate and detailed references to the text or to other works and authors;						M		H								
	c. analyze the author's use of stylistic devices and express an appreciation of the effects the devices create;						M		H								
	d. identify and assess the impact of possible ambiguities, nuances and complexities within text;						M		H								
	e. anticipate and answer a reader's questions, counterclaims or divergent interpretations; and						M		H								
	f. provide a sense of closure to the writing.						M		H								
3.	Write functional documents (e.g., requests for information, resumes, letters of complaint, memos and proposals) that:																
	a. report, organize and convey information accurately.																
	b. use formatting techniques that make a document user-friendly.																
	c. anticipate readers' problems, mistakes and misunderstandings.																
4.	Write informational essays or reports, including research, that:																
	a. develop a controlling idea that conveys a perspective on the subject;			H			H		H								
	b. create an organizing structure appropriate to purpose, audience and context;			H			H		H								
	c. include information on all relevant perspectives, considering the validity and reliability of primary and secondary sources;			H			L		H								

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	d. make distinctions about the relative value and significance of specific data, facts and ideas;			H			L		H								
	e. anticipate and address a reader's potential biases, misunderstandings and expectations; and			H					H								
	f. provide a sense of closure to the writing.			H			H		H								
5.	Write persuasive compositions that:	E-W															
	a. articulate a clear position;	E-W	H	L			H		H								
	b. support assertions using rhetorical devices, including appeals to emotion or logic and personal anecdotes; and	E-W					H		H								
	c. develop arguments using a variety of methods (e.g., examples, beliefs, expert opinion, cause-effect reasoning).	E-W		L			H		H								
6.	Produce informal writings (e.g., journals, notes and poems) for various purposes.			H			H		L						M		
Writing Conventions																	
1.	Use correct spelling conventions.	WDT, WSPT	H	H			H	H	H								
2.	Use correct capitalization and punctuation.	WDT, WSPT	H	H			H	H	H								
3.	Use correct grammar (e.g, verb tenses, parallel structure, indefinite and relative pronouns).	WDT, WSPT	H	M			H	H	H								
Research		not measured	-	-			L		H				-	-	-	-	-
Communication: Oral and Visual		not measured	-				H	H	H				-	-	-	-	-

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OHIO Grade 12 English Language Arts Academic Content Standards																	
Acquisition of Vocabulary																	
1.	Recognize and identify how authors clarify meanings of words through context and use definition, restatement, example, comparison, contrast and cause and effect to advance word study	RSPT	L	M			M	H	H				M		M		
2.	Analyze the relationships of pairs of words in analogical statements (e.g., synonyms and antonyms, connotation and denotation) and evaluate the effectiveness of analogous relationships.			L			M	H	M				H		L		
3.	Examine and explain the influence of the English language on world literature, communications and popular cultures.			L				M	M								
4.	Use knowledge of Greek, Latin and Anglo-Saxon roots, prefixes and suffixes to understand complex words and new subject-area vocabulary (e.g., unknown words in science, mathematics and social studies).			H			L	H	M				M		L		
5.	Determine the meanings and pronunciations of unknown words by using dictionaries, thesauruses, glossaries, technology and textual features, such as definitional footnotes or sidebars.			H			H	H	H				M		L		
Reading Processes: Concepts of Print, Compre-hension Strategies and Self-Monitoring Strategies																	
1.	Apply reading comprehension strategies, including making predictions, comparing and contrasting, recalling and summarizing and making inferences and drawing conclusions.	RSPT, RCD	H	H			M	H	H				H		L		
2.	Answer literal, inferential, evaluative and synthesizing questions to demonstrate comprehension of grade-appropriate print texts and electronic and visual media.	RSPT	H	M			M	H	H				M		M		
3.	Monitor own comprehension by adjusting speed to fit the purpose, or by skimming, scanning, reading on, looking back, note taking or summarizing what has been read so far in text.			H			H	H	H				H		H		
4.	Use criteria to choose independent reading materials (e.g., personal interest, knowledge of authors and genres or recommendations from others).								H				L				

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5.	Independently read books for various purposes (e.g., for enjoyment, for literary experience, to gain information or to perform a task).			L					H				L				
Reading Applications: Informational, Technical and Persuasive Text																	
1.	Analyze the rhetorical devices used in public documents, including state or school policy statements, newspaper editorials and speeches.	RSPT	L				L	H	M								
2.	Analyze and critique organizational patterns and techniques including repetition of ideas, appeals to authority, reason and emotion, syntax and word choice that authors use to accomplish their purpose and reach their intended audience.	RSPT	M	L			M	H	H								
3.	Analyze and compile information from several sources on a single issue or written by a single author, clarifying ideas and connecting them to other sources and related topics.		M	M					H								
4.	Distinguish between valid and invalid inferences and provide evidence to support the findings, noting instances of unsupported inferences, fallacious reasoning, propaganda techniques, bias and stereotyping.	RSPT	L				L	H	H								
5.	Examine an author's implicit and explicit philosophical assumptions and beliefs about a subject.	RSPT	M	L			M	H	H								
6.	Evaluate the effectiveness and validity of arguments in public documents and their appeal to various audiences.	RSPT					M	H	H								
7.	Analyze the structure and features of functional and workplace documents, including format, sequence and headers, and how authors use these features to achieve their purposes and to make information accessible and usable.							H	M						L		
8.	Critique functional and workplace documents (e.g., instructions, technical manuals, travel schedules and business memoranda) for sequencing of information and procedures, anticipation of possible reader misunderstandings and visual appeal.							M	M								
Reading Applications: Literary Text																	
1.	Compare and contrast motivations and reactions of literary characters confronting similar conflicts (e.g., individual vs. nature, freedom vs. responsibility, individual vs. society), using specific examples of characters' thoughts, words and actions.	RSPT	M														

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2.	Analyze the historical, social and cultural context of setting.																
3.	Explain how voice and narrator affect the characterization, plot and credibility.	RSPT	L					H	H								
4.	Evaluate an author's use of point of view in a literary text.	RSPT	H														
5.	Analyze variations of universal themes in literary texts.																
6.	Recognize and differentiate characteristics of subgenres, including satire, parody and allegory, and explain how choice of genre affects the expression of theme or topic.																
7.	Compare and contrast varying characteristics of American, British, world and multi-cultural literature.																
8.	Evaluate ways authors develop point of view and style to achieve specific rhetorical and aesthetic purposes (e.g., through use of figurative language, irony, tone, diction, imagery, symbolism and sounds of language), citing specific examples from text to support analysis.	RSPT	M				L	H	H								
Writing Process																	
1.	Generate writing ideas through discussions with others and from printed material, and keep a list of writing ideas.			L			M		M								
2.	Determine the usefulness of and apply appropriate pre-writing tasks (e.g., background reading, interviews or surveys).			L			M		M								
3.	Establish and develop a clear thesis statement for informational writing or a clear plan or outline for narrative writing.	E-W	H	M			H		H								
4.	Determine a purpose and audience and plan strategies (e.g., adapting formality of style, including explanations or definitions as appropriate to audience needs) to address purpose and audience.	E-W	H	L			H		H				M				H
5.	Use organizational strategies (e.g., notes and outlines) to plan writing.			M			M		H								H
6.	Organize writing to create a coherent whole with an effective and engaging introduction, body and conclusion and a closing sentence that summarizes, extends or elaborates on points or ideas in the writing.	E-W	H	M			H		H								H
7.	Use a variety of sentence structures and lengths (e.g., simple, compound and complex sentences; parallel or repetitive sentence structure).	E-W	M				H		H					L			H

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8.	Use paragraph form in writing, including topic sentences that arrange paragraphs in a logical sequence, using effective transitions and closing sentences and maintaining coherence across the whole through the use of parallel structures.	E-W	M		M		H		H								H
9.	Use precise language, action verbs, sensory details, colorful modifiers and style as appropriate to audience and purpose, and use techniques to convey a personal style and voice.	E-W	M				H		H								L
10.	Use available technology to compose text.	E-W		H			H	H	H				L		L	L	
11.	Reread and analyze clarity of writing, consistency of point of view and effectiveness of organizational structure.			M			H	H	H				M	L	L		M
12.	Add and delete examples and details to better elaborate on a stated central idea, to develop more precise analysis or persuasive argument or to enhance plot, setting and character in narrative texts.	E-W, WSPT		M			H		H				M				M
13.	Rearrange words, sentences and paragraphs and add transitional words and phrases to clarify meaning and achieve specific aesthetic and rhetorical purposes.	E-W		L			H		H						L		L
14.	Use resources and reference materials (e.g., dictionaries and thesauruses) to select effective and precise vocabulary that maintains consistent style, tone and voice.			L			H	H	H				M		L		
15.	Proofread writing, edit to improve conventions (e.g., grammar, spelling, punctuation and capitalization), identify and correct fragments and run-ons and eliminate inappropriate slang or informal language.	E-W, WSPT		M			H	H	H				L	L	L		H
16.	Apply tools (e.g., rubric, checklist and feedback) to judge the quality of writing.			M			H		H				L	L	L		L

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17.	Prepare for publication (e.g., for display or for sharing with others) writing that follows a manuscript form appropriate for the purpose, which could include such techniques as electronic resources, principles of design (e.g., margins, tabs, spacing and columns) and graphics (e.g., drawings, charts and graphs) to enhance the final product.			M			M		H				L	L	L		L
Writing Applications																	
1.	Write reflective compositions that:																
	a. use personal experiences as a basis for reflection on some aspect of life;		M				H		H								
	b. draw abstract comparisons between specific incidents and abstract concepts;	E-W	L				H		H								
	c. maintain a balance between describing incidents and relating them to more general, abstract ideas that illustrate personal beliefs; and						H		H								
	d. move from specific examples to generalizations about life.						H		H								
2.	Write responses to literature that:																
	a. advance a judgment that is interpretative, analytical, evaluative or reflective;						M		H								
	b. support key ideas and viewpoints with accurate and detailed references to the text or to other works and authors;						M		H								
	c. analyze the author's use of stylistic devices and express an appreciation of the effects the devices create;						M		H								
	d. identify and assess the impact of possible ambiguities, nuances and complexities within text;						M		H								
	e. anticipate and answer a reader's questions, counterclaims or divergent interpretations; and						M		H								
	f. provide a sense of closure to the writing.						M		H								
3.	Write functional documents (e.g., requests for information, resumes, letters of complaint, memos, proposals) that:																
	a. report, organize and convey information accurately;																

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	b. use formatting techniques that make a document user-friendly; and																
	c. anticipate readers' problems, mistakes and misunderstandings.																
4.	Write informational essays or reports, including research, that:																
	a. develop a controlling idea that conveys a perspective on the subject;						H		H								
	b. create an organizing structure appropriate to purpose, audience and context;						H		H								
	c. include information on all relevant perspectives, considering the validity and reliability of primary and secondary sources;						L		H								
	d. make distinctions about the relative value and significance of specific data, facts and ideas;						L										
	e. anticipate and address a reader's potential biases, misunderstandings and expectations; and																
	f. provide a sense of closure to the writing.						H										
5.	Write persuasive compositions that:	E-W															
	a. articulate a clear position;	E-W	H				H		H								
	b. support assertions using rhetorical devices, including appeals to emotion or logic and personal anecdotes; and	E-W	H				H		H								
	c. develop arguments using a variety of methods (e.g., examples, beliefs, expert opinion, cause-effect reasoning).	E-W	H				L		H								
6.	Produce informal writings (e.g., journals, notes and poems) for various purposes.						L		H				M		L		L
Writing Conventions																	
1.	Use correct spelling conventions.	WSPT, WDT	H	H			H	H	H				M	L			M
2.	Use correct capitalization and punctuation.	WSPT, WDT	H	H			H	H	H				M	H			H
3.	Use correct grammar (e.g, verb tenses, parallel structure, indefinite and relative pronouns).	WSPT, WDT	H	M			H	H	H				L	L			M
Research		not	-	-			L		H				-	-	-	-	-

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	measured															
Communication: Oral and Visual	not measured	-	-			H	H	H				-	-	-	-	-

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OHIO Grade 7 Mathematics Academic Content Standards													
Number, Number Sense and Operations													
4.	Demonstrate an understanding of place value using powers of 10 and write large numbers in scientific notation.	NS/PAPT, NS/PADT	M		L * [22]	H	H				M	
5.	Explain the meaning of exponents that are negative or 0.	NS/PAPT, APT:IA	M	M	L *	H	H				M	
6.	Describe differences between rational and irrational numbers; e.g., use technology to show that some numbers (rational) can be expressed as terminating or repeating decimals and others (irrational) as non-terminating and non-repeating decimals.	NS/PAPT		M	L *	H	H				M	
7.	Use order of operations and properties to simplify numerical expressions involving integers, fractions and decimals.	NS/PAPT, NS/PADT		M	M *	H	H				H	
8.	Explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value.	NS/PAPT, NS/PADT		M	H *	H	H				M	
9.	Simplify numerical expressions involving integers and use integers to solve real-life problems.	NS/PAPT, NS/PADT		M	L *	H	H				M	
10.	Solve problems using the appropriate form of a rational number (fraction, decimal or percent).	NS/PAPT, NS/PADT	M	M	H *	H	H				M	
11.	Develop and analyze algorithms for computing with percents and integers, and demonstrate fluency in their use.	NS/PAPT, APT		L	L *	H	H					
12.	Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents and square roots (for perfect squares).	NS/PAPT, NS/PADT	L	M	L * *	M *	H				L	

[22] * material covered in course ** square root not covered

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Measurement												
13.	Select appropriate units for measuring derived measurements; e.g., miles per hour, revolutions per minute.		M	M	L	M	H				L	
14.	Convert units of area and volume within the same measurement system using proportional reasoning and a reference table when appropriate; e.g., square feet to square yards, cubic meters to cubic centimeters.		L		L	M	H				L	
15.	Estimate a measurement to a greater degree of precision than the tool provides.		M	L		M*	H					
16.	Solve problems involving proportional relationships and scale factors; e.g., scale models that require unit conversions within the same measurement system.			M	L*	M*	H				M	
17.	Analyze problem situations involving measurement concepts, select appropriate strategies, and use an organized approach to solve narrative and increasingly complex problems.		L		L*	M*	H				M	
18.	Use strategies to develop formulas for finding area of trapezoids and volume of cylinders and prisms.	GPT		M	[23]	M*	H					
19.	Develop strategies to find the area of composite shapes using the areas of triangles, parallelograms, circles and sectors.	GPT		H		L*	H				L	
20.	Understand the difference between surface area and volume and demonstrate that two objects may have the same surface area, but different volumes or may have the same volume, but different surface areas.	GPT	L	H		L*	H					
21.	Describe what happens to the surface area and volume of a three-dimensional object when the measurements of the object are changed; e.g., length of sides are doubled.	GPT	L	M		L*	H					
Geometry and Spatial Sense												
22.	Use proportional reasoning to describe and express relationships between parts and attributes of similar and congruent figures.	APT		M	L*	M*	H					

[23] area of trapezoid is covered in course

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23.	Determine sufficient (not necessarily minimal) properties that define a specific two-dimensional figure or three-dimensional object. For example: d. Determine when one set of figures is a subset of another; e.g., all squares are rectangles. e. Develop a set of properties that eliminates all but the desired figure; e.g., only squares are quadrilaterals with all sides congruent and all angles congruent.	GPT		M	L	M *	H					
24.	Use and demonstrate understanding of the properties of triangles. For example: f. Use Pythagorean Theorem to solve problems involving right triangles. g. Use triangle angle sum relationships to solve problems.	GPT		H		L *	H					
25.	Determine necessary conditions for congruence of triangles.	GPT		M		L *	H					
26.	Apply properties of congruent or similar triangles to solve problems involving missing lengths and angle measures.	APT		M		L *	H					
27.	Determine and use scale factors for similar figures to solve problems using proportional reasoning.	APT		M	L *	M *	H					
28.	Identify the line and rotation symmetries of two-dimensional figures to solve problems.	APT	L	M			M *					
29.	Perform translations, reflections, rotations and dilations of two-dimensional figures using a variety of methods (paper folding, tracing, graph paper).	APT		M		L [24]	M					
30.	Draw representations of three-dimensional geometric objects from different views.	GPT		M								
Patterns, Functions and Algebra												
31.	Represent and analyze patterns, rules and functions with words, tables, graphs and simple variable expressions.	CAPT		H	L *	M *	H				H	

[24] translations and reflections covered in course

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32.	Generalize patterns by describing in words how to find the next term.	CAPT		H		L *	H				L	
33.	Recognize and explain when numerical patterns are linear or nonlinear progressions; e.g., 1,3,5,7... is linear and 1,3,4,8,16... is nonlinear.	CAPT		M								
34.	Create visual representations of equation-solving processes that model the use of inverse operations.		M	H	L *	M *	H				M	
35.	Represent linear equations by plotting points in the coordinate plane.	APT, CAPT, ADT			L *	M *	H					
36.	Represent inequalities on a number line or a coordinate plane.	APT		M	L *		H				M	
37.	Justify that two forms of an algebraic expression are equivalent, and recognize when an expression is simplified; e.g., 4m = m + m + m + m or a · 5 + 4 = 5a + 4.	APT, ADT	L	M	L *	H	H				M	
38.	Use formulas in problem-solving situations.	APT, CAPT, ADT	M	M	L *	H	H				M	
39.	Recognize a variety of uses for variables; e.g., placeholder for an unknown quantity in an equation, generalization for a pattern, formula.	APT	M	M	L *	M *	H				M	
40.	Analyze linear and simple nonlinear relationships to explain how a change in one variable results in the change of another.	CAPT	L	M	L *	M *	H				L	
41.	Use graphing calculators or computers to analyze change; e.g., distance-time relationships.			L		M *	H					
42.	Read, create and interpret box-and-whisker plots, stem-and-leaf plots, and other types of graphs, when appropriate.		H	H							M	
Data Analysis and Probability												
43.	Analyze how decisions about graphing affect the graphical representation; e.g., scale, size of classes in a histogram, number of categories in a circle graph		H	L	L [25]		M				M	
44.	Analyze a set of data by using and comparing combinations of measures	NS/PAPT,	L	H							M	

[25] histograms and pie graphs covered in class

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	of center (mean, mode, median) and measures of spread (range, quartile, interquartile range), and describe how the inclusion or exclusion of outliers affects those measures.	NS/PADT										
45.	Construct opposing arguments based on analysis of the same data, using different graphical representations.										M	
46.	Compare data from two or more samples to determine how sample selection can influence results.										M	
47.	Identify misuses of statistical data in articles, advertisements, and other media.		M	L				L			M	
48.	Compute probabilities of compound events; e.g., multiple coin tosses or multiple rolls of number cubes, using such methods as organized lists, tree diagrams and area models.	NS/PAPT	M	M							L	
49.	Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results to predicted results, and explain differences.	NS/PAPT	H	M								

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OHIO Grade 8 Mathematics Academic Content Standards												
Number, Number Sense and Operations												
50.	Use scientific notation to express large numbers and small numbers between 0 and 1.	NS/PAPT, NS/PADT	M		M	H	H			M		
51.	Recognize that natural numbers, whole numbers, integers, rational numbers and irrational numbers are subsets of the real number system.	NS/PAPT		M	M	H	H			H		
52.	Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals.	NS/PAPT, NS/PADT	L	M	M *	H	H			H		
53.	Explain and use the inverse and identity properties and use inverse relationships (addition/subtraction, multiplication/division, squaring/square roots) in problem solving situations.	NS/PAPT		H	L *	H	H			H		
54.	Determine when an estimate is sufficient and when an exact answer is needed in problem situations, and evaluate estimates in relation to actual answers; e.g., very close, less than, greater than.	NS/PAPT	M	M		L *	H			M		
55.	Estimate, compute and solve problems involving rational numbers, including ratio, proportion and percent, and judge the reasonableness of solutions.	NS/PAPT, NS/PADT	L	M	M *	H	H			M		
56.	Find the square root of perfect squares, and approximate the square root of non-perfect squares as consecutive integers between which the root lies; e.g., √130 is between 11 and 12.	NS/PAPT, NS/PADT		H		M *	H					
57.	Add, subtract, multiply, divide and compare numbers written in scientific notation.	NS/PAPT, NS/PADT	L		M *	H	H			M		
Measurement												
58.	Compare and order the relative size of common U.S. customary units and metric units; e.g., mile and kilometer, gallon and liter, pound and kilogram.	NS/PAPT, NS/PADT	M	M		M	H			M		
59.	Use proportional relationships and formulas to convert units from one measurement system to another; e.g., degrees Fahrenheit to degrees Celsius.		M			M	H			M		

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60.	Use appropriate levels of precision when calculating with measurements.		M	L		M * [26]	H			M		
61.	Derive formulas for surface area and volume and justify them using geometric models and common materials. For example, find: h. the surface area of a cylinder as a function of its height and radius; i. that the volume of a pyramid (or cone) is one-third of the volume of a prism (or cylinder) with the same base area and height.		L	M		M	H			L		
62.	Determine surface area for pyramids by analyzing their parts.	GPT		M								
63.	Solve and determine the reasonableness of the results for problems involving rates and derived measurements, such as velocity and density, using formulas, models and graphs.	APT, CAPT, ADT	M	H		L	H *			L		
64.	Apply proportional reasoning to solve problems involving indirect measurements or rates.		L		L *	M *	H *			M		
65.	Find the sum of the interior and exterior angles of regular convex polygons with and without measuring the angles with a protractor.	GPT		M						L		
66.	Demonstrate understanding of the concepts of perimeter, circumference and area by using established formula for triangles, quadrilaterals, and circles to determine the surface area and volume of prisms, pyramids, cylinders, spheres and cones. (Note: Only volume should be calculated for spheres and cones.)	GPT	M	M	L	L * * [27]	M			M		
67.	Use conventional formulas to find the surface area and volume of prisms, pyramids and cylinders and the volume of spheres and cones to a specified level of precision.	GPT	L	M		L	M			L		
Geometry and Spatial Sense												
68.	Make and test conjectures about characteristics and properties (e.g., sides, angles, symmetry) of two-dimensional figures and three-	GPT		M	L *	M *	H					

[26] * material covered in course

[27] prisms, pyramids, cylinders, spheres and cones not covered

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	dimensional objects.											
69.	Recognize the angles formed and the relationship between the angles when two lines intersect and when parallel lines are cut by a transversal.	GPT		H	L * [28]	M *	H					
70.	Use proportions in several forms to solve problems involving similar figures (part-to-part, part-to-whole, corresponding sides between figures).	GPT		M	L	M *	H					
71.	Represent and analyze shapes using coordinate geometry; e.g., given three vertices and the type of quadrilateral, find the coordinates of the fourth vertex.	APT		M		L	H					
72.	Draw the results of translations, reflections, rotations and dilations of objects in the coordinate plane, and determine properties that remain fixed; e.g., lengths of sides remain the same under translations.	APT		M		L * * [29]	M					
73.	Draw nets for a variety of prisms, pyramids, cylinders and cones.	APT		L								
Patterns, Functions and Algebra												
74.	Relate the various representations of a relationship; i.e., relate a table to graph, description and symbolic form.	APT, CAPT	H	M	M *	H	H	L		L		
75.	Generalize patterns and sequences by describing how to find the *n*th term.	CAPT	M	H			L *					
76.	Identify functions as linear or nonlinear based on information given in a table, graph or equation.	CAPT	L	H		M	H					
77.	Extend the uses of variables to include covariants where y depends on x.	CAPT	M	M	L *	M *	H			L		
78.	Use physical models to add and subtract monomials and polynomials, and to multiply a polynomial by a monomial.	APT, ADT		M	L * *	L * *	H * *					

[28] * material covered in course
[29] ** Physical models not used

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79.	Describe the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change and y-intercept in real-world problems.	APT, CAPT, ADT	L	H	L *	M *	H					
80.	Use symbolic algebra (equations and inequalities), graphs and tables to represent situations and solve problems.	APT, CAPT, ADT	L	M	L *	M *	H			L		
81.	Write, simplify and evaluate algebraic expressions (including formulas) to generalize situations and solve problems.	APT, ADT	L	M	L *	M *	H			M		
82.	Solve linear equations and inequalities graphically, symbolically and using technology.	APT, CAPT, ADT	M	M	L *	M *	H					
83.	Solve 2 by 2 systems of linear equations graphically and by simple substitution.	APT, ADT		H	L *	M *	H					
84.	Interpret the meaning of the solution of a 2 by 2 system of equations; i.e., point, line, no solution.	APT, ADT		H	L *	M *	H					
85.	Solve simple quadratic equations graphically; e.g., y = x2 – 16.	APT		H	L [30]	M *	H *					
86.	Compute and interpret slope, midpoint and distance given a set of ordered pairs.	APT, ADT	L	M	L *	M *	H *					
87.	Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, continuous vs. noncontinuous, direct variation vs. inverse variation.	APT, CAPT, ADT		M		M *	H *					
88.	Describe and compare how changes in an equation affects the related graphs; e.g., for a linear equation changing the coefficient of x affects the slope and changing the constant affects the intercepts.	APT, CAPT	L	M		M	H					
89.	Use graphing calculators or computers to analyze change; e.g., interest compounded over time as a nonlinear growth pattern.					L	M					
Data Analysis and Probability												
90.	Use, create and interpret scatterplots and other types of graphs as appropriate.		M	L				L		M		

[30] not solved graphically

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91.	Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose; e.g., line graph for change over time, circle graph for part-to-whole comparison, scatterplot for relationship between two variants.		M		L *		L			M		
92.	Differentiate between discrete and continuous data and appropriate ways to represent each.			M								
93.	Compare two sets of data using measures of center (mean, mode, median) and measures of spread (range, quartiles, interquartile range, percentiles).	NS/PAPT	M	H			L			L		
94.	Explain the mean's sensitivity to extremes and its use in comparison with the median and mode.	NS/PAPT, NS/PADT		M						L		
95.	Make conjectures about possible relationship in a scatterplot and approximate line of best fit.		L	L								
96.	Identify different ways of selecting samples, such as survey response, random sample, representative sample and convenience sample.			L								
97.	Describe how the relative size of a sample compared to the target population affects the validity of predictions.			L				L		L		
98.	Construct convincing arguments based on analysis of data and interpretation of graphs.		H					L		M		
99.	Calculate the number of possible outcomes for a situation, recognizing and accounting for when items may occur more than once or when order is important.	NS/PAPT	L	M						L		
100.	Demonstrate an understanding that the probability of either of two disjoint events occurring can be found by adding the probabilities for each and that the probability of one independent event following another can be found by multiplying the probabilities.	NS/PAPT	L	M								

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OHIO Grade 9 Mathematics Academic Content Standards												
Number, Number Sense and Operations												
101.	Identify and justify whether properties (closure, identity, inverse, commutative and associative) hold for a given set and operations; e.g., even integers and multiplication.	NS/PAPT		H	L * [31]	M *	H			L		
102.	Compare, order and determine equivalent forms for rational and irrational numbers.	NS/PAPT		H	L *	M *	H			H		
103.	Explain the effects of operations such as multiplication or division, and of computing powers and roots on the magnitude of quantities.	NS/PAPT, NS/PADT	L	H	L	M *	H			L		
104.	Demonstrate fluency in computations using real numbers.	NS/PAPT, NS/PADT	H	H	M	H	H			H		
105.	Estimate the solutions for problem situations involving square and cube roots.	NS/PAPT		H		L *	H			L		
Measurement												
106.	Convert rates within the same measurement system; e.g., miles per hour to feet per second; kilometers per hour to meters per second.		M	M	L	M	H			M		
107.	Use unit analysis to check computations involving measurement.									L		
108.	Use the ratio of lengths in similar two-dimensional figures or three-dimensional objects to calculate the ratio of their areas or volumes respectively.	GPT	L	M								
109.	Use scale drawings and right triangle trigonometry to solve problems that include unknown distances and angle measures.	TPT		M		M *	H					
110.	Solve problems involving unit conversion for situations involving distances, areas, volumes and rates within the same measurement system.		M	M	L	M *	H			M		
Geometry and Spatial Sense												
111.	Define the basic trigonometric ratios in right triangles: sine, cosine	TPT		H		M	H					

[31] * material covered in course

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	and tangent.			+[32]		*						
112.	Apply proportions and right triangle trigonometric ratios to solve problems involving missing lengths and angle sizes in similar figures.	TPT		H+		M*	H					
113.	Analyze two-dimensional figures in a coordinate plane; e.g., use slope and distance formulas to show that a quadrilateral is a parallelogram.	APT		H+			L					
Patterns, Functions and Algebra												
114.	Define function with ordered pairs in which each domain element is assigned exactly one range element.	CAPT		H		M*	H					
115.	Generalize patterns using functions or relationships (linear, quadratic and exponential), and freely translate among tabular, graphical and symbolic representations.	CAPT		H		L*	H					
116.	Describe problem situations (linear, quadratic and exponential) by using tabular, graphical and symbolic representations.	APT, CAPT	L	H		L*	H					
117.	Demonstrate the relationship among zeros of a function, roots of equations, and solutions of equations graphically and in words.	CAPT		M		M*	H			L		
118.	Describe and compare characteristics of the following families of functions: linear, quadratic and exponential functions; e.g., general shape, number of roots, domain, range, rate of change, maximum or minimum.	CAPT		M		L*	H*					
119.	Write and use equivalent forms of equations and inequalities in problem situations; e.g., changing a linear equation to the slope-intercept form.	APT, ADT	L	M	L*	M*	H					
120.	Use formulas to solve problems involving exponential growth and decay.	APT, ADT	M	M			M					
121.	Find linear equations that represent lines that pass through a given set of ordered pairs, and find linear equations that represent lines parallel or perpendicular to a given line through a specific point.	APT	L	M	L*	M*	H*					

[32] + Geometry

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122.	Solve and interpret the meaning of 2 by 2 systems of linear equations graphically, by substitution and by elimination, with and without technology.	APT, ADT	L	H	L *	M *	H					
123.	Solve quadratic equations with real roots by factoring, graphing, using the quadratic formula and with technology.	APT		H	L [33]	M *	H					
124.	Add, subtract, multiply and divide monomials and polynomials (division of polynomials by monomials only).	APT, ADT	L	H	L *	M *	H					
125.	Simplify rational expressions by eliminating common factors and applying properties of integer exponents.	APT, ADT	L	M	L *	M *	H			L		
126.	Model and solve problems involving direct and inverse variation using proportional reasoning.											
127.	Describe the relationship between slope and the graph of a direct variation and inverse variation.	APT, CAPT		M								
128.	Describe how a change in the value of a constant in a linear or quadratic equation affects the related graphs.	APT		M		M *	H					
Data Analysis and Probability												
129.	Classify data as univariate (single variable) or bivariate (two variables) and as quantitative (measurement) or qualitative (categorical) data.		L	M								
130.	Create a scatterplot for a set of bivariate data, sketch the line of best fit, and interpret the slope of the line of best fit.		M	M								
131.	Analyze and interpret frequency distributions based on spread, symmetry, skewness, clusters and outliers.			M								
132.	Describe and compare various types of studies (survey, observation, experiment), and identify possible misuses of statistical data.		L	M				L		L		
133.	Describe characteristics and limitations of sampling methods, and analyze the effects of random versus biased sampling; e.g., determine and justify whether the sample is likely to be representative of the population.		L	L				L		L		
134.	Make inferences about relationships in bivariate data, and recognize the		M	M								

[33] quadratic formula not covered in class

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	difference between evidence of relationship (correlation) and causation.											
135.	Use counting techniques and the Fundamental Counting principle to determine the total number of possible outcomes for mathematical situations.	NS/PAPT		H								
136.	Describe, create and analyze a sample space and use it to calculate probability.	NS/PAPT		M								
137.	Identify situations involving independent and dependent events, and explain differences between and common misconceptions about probabilities associated with those events.		L	L								
138.	Use theoretical and experimental probability, including simulations or random numbers, to estimate probabilities and to solve problems dealing with uncertainty; e.g., compound events, independent events, simple dependent events.		L	M								

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OHIO Grade 10 Mathematics Academic Content Standards												
Number, Number Sense and Operations												
139.	Connect physical, verbal and symbolic representations of irrational numbers; e.g., construct 2 as a hypotenuse or on a number line.					L *	H					
140.	Explain the meaning of the *n*th root.	NS/PAPT		M		L *	H					
141.	Use factorial notation and computations to represent and solve problem situations involving arrangements.	CAPT		L								
142.	Approximate the *n*th root of a given number greater than zero between consecutive integers when *n* is an integer; e.g., the 4th root of 50 is between 2 and 3.	NS/PAPT		H			L *					
Measurement												
143.	Explain how a small error in measurement may lead to a large error in calculated results.		M		L	M *	H			L		
144.	Calculate relative error.		M									
145.	Explain the difference between absolute error and relative error in measurement.		M				L *					
146.	Give examples of how the same absolute error can be problematic in one situation but not in another; e.g., compare "accurate to the nearest foot" when measuring the height of a person versus when measuring the height of a mountain.		M				L *					
147.	Determine the measures of central and inscribed angles and their associated major and minor arcs.	GPT		H								
Geometry and Spatial Sense												
148.	Formally define and explain key aspects of geometric figures, including: j. Interior and exterior angles of polygons;	GPT		H		L [34]				L [35]		

[34] parts j,l,m not covered
[35] Only A few of these

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	k. Segments related to triangles (median, altitude, midsegment); l. Points of concurrency related to triangles (centroid, incenter, orthocenter, and circumcenter); m. Circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle).											
149.	Recognize and explain the necessity for certain terms to remain undefined, such as point, line and plane			M	L *	M *	H					
150.	Make, test and establish the validity of conjectures about geometric properties and relationships using counterexample, inductive and deductive reasoning, and paragraph or two-column proof, including: n. Prove the Pythagorean Theorem; o. Prove theorems involving triangle similarity and congruence; p. Prove theorems involving properties of lines, angles, triangles and quadrilaterals; q. Test a conjecture using basic constructions made with a COMPASS/ESL and straightedge or technology.	GPT, CAPT		M		L	M					
151.	Construct right triangles, equilateral triangles, parallelograms, trapezoids, rectangles, rhombuses, squares and kites, using COMPASS/ESL and straightedge or dynamic geometry software.	GPT		M								
152.	Construct congruent figures and similar figures using tools, such as COMPASS/ESL, straightedge, and protractor or dynamic geometry software.	APT		L								
153.	Identify the reflection and rotation symmetries of two- and three-dimensional figures.	APT		M [36]		L [37]	M					
154.	Perform reflections and rotations using COMPASS/ESL and straightedge constructions and dynamic geometry software.	APT		L								
155.	Derive coordinate rules for translations, reflections and rotations of geometric figures in the coordinate plane.	APT		L								

[36] 153-157, 160 CCS Geometry
[37] not on three dimensional figures

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156.	Show and describe the results of combinations of translations, reflections and rotations (compositions); e.g., perform compositions and specify the result of a composition as the outcome of a single motion, when applicable.	APT		L								
157.	Solve problems involving chords, radii, and arcs within the same circle.	GPT		M		L *	M					
Patterns, Functions and Algebra												
158.	Define function formally and with f(*x*) notation.	CAPT		H		L *	H *					
159.	Describe and compare characteristics of the following families of functions: square root, cubic, absolute value and basic trigonometric functions; e.g., general shape, possible number of roots, domain and range.	CAPT, TPT		M		L *	H			L [38]		
160.	Solve equations and formulas for a specified variable; e.g., express the base of a triangle in terms of the area and height.	APT, CAPT, TPT	L	M	L *	M *	H			M		
161.	Use algebraic representations and functions to describe and generalize geometric properties and relationships.	APT		M						L		
162.	Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.	APT, CAPT, ADT		M		L *	H			L		
163.	Solve equations and inequalities having rational expressions as coefficients and solutions.	APT, ADT	L	M	L *	M *	H			M		
164.	Solve systems of linear inequalities.	CAPT		L			H					
165.	Graph the quadratic relationship that defines circles.	APT		L			H					
166.	Recognize and explain that the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals.	APT			L	M	H					
167.	Solve real-world problems that can be modeled using linear, quadratic, exponential or square root functions.	CAPT		H	L [39]	L [40]	H *			L		

[38] ONLY A FEW
[39] only linear functions are covered in course
[40] linear, quadratic and square root functions covered in course

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168.	Solve real-world problems that can be modeled, using systems of linear equations and inequalities.	APT, CAPT, ADT	L	M		L *	H			M		
169.	Describe the relationship between slope of a line through the origin and the tangent function of the angle created by the line and the positive x-axis.	APT, CAPT, ADT	M [41]	L		M *	H					
Data Analysis and Probability												
170.	Describe measures of center and the range verbally, graphically and algebraically.	NS/PAPT, NS/PADT		M								
171.	Represent and analyze bivariate data using appropriate graphical displays (scatterplots, parallel box-and-whisker plots, histograms with more than one set of data, tables, charts, spreadsheets) with and without technology		H	M						L		
172.	Display bivariate data where at least one variable is categorical.			M								
173.	Identify outliers on a data display; e.g., use the interquartile range to identify outliers on a box-and-whisker plot.		M	M								
174.	Provide examples and explain how a statistic may or may not be an attribute of the entire population; e.g., intentional or unintentional bias may be present.		H	L								
175.	Interpret the relationship between two variables using multiple graphical displays and statistical measures; e.g., scatterplots, parallel box-and-whisker plots, and measures of center and spread.		M	L						L		
176.	Model problems dealing with uncertainty with area models (geometric probability).		M									
177.	Differentiate and explain the relationship between the probability of an event and the odds of an event, and compute one given the other.	NS/PAPT	H	M								

[41] Physics

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OHIO Grade 11 Mathematics Academic Content Standards												
Number, Number Sense and Operations												
178.	Determine what properties hold for matrix addition and matrix multiplication; e.g., use examples to show addition is commutative and when multiplication is not commutative.	CAPT									L	
179.	Determine what properties hold for vector addition and multiplication, and scalar multiplication.	CAPT										
180.	Represent complex numbers on complex plane.	CAPT					M					
181.	Use matrices to represent given information in a problem situation.	CAPT										
182.	Model, using the coordinate plane, vector addition and scalar multiplication.	CAPT										
183.	Compute sums, differences and products of matrices using paper and pencil calculations for simple cases, and technology for more complicated cases.	CAPT										
184.	Compute sums, differences, products and quotients of complex numbers.	CAPT					H				L	
185.	Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., $27^{2/3} = (27^{1/3})^2 = 9$.	APT, CAPT	L	L		L *	H					
186.	Use vector addition and scalar multiplication to solve problems.	CAPT										
Measurement												
187.	Determine the number of significant digits in a measurement.		M		L	M *	H				L	
188.	Use radian and degree angle measures to solve problems and perform conversions as needed.	GPT				M *	H					
189.	Derive a formula for the surface area of a cone as a function of its slant height and the circumference of its base	GPT		L		L *	M					
190.	Calculate distances, areas, surface areas and volumes of composite three-dimensional objects to a specified number of significant digits.	GPT		L							L	
191.	Solve real-world problems involving area, surface area, volume and density to a specified degree of precision.	GPT		L		L *	H				L	

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Geometry and Spatial Sense												
192.	Use polar coordinates to specify locations on a plane.	TPT										
193.	Represent translations using vectors.	CAPT										
194.	Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations.	CAPT										
195.	Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines.	TPT	L	M[42]			H					
196.	Identify, sketch and classify the cross sections of three-dimensional objects.	GPT										
Patterns, Functions and Algebra												
197.	Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest.	CAPT	L								L	
198.	Translate a recursive function into a closed form expression or formula for the nth term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years.	CAPT	L									
199.	Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior.	CAPT					H					
200.	Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology.	CAPT				L *	H *					
201.	Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the y-axis, x-axis or y = x.	CAPT					H					
202.	Represent the inverse of a function symbolically and graphically as a reflection about *y* = x.	CAPT					M					
203.	Model and solve problems with matrices and vectors.	CAPT										
204.	Solve equations involving radical expressions and complex roots.	APT					M					
205.	Solve 3 by 3 systems of linear equations by elimination and using	CAPT		L		M	H					

[42] Geometry

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	technology, and interpret graphically what the solution means (a point, line, plane, or no solution).					*						
206.	Describe the characteristics of the graphs of conic sections.	APT					M					
207.	Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation.	APT		L			M					
Data Analysis and Probability												
208.	Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation.		H	L								
209.	Describe the role of randomization in a well-designed study, especially as compared to a convenience sample, and the generalization of results from each.		M									
210.	Describe how a linear transformation of univariate data affects range, mean, mode, and median.		L									
211.	Create a scatterplot of bivariate data, identify trends, and find a function to model the data.											
212.	Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation.											
213.	Use technology to compute the standard deviation for a set of data, and interpret standard deviation in relation to the context or problem situation.		L									
214.	Describe the standard normal curve and its general properties, and answer questions dealing with data assumed to be normal.		L									
215.	Analyze and interpret univariate and bivariate data identify patterns, note trends, draw conclusions, and to make predictions.		M									
216.	Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques.		M									
217.	Understand and use the concept of random variable, and compute and interpret the expected value for a random variable in simple											

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	cases.											
218.	Examine statements and decisions involving risk; e.g., insurance rates and medical decisions.		H									

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OHIO Grade 12 Mathematics Academic Content Standards												
Number, Number Sense and Operations												
219.	Determine what properties (closure, identity, inverse, commutative and associative) hold for operations with complex numbers.	CAPT										
220.	Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations.											
Measurement												
221.	Solve problems involving derived measurements; e.g., acceleration and pressure.	APT, CAPT	H		L *	M *	H					
222.	Use radian measures in the solution of problems involving angular velocity and acceleration.	TPT	L			M *	H					
223.	Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations.						L *					
Geometry and Spatial Sense												
224.	Use matrices to represent translations, reflections, rotations, dilations and their compositions.	APT, CAPT										
225.	Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction, and double angle	TPT					M					
226.	Relate graphical and algebraic representations of lines, simple curves and conic sections.	APT, ADT				L [43]	M *					
227.	Recognize and compare specific shapes and properties in multiple geometries; e.g., plane, spherical and hyperbolic.	GPT					L *					
Patterns, Functions and Algebra												
228.	Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases.	CAPT										
229.	Translate between the numeric and symbolic form of a sequence or series.	CAPT										

[43] conic sections not covered

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230.	Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior.	CAPT					L[44]					
231.	Represent the inverse of a transcendental function symbolically.	CAPT										
232.	Set up and solve systems of equations using matrices and graphs, with and without technology.	CAPT										
233.	Make arguments about mathematical properties using mathematical induction.	CAPT										
234.	Make mathematical arguments using the concepts of limit.	CAPT					L *					
235.	Compare estimates of the area under a curve over a bounded interval by partitioning the region with rectangles; e.g., make successive estimates using progressively smaller rectangles.						M *					
236.	Translate freely between polar and Cartesian coordinate systems.	TPT					M					
237.	Use the concept of limit to find instantaneous rate of change for a point on a graph as the slope of a tangent at a point.	CAPT					L *					
Data Analysis and Probability												
238.	Identify and use various sampling methods (voluntary response, convenience sample, random sample, stratified random sample, census) in a study.		L									
239.	Transform bivariate data so it can be modeled by a function; e.g., use logarithms to allow nonlinear relationship to be modeled by linear function.											
240.	Describe the shape and find all summary statistics for a set of univariate data, and describe how a linear transformation affects shape, center and spread.											
241.	Apply the concept of a random variable to generate and interpret probability distributions, including binomial, normal and uniform.											
242.	Use sampling distributions as the basis for informal inference.											
243.	Use theoretical or experimental probability, including simulations, to determine probabilities in real-world problem situations involving uncertainty, such as mutually exclusive events, complementary events and conditional probability.	NS/PAPT	M	M								

[44] not for transcendental functions