



Ohio Assessments for Educators

Technical Report Addendum

Development and Validation
2018–2020

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Preface

This technical manual is an addendum to the test development activities undertaken for the Ohio Assessments for Educators (OAE) program and completed during the 2018–2019 and 2019–2020 Program Years. The manual provides validity evidence to support the use of the new Computer Science test (test field number 054) in the OAE program. This test was first operational in December 2019. This manual also provides evidence to support the validity of score interpretations for this new assessment.

This manual is intended for policy makers, state educators, and other interested stakeholders who would like to learn more about:

- the purpose, structure, and composition of the OAE testing program;
- the assessment frameworks and test item validation processes;
- the content and bias review processes; and
- the establishment of Ohio passing standards.

Purpose of the Ohio Assessments for Educators (OAE) Program

Introduction

The Ohio Assessments for Educators (OAE) program for candidates seeking licensure in a subject area assesses the content-area and professional (pedagogical) knowledge of candidates who are either seeking initial Ohio educator licensure or adding a new licensure area. The OAE program, administered by Pearson, currently includes 41 content-area assessments and four professional (pedagogical) knowledge assessments. Six OAE assessments include two separate tests each (i.e., Subtest I and Subtest II) for a total of 51 unique tests. The OAE tests are aligned with [Ohio Educator Standards](#), [Ohio Learning Standards](#), and other professional standards, as appropriate, such as the National Council of Teachers of Mathematics.

Tests in the OAE program were validated for use in Ohio in accordance with the practices recommended by the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014). The Standards require a clear definition of content domain and a rationale to support a claim that the knowledge, skills, and abilities being assessed in a licensure test are required for credential-worthy performance. Educators, educator preparation program faculty, and administrators from across Ohio were involved in reviewing the test materials for content, job-relatedness, and prevention of bias, and in validating their appropriateness for use in Ohio.

During the program years for this Addendum, the Computer Science assessment (test field number 054) was developed and validated using industry-approved processes, including the review of content, job-relatedness, and prevention of bias. For all OAE tests, including Computer Science, Ohio educators and educator preparation program faculty and administrators made recommendations for the passing score for each test.

The OAE tests are computer-based and delivered through a national network of Pearson computer-based testing centers. Computer Science consists of 125 multiple-choice questions (100 scorable and 25 non-scorable). The Computer Information Science assessment (test field number 010) was retired immediately prior to the new Computer Science test's launch.

The OAE program offers several web-based resources to help candidates prepare for the assessments. These resources include online study guides, practice assessments, detailed score reports, and computer-based testing tutorials. In addition, a suite of faculty resources and interactive worksheets is available to assist in candidate preparation. The Ohio Department of Education and educator preparation programs have access to an interactive, electronic database that allows them to create customized reports of candidate test results and institution performance, or to perform customized data queries.

Composition of the OAE Program

Currently, 51 OAE tests are available for test administration. Thirty-two OAE tests have been operational since September 3, 2013; twelve OAE tests have been operational since January 21, 2014; two OAE tests have been operational since September 2, 2014; two OAE tests have been operational since August 29, 2016, and December 19, 2016, respectively; and two OAE tests, Gifted Education and American Sign Language (ASL) Assessment for World Language Teachers of ASL (Subtests I & II), have been

operational since September 24, 2018, and October 22, 2018, respectively. Computer Science was launched on December 16, 2019. This addendum reports on the development and validation process for the Computer Science assessment.

Ohio Assessments for Educators (OAE)

Pedagogical Knowledge Assessments:

- 001 Assessment of Professional Knowledge: Early Childhood (PK–3)
- 002 Assessment of Professional Knowledge: Middle Childhood (4–9)
- 003 Assessment of Professional Knowledge: Adolescence to Young Adult (7–12)
- 004 Assessment of Professional Knowledge: Multi-Age (PK–12)

Content Knowledge Assessments:

- | | |
|---|---|
| 005 Agriscience | 053 Gifted Education |
| 050 American Sign Language (ASL)
Assessment for World Language
Teachers of ASL (Subtest I) | 023 Health |
| 051 American Sign Language (ASL)
Assessment for World Language
Teachers of ASL (Subtest II) | 024 Integrated Science |
| 006 Art | 025 Integrated Social Studies |
| 007 Biology | 026 Marketing |
| 008 Business Education | 027 Mathematics |
| 009 Chemistry | 028 Middle Grades English Language Arts |
| 010 Computer Information Science
(OAE assessment 010 retired from
the OAE program 12/15/2019) | 029 Middle Grades Science |
| 054 Computer Science | 030 Middle Grades Mathematics |
| 016 Computer/Technology (Subtest I) | 031 Middle Grades Social Studies |
| 017 Computer/Technology (Subtest II) | 032 Music |
| 011 Dance | 034 Physical Education |
| 012 Early Childhood Education | 035 Physics |
| 013 Early Childhood Special Education | 036 Prekindergarten (Subtest I) |
| 014 Earth and Space Science | 037 Prekindergarten (Subtest II) |
| 015 Educational Leadership | 038 Reading (Subtest I) |
| 018 Elementary Education (Subtest I) | 039 Reading (Subtest II) |
| 019 Elementary Education (Subtest II) | 040 School Counselor |
| 020 English Language Arts | 041 School Library Media Specialist |
| 021 English to Speakers of Other
Languages | 042 School Psychologist |
| 022 Family and Consumer Sciences | 043 Special Education |
| 090 Foundations of Reading (FOR) | 044 Special Education Specialist:
Deaf/Hard of Hearing |
| | 045 Special Education Specialist: Visually
Impaired |
| | 046 Technology Education (Subtest I) |
| | 047 Technology Education (Subtest II) |
| | 048 Theater |

Alignment of the OAE Assessments and State Needs

The process of gathering validity evidence to support the use of the OAE assessments begins with the alignment of the OAE test frameworks to Ohio Learning Standards and national standards. Pearson worked with the Ohio Department of Education to verify that the content of the OAE is appropriate as defined by these standards. The standards that were consulted during the OAE Computer Science test validation process are listed below.

- **Computer Science:**

- Ohio Learning Standards: K-12 Computer Science (December 2018)
- Computer Science Teachers Association (CSTA)/International Society for Technology in Education (ISTE) Standards for Computer Science Educators (Second Draft, November 2019)

More information about the alignment studies for Computer Science may be found in Appendix A of this manual.

For a list of standards consulted during the test validation process of OAE assessments operational before 2016, refer to the [Ohio Assessments for Educators Technical Report, Development and Validation, 2012–2014, Technical Report Addendum, Development and Validation, 2014–2016](#) and [Technical Report Addendum, Development and Validation, 2016–2018](#). The OAE Technical Reports are available on the [OAE program website](#) under Faculty Resources. [OAE Alignment studies](#) are also posted to the Faculty Resources section of the OAE program website.

Validity Evidence to Support the OAE Program

Gathering validity evidence is a comprehensive process of reviewing assessment content for alignment with state requirements for licensure, reviewing content to verify it is equitable and free from bias, validating competencies and items, and establishing an appropriate passing standard. Pearson worked with the Ohio Department of Education and Ohio educators and educator preparation faculty to implement such a process for the development of the Computer Science assessment, collecting key validity evidence to support the use of the assessment for the purpose of educator licensure.

The process used to gather validity evidence to support the use of the Computer Science assessment in the OAE program was designed to establish and/or support the connection between the assessments and their educational purposes (i.e., educator licensure). This connection provides evidence supporting the validity of score interpretations, which is the central concern in high-stakes professional testing programs. Comprehensive validity evidence strengthens the credibility of a licensure test for state use.

Validity refers to the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests. Validity is, therefore, the most fundamental consideration in developing and evaluating tests. The process of validation involves accumulating relevant evidence to provide a sound scientific basis for the proposed score interpretations. (AERA, APA, & NCME, 2014, p. 11)

The *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014) provides professional guidelines for accumulating validity evidence. The guidelines are clear that the process for accumulating such validity evidence must be comprehensive and draw from every aspect of test development.

Bias Prevention and Fairness in Test Development

To create sensitive, fair, and valid assessments for test takers, Pearson makes bias prevention and equity a priority during the development and review of test materials. Test developers and editors are charged with detecting and removing potentially biased content, situations, language, and stereotypes throughout the test design process. The composition of educator review committees reflects, to the extent possible, representative demographic characteristics, as does the drawing of participant samples for content validation surveys and standard setting activities.

Additionally, Pearson test development staff employ statistical analyses designed to detect instances where one group of candidates performs significantly better on an item than another group of equivalent ability (differential item functioning). Based on the results, any issues with the items can be addressed before tests become operational.

Pearson's Fairness and Diversity in Tests manual guides these efforts. This manual was developed by psychometricians and test development experts and is used by educators across the country for test development purposes. In four major sections, it provides an in-depth discussion of the dimensions of bias in test development, addresses specific bias prevention steps and methods of bias review to be taken in test development, and includes a comprehensive understanding of equity inclusion (i.e., the inclusion of content that reflects diverse populations).

The sources of bias discussed in the manual include:

- bias due to content;
- bias in language;
- bias due to assumptions and stereotypes; and
- bias due to lack of inclusion of test content that reflects diversity of the population for whom the test is intended.

While bias prevention is an integral part of Pearson’s test development activities and a component of each Content Advisory Committee’s (CAC’s) responsibility, Pearson established a separate and independent Bias Review Committee (BRC), composed of Ohio educators, to specifically focus on reviewing assessment materials for potential bias issues, a test development step recommended by the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014). The BRC in Ohio reviewed the Computer Science framework and test items prior to the operational launch of the assessment.

The Assessment Validation Process

The process begins with defining test materials and linking them to the most appropriate measurement tools for assessing the content.

The Computer Science assessment provided for validation for use in Ohio was developed in accordance with the guidelines specified in the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014) for defining test materials, developing test items, establishing passing standards, and collecting evidence to support the validity of the tests. Pearson conducted the following activities to collect validity evidence to support the use of these OAE program tests.

1. Establish Ohio Advisory Committees
2. Review Assessment Frameworks
3. Conduct Content Validation Surveys
4. Conduct Bias Item Review and Validation
5. Conduct Item Review and Validation
6. Field Test Items
7. Conduct Standard Setting
8. Establish Passing Standards

1. Establish Ohio Advisory Committees

Ohio educators and educator preparation program faculty reviewed and validated test materials for the use of the Computer Science test in the OAE program. Pearson worked with the Ohio Department of Education (ODE) to establish a standing Bias Review Committee (BRC) and separate Content Advisory Committee (CAC) to review the field.

The BRC and the CAC for Computer Science included licensed Ohio educators and educator preparation program faculty as recommended by educator stakeholder groups (e.g., professional organizations, preparation program deans, school superintendents and principals). Recommended individuals were invited to complete a committee application form. In assembling each review group, Pearson worked with the ODE to provide representation in terms of ethnicity, gender, geographic region of the state, and school

setting (e.g., urban, suburban, and rural areas). The ODE approved all committee participants.

When appropriate to documenting the validity of test score interpretations for intended uses, relevant experts external to the testing program should review the test specifications to evaluate their appropriateness for intended uses of the test scores and fairness for intended test takers. The purpose of the review, the process by which the review is conducted, and the results of the review should be documented. The qualifications, relevant experiences, and demographic characteristics of expert judges should also be documented. (AERA, APA, & NCME, 2014, p. 87)

2. Review Assessment Frameworks

Standard 11.13 of the *Standards for Educational and Psychological Testing* requires that evidence should be provided to show that the knowledge, skills, and abilities that the test intends to assess are required for credential-worthy performance in the occupation and are consistent with the purpose of the licensure program (AERA, APA, & NCME, 2014). For each assessment in the OAE program, a Content Advisory Committee (CAC) reviewed test materials for accuracy and validated materials to include only content that is pertinent to the field and important for use in a licensing instrument. The role of each CAC was to review test materials for content accuracy and appropriateness. The CACs provide content-related validity evidence to support the use of the tests. CACs reviewed frameworks and test items and participated in standard setting activities.

An assessment framework defines the content knowledge, skills, and abilities important for the job of an entry-level educator in the area being assessed. Pearson developed an assessment framework for each OAE test, guided by recommendations in the *Standards for Educational and Psychological Testing*:

The first step in developing test specifications is to extend the original statement of purpose(s), and the construct or content domain being considered, into a framework for the test that describes the extent of the domain, or the scope of the construct to be measured. Content specifications, sometimes referred to as content frameworks, delineate the aspects (e.g., content, skills, processes, and diagnostic features) of the construct or domain to be measured.... The delineation of the content specifications can be guided by theory or by an analysis of the content domain (e.g., an analysis of job requirements in the case of many credentialing and employment tests). The content specifications serve as a guide to subsequent test evaluation. (AERA, APA, & NCME, 2014, p. 76)

Each OAE assessment framework is structured to include content domains, competencies, and descriptive statements.

- Content domains (subareas) are the primary areas of content knowledge for the test area and serve to structure the content for both test preparation and score reporting purposes.
- The competencies (objectives) are broad meaningful statements of knowledge and/or skills that are important for performing the job of a licensed educator in Ohio public and nonpublic schools. Collectively, the competencies/objectives define the range of content to be measured by the test.
- The descriptive statements provide examples of the content and applications covered by the competencies/objectives. The descriptive statements are meant to be examples; they are not intended to cover the entire range of the competencies/objectives.

For the Computer Science assessment Pearson completed an alignment study of the frameworks with relevant Ohio standards (see Appendix A).

Preliminary bias prevention and content reviews of the Computer Science framework was conducted with Ohio advisory committees.

- **Bias review of assessment framework.** The framework provided for the OAE was reviewed for potential bias by the BRC and then were later reviewed for potential bias by the CAC. For the review of the framework, Pearson trainers and facilitators provided information to BRC members regarding the background, purpose, and policies of the OAE program, and directions for completing the framework reviews. Committee members were trained in the definition of bias as well as the inclusive and exclusive aspects of bias review. They reviewed the competencies included in the frameworks using criteria pertaining to content, language, offense, stereotypes, fairness, and diversity. Committee members considered each competency as fair only if it met all criteria for fairness and diversity.
- **Content review of assessment framework.** For Computer Science, a Content Advisory Committee (CAC), composed of experts in the respective field, participated in a review of the assessment framework.

As required by the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014), assessment frameworks for licensure need to focus on knowledge, skills, and abilities necessary for safe and effective practice in the profession. Therefore, the role of the CACs in Ohio is to consider if the frameworks are aligned with expectations for Ohio educators, address important areas of Ohio educator knowledge, skills, and abilities clearly and appropriately, and are free from potential bias.

Pearson provided information regarding the background and purpose of the OAE program and directions for completing the review. Committee members reviewed the assessment frameworks for alignment, completeness, language and terminology, and freedom from bias. The criteria used to determine if revisions were needed to the framework included the following:

- improving alignment to Ohio and/or national standards
- adding emerging content
- addressing potential bias
- enhancing job-relatedness
- increasing or decreasing the emphasis of one component of content versus another component to align with Ohio needs
- incorporating terminology commonly used in Ohio
- increasing representativeness of content with Ohio educator preparation program curricula

3. Conduct Content Validation Surveys

Content-related validity evidence is important in licensure testing because it provides evidence that the test adequately represents the content domain of the occupation for which the assessment is developed (AERA, APA, & NCME, 2014). The *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014) require a clear definition of content domain and a rationale to support a claim that the knowledge, skills, and abilities being

assessed in a licensure test are required for credential-worthy performance. Pearson conducted a content validation survey with Ohio educators and faculty at Ohio educator preparation programs to gather additional input from experts and stakeholders regarding the importance of the knowledge, skills, and abilities specified in the Computer Science framework.

Survey participants and ratings. Pearson targeted practicing public school teachers and educator preparation faculty for the Content Validation Survey of the Computer Science framework.

Using an interactive, online survey instrument, participants used a five-point scale to independently rate the components of the assessment frameworks, as shown below.

How important is the knowledge or skill described by this competency for performing the job of an educator in this field in Ohio public and non-public schools?

1. No importance
2. Little importance
3. Moderate importance
4. Great importance
5. Very great importance

How well does the set of descriptive statements represent important aspects of the competency?

1. Poorly
2. Somewhat
3. Adequately
4. Well
5. Very well

How well does the set of competencies as a whole cover the content knowledge and skills required for teaching in this field in Ohio public and non-public schools?

1. Poorly
2. Somewhat
3. Adequately
4. Well
5. Very well

Survey results. Based on the survey results, all competencies and descriptive statements for Computer Science met the retention criteria, receiving mean ratings of 3.0 or higher across respondent groups. Appendix B provides the overall mean competency (importance) ratings, mean descriptive statements ratings, and mean composite (the set of all competencies for a field) ratings for the Computer Science field.

4. Conduct Bias Item Review and Validation

Pearson conducted an item review and validation conference with the Ohio BRC for items in the Computer Science test bank. The purpose of the meeting was to review test items for potential bias according to established review criteria. As the *Standards for Educational and Psychological Testing* state:

Test developers are responsible for developing tests that measure the intended construct and for minimizing the potential for tests' being affected by construct-irrelevant characteristics, such as linguistic, communicative, cognitive, cultural, physical, or other characteristics. (AERA, APA, & NCME, 2014, p. 64)

Pearson trainers and facilitators provided BRC committee members with information regarding the background, purpose, and policies of the OAE program, and directions for completing the review. Committee members were provided training in the definition of bias as well as the exclusive and inclusive aspects of bias review. If the committee indicated that an item contained potential bias, they were asked to suggest possible revisions to address the potential bias. The BRC concerns and suggested revisions were shared with the content advisory committees.

5. Conduct Item Review and Validation

Pearson conducted item review and validation activities with the Computer Science Content Advisory Committee. Committee members participated in an independent review of each item in the item bank. Additionally, each committee member provided an independent item validation judgment. Committee members rated each test item as either "valid" or "not valid" according to the review criteria listed below.

- Match to competency or content domain
- Accuracy
- Freedom from bias
- Job-relatedness

An item was rated "valid" if it matched all four of the review criteria; an item was rated "not valid" if it failed to match one or more of the review criteria. When rating items "not valid," committee members indicated which of the four criteria were not met and provided a written reason for the "not valid" rating. Pearson analyzed the item validation ratings and reviewed the committee members' item validation comments.

6. Field Test Items

When testing volumes and candidate populations permit, Pearson conducts field testing to collect empirical data and evaluate the statistical and qualitative characteristics of the new items. Field testing was not conducted for the Computer Science assessment due to the small candidate population. In keeping with industry standards, new items for the Computer Science assessment will be included on operational forms in the non-scorable slots for future evaluation.

7. Conduct Standard Setting

The process of establishing passing requirements on a test is referred to as standard setting. Standard setting relates directly to the validity of the interpretations made about candidates based on their test scores because the process produces a recommended passing score. The recommended passing score defines the boundary line between the acceptable level of knowledge, skills, and abilities required of an entry-level educator and an unacceptable level of knowledge, skills, and abilities. The *Standards for Educational and Psychological Testing* require that passing scores be set high enough to distinguish adequate from inadequate performance, but not too high to be unreasonably limiting (AERA, APA, & NCME, 2014).

Standard setting activities were conducted with Ohio educators for Computer Science. Pearson used an industry accepted Modified-Angoff Standard Setting process described below.

Composition of standard setting committees. The standard setting committees convened for Computer Science included educators from Ohio institutions of higher education and currently practicing Ohio teachers.

Implementation of the modified-Angoff procedure for multiple-choice items.

Committee members provided standard setting ratings based on their professional judgment, their knowledge of their test field, their understanding of the qualifications of prospective educators, the content of a test form, and test data, when available, about candidate performance on the test form. This process conforms to Standard 5.22 of the *Standards for Educational and Psychological Testing*, which states:

When cut scores defining pass-fail or proficiency levels are based on direct judgments about the adequacy of item or test performances, the judgmental process should be designed so that the participants providing the judgements can bring their knowledge and experience to bear in a reasonable way. (AERA, APA, & NCME, 2014, p. 108)

For standard setting, Pearson trainers and facilitators provided committee members with background information regarding the assessment validation process employed for the OAE program. To orient them to the content and items of the assessment as seen by candidates, committee members participated in a simulated test-taking activity, during which they reviewed and answered the items on the appropriate test form. Committee members were also provided with the assessment framework for their field and an answer key.

Following the simulated test-taking activity, the Pearson facilitator presented the committees with the standard setting task and process. For each multiple-choice item on the test form, committee members were asked to respond to the following question:

Imagine a hypothetical group of individuals who are just at the level of knowledge and skills required to perform effectively the job of an initially licensed educator in this field in Ohio schools.

What percent of this group would answer the item correctly?

Once the task was introduced, the Pearson facilitator led a discussion to help committee members understand the concept of the hypothetical reference group. Individuals in the hypothetical reference group are defined as having a sufficient level of knowledge, skills, and abilities needed to serve as initially licensed educators.

Following the training, which included a practice component, committee members provided their professional judgments concerning the performance of the hypothetical group of individuals on the items. Then, committee members participated in a second round of

ratings. For the second round, they were provided with an Item Rating Summary Form. The Item Rating Summary Form provided committee members with their own initial item ratings, the median rating for the item, and the distribution of item ratings from committee members. Before completing the second round of ratings, committee members were instructed on how to read and consider the information included on the Item Rating Summary Form. In the second round, committee members were able to change all, some, or none of their first-round ratings.

Evaluation of process. At the end of the standard setting meeting, the Computer Science committee members were asked to complete an evaluation of the standard setting process.

Passing Standard Calculations. Following the standard setting meeting, Pearson calculated a panel-based recommended passing standard based on the final ratings provided by the committee members.

8. Establish Passing Standards

A multi-step process was used to establish the passing standards for Computer Science that involved the Ohio Educator Standards Board, the Teaching, Leading, Learning Committee of the State Board of Education of Ohio, and the full State Board of Education of Ohio.

Educator Standards Board. Pearson provided the following information to the Ohio Educator Standards Board:

- a presentation regarding the assessment validation process
- the relationship of the OAE assessments to the corresponding Ohio licensure areas
- panel-recommended passing standard yielded from the standard setting process described in step 7 above for Computer Science and standard error of measurement adjustments to the panel-recommended passing standard

The Educator Standards Board reviewed and discussed the information provided and made a recommendation for a passing score for the Computer Science test that was provided to the Teaching, Leading, Learning Committee of the State Board of Education of Ohio.

Teaching, Leading, Learning Committee. Pearson provided the following information to the Teaching, Leading, Learning Committee of the State Board of Education of Ohio:

- a presentation regarding the assessment validation process
- the relationship of the OAE assessments to the corresponding Ohio licensure areas
- panel-recommended passing standard yielded from the standard setting process described in step 7 above for Computer Science and standard error of measurement adjustments to the panel-recommended passing standard
- the passing score recommendation from the Ohio Educator Standards Board

The Teaching, Leading, Learning Committee reviewed and discussed the information provided and made a recommendation for a passing score for the Computer Science test that was provided to the State Board of Education of Ohio.

State Board of Education of Ohio. The Teaching, Leading, Learning Committee made a recommendation to the full State Board of Education of Ohio. The State Board of Education of Ohio reviewed and discussed the recommendations provided and determined the passing score for the test. The State Board of Education of Ohio approved passing score was implemented when the test became operational.

The assessment validation activities described above, and in greater detail throughout this manual, provide support that the OAE Computer Science test is aligned to the state's need

for a system of evaluating educator candidates and the state’s need to identify candidates who possess the knowledge, skills, and abilities necessary to be an entry level educator in the state.

The table below lists the major test development activities and the dates these activities took place during development for the OAE Computer Science test.

Computer Science (054)	Test Development Activity
June-July 2019	Review of Assessment Framework
October 2019	Conduct Content Validation Survey
October 2019	Conduct Item Reviews
N/A	Conduct Field Testing
October 2019	Conduct Standard Setting
December 2019	Operational Test Launch

Support Materials and Other Tools for the OAE Program

Pearson developed multiple web-based OAE preparation tools designed to help candidates prepare for the OAE. The preparation tools are available on the [OAE program website](#). The online tools are designed to accommodate varying methods of preparation (independent study or under the direction of an instructor or faculty advisor); areas of focus (test content); and opportunities for access (at school, at home, while traveling). Educator preparation program faculty can also gain an understanding of the assessments and how to help their candidates prepare through the use of the OAE faculty resources.

Candidates have access to the following resources to guide their preparation:

- **OAE assessment frameworks.** Assessment frameworks include the test competencies covered by each OAE assessment. In each framework, the competencies are organized into content domains that reflect the main areas of pedagogical or content area knowledge included on the assessment. Descriptive statements provide details about the nature and range of content covered by each competency.
- **OAE study guides.** Online study guides are available for each assessment. The study guides include an overview of the test format, number of questions, test duration, competencies with descriptive statements, and sample test questions with explanations of correct responses. The guides also include information to assist candidates in preparing for and taking the assessment.
- **OAE practice assessments.** Online practice assessments simulate the computer-based testing experience. The practice assessments can be taken in real time or paused and returned to at any time. Test-takers receive a competency-level report with instant scoring of multiple-choice questions and explanations of correct responses.
- **Computer-based testing tutorials.** Two tutorials are available to candidates on the program website. One tutorial is designed to help familiarize candidates with the navigation tools and operations of computer-based testing. It includes information about how to navigate through an assessment, select answers, and end the assessment. The second tutorial is downloadable and interactive. It guides candidates on how to record, change, and review answers. The tutorial also gives candidates the opportunity to practice using various functions of the computer-based environment, including viewing visuals and exhibits, scrolling pages, reviewing items, typing in an essay box, and using an on-screen calculator.
- **Faculty resources.** Educator preparation program faculty have access to an array of resources, including specially designed worksheets that may be used to map the OAE assessment framework content to the program curriculum. This mapping may assist in assessing the degree of alignment between the knowledge and skills taught in the preparation program curriculum and in the content of the OAE assessment frameworks.
- **Test preparation worksheets.** Candidates can complete worksheets to assess their preparedness to test. Faculty can review the completed worksheets to help assess whether a candidate may be ready to test based on the content covered in their coursework and guide further candidate preparation.

References

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education (2014). *Standards for educational and psychological testing*. American Educational Research Association.

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Evaluation Systems Pearson. (2009). *Fairness and diversity in tests*. Amherst, MA: Author.

Appendices

Appendix A: OAE Alignment Studies

Computer Science

Appendix B: Content Validation Survey Results

Computer Science

Appendix A: OAE Alignment Studies

Alignment of Ohio Assessments for Educators (OAE) Computer Science Assessment Framework with Ohio-specified Standards

This alignment study identifies the national and/or Ohio educational standards that are addressed in whole or in part by each competency of the assessment framework. An indication of alignment does not necessarily imply complete congruence of the content of an OAE test competency with the relevant standard. The information in this document is subject to change if revisions are made to the assessment framework. Any changes will fully supersede the information contained in this document.

Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
<u>Algorithmic Thinking and Data Analysis</u>			
0001	Understand problem solving and algorithm development.	Algorithms: ATP.A.K.a – ATP.A.12.a ATP.A.9-12.F.a ATP.A.9-12. F.b ATP.A.9-12.A.b Modularity ATP.M.1.a – ATP.M.8.a ATP.M.9–12.F.a ATP.M.9–12.A.a	1d. Develop programs and understand algorithms. Design, implement, and review programs in an iterative process using appropriate CS tools and technologies. Understand tradeoffs associated with different algorithms. 1f. Demonstrate CS practices. Apply and model CS and computational thinking practices in flexible and appropriate ways.
0002	Understand characteristics of algorithms.	Algorithms: ATP.A.K.a – ATP.A.12.a ATP.A.9-12.F.a ATP.A.9-12. F.b ATP.A.9-12.A.b ATP.A.9-12.A.c ATP.A.9-12.A.d Program Development	1d. Develop programs and understand algorithms. Design, implement, and review programs in an iterative process using appropriate CS tools and technologies. Understand tradeoffs associated with different algorithms. 1f. Demonstrate CS practices. Apply and model CS and computational thinking practices in flexible and appropriate ways.

This draft includes some materials that are test secure and/or confidential. It should not be circulated to unauthorized persons.
The information in this document is for discussion purposes and is subject to change. Any changes will fully supersede the information contained in this draft.

Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
		ATP.PD.K.a – ATP.PD.8.a ATP.PD.1.b – ATP.PD.8.b ATP.PD.7.c – ATP.PD.8.c	
0003	Understand data analysis, modeling, and simulation.	Data Collection and Storage: DA.DCS.K.a – DA.DCS.8.a DA.DCS.K.b – DA.DCS.8.b DA.DCS.6.c – DA.DCS.8.c DA.DCS.9-12.F.a DA.DCS.9-12.F.b Visualization and Communication: DA.VC.K.a – DA.VC.8.a DA.VC.6.b – DA.VC.8.b DA.VC.9-12.F.a DA.VC.9-12.A.a Inference and Modeling: DA.IM.K.a – DA.IM.8.a DA.IM.9-12.F.a DA.IM.9-12.A.a	1c. Use and analyze data. Collect, store, transform, and analyze digital data to better understand the world and make more accurate predictions. 1f. Demonstrate CS practices. Apply and model CS and computational thinking practices in flexible and appropriate ways.

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Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
<u>Programming</u>			
0004	Understand programming concepts and program design and development.	Program Development: ATP.PD.K.a – ATP.PD.8.a ATP.PD.9-12.F.a ATP.PD.9-12.F.b ATP.PF.9-12.F.c ATP.PD.9-12.A.a	1d. Develop programs and understand algorithms. Design, implement, and review programs in an iterative process using appropriate CS tools and technologies. Understand tradeoffs associated with different algorithms. 1f. Demonstrate CS practices. Apply and model CS and computational thinking practices in flexible and appropriate ways.
0005	Understand characteristics and uses of data types.	Variables and Data Representation: ATP.VDR.K.a – ATP.VDR.8.a ATP.VDR.6.b ATP.VDR.8.b– ATP.VDR.9-12.F.a ATP.VDR.9-12.A.a ATP.VDR.9-12.A.b	1d. Develop programs and understand algorithms. Design, implement, and review programs in an iterative process using appropriate CS tools and technologies. Understand tradeoffs associated with different algorithms. 1f. Demonstrate CS practices. Apply and model CS and computational thinking practices in flexible and appropriate ways.

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Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
0006	Understand operators and control structures.	Control Structures: ATP.CS.K.a – ATP.CS.8.a ATP.CS.9-12.F.a ATP.CS.9-12.A.a ATP.CS.9-12.F.c ATP.VDR.9-12.A.a ATP.VDR.9-12.A.b	1d. Develop programs and understand algorithms. Design, implement, and review programs in an iterative process using appropriate CS tools and technologies. Understand tradeoffs associated with different algorithms. 1f. Demonstrate CS practices. Apply and model CS and computational thinking practices in flexible and appropriate ways.

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Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
0007	Understand concepts of object-oriented design and programming.	Control Structures ATP.CS.9-12.F.b ATP.CS.9-12.A.a Modularity: ATP.M.1.a – ATP.M.8.a ATP.M.5.b ATP.M.9-12.F.a ATP.A.9-12.F.b ATP.M.9-12.F.b ATP.VDR.9-12.A.a ATP.VDR.9-12.A.b ATP.M.9-12.A.a ATP.CS.9-12.F.b ATP.M.9-12.A.b ATP.PD.9-12.A.a ATP.M.9-12.A.c ATP.CS.9-12.A.a	1d. Develop programs and understand algorithms. Design, implement, and review programs in an iterative process using appropriate CS tools and technologies. Understand tradeoffs associated with different algorithms. 1f. Demonstrate CS practices. Apply and model CS and computational thinking practices in flexible and appropriate ways.
<u>Computing Systems, Networks, and the Internet</u>			
0008	Understand terminology and concepts related to computing systems.	Devices: CS.D.K.a – CS.D.8.a	1a. Understand computing systems. Understand how hardware and software work within systems to input, process, store, and output information.

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Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
		CS.D.9-12.F.a CS.D.9-12.F.b CS.D.9-12.F.c CS.D.9-12.A.a CS.D.9-12.A.b CS.D.9-12.A.c Hardware/Software: CS.HS.K.a – CS.HS.8.a CS.HS.9-12.F.a CS.HS.9-12.A.a Troubleshooting: CS.T.K.a – CS.T.8.a CS.T.9-12.F.a CS.T.9-12.F.b CS.T.9-12.A.a	
0009	Understand networks and the Internet.	Networking: NI.N.K.a – NI.N.8.a NI.N.1.b – NI.N.8.b NI.N.8.c NI.N.9-12.F.a NI.N.9-12.F.b	1b. Understand networks and the Internet. Understand how computing devices connect via networks and the Internet to facilitate communication and foster innovation.

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Computer Science	Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
	NI.N.9-12.F.c NI.N.9-12.A.a NI.N.9-12.A.b NI.N.9-12.A.c Cyber Security: NI.C.K.a – NI.C.8.a NI.C.6.b – NI.C.8.b NI.C.6.c – NI.C.7.c NI.C.9-12.F.a NI.C.9-12.F.b NI.C.9-12.A.a NI.C.9-12.A.b	
<u>Impacts of Computing and Learning Environments</u>		

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Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
0010	Understand social and global issues related to computer technology.	Culture: IC.Cu.K.a – IC.Cu.8.a IC.Cu.K.b – IC.Cu.8.b IC.Cu.6.c – IC.Cu.8.c IC.CU.7.d – IC.Cu.8.d IC.Cu.9-12.F.a IC.Cu.9-12.F.b IC.Cu.9-12.A.a IC.Cu.9-12.A.b IC.Cu.9-12.A.c	1e. Analyze impacts of computing. Analyze how people influence computing through their behaviors and cultural and social interactions, as well as how computing impacts society in both positive and negative ways. 2a. Understand issues of equity in Computer Science. Explain how structural barriers and social and psychological factors contribute to inequitable access, engagement, and achievement in Computer Science among marginalized groups. 2c. Represent diverse perspectives. Incorporate the perspectives and experiences of individuals from marginalized groups in curricular materials.

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Competencies		Ohio Learning Standards	CSTA/ISTE
Computer Science		Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
		Social Interaction: IC.SI.K.a – IC.SI.8.a IC.SI.9-12.F.a IC.SI.9-12.F.b Safety, Law & Ethics: IC.SLE.K.a – IC.SLE.8.a IC.SLE.3.b – IC.SLE.8.b IC.SLE.3.c – IC.SLE.8.c IC.SLE.6.d – IC.SLE.8.d IC.SLE.6.e – IC.SLE.7.e IC.SLE.9-12.F.a IC.SLE.9-12.F.b IC.SLE.9-12.F.c IC.SLE.9-12.F.d IC.SLE.9-12.A.a IC.SLE.9-12.A.b	5e. Encourage student communication about computing. Create meaningful opportunities for students to discuss, read, and write about computing.
0011	Understand effective learning environments.	Safety, Law & Ethics: IC.SLE.K.a – IC.SLE.8.a IC.SLE.3.b – IC.SLE.8.b IC.SLE.3.c – IC.SLE.8.c IC.SLE.6.d – IC.SLE.8.d	1e. Analyze impacts of computing. Analyze how people influence computing through their behaviors and cultural and social interactions, as well as how

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Competencies	Ohio Learning Standards	CSTA/ISTE
Computer Science	Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
	IC.SLE.6.e – IC.SLE.7.e IC.SLE.9-12.F.a IC.SLE.9-12.F.b IC.SLE.9-12.F.c IC.SLE.9-12.F.d IC.SLE.9-12.A.a IC.SLE.9-12.A.b	<p>computing impacts society in both positive and negative ways.</p> <p>2a. Understand issues of equity in Computer Science. Explain how structural barriers and social and psychological factors contribute to inequitable access, engagement, and achievement in Computer Science among marginalized groups.</p> <p>2b. Minimize threats to inclusion. Develop strategies to proactively challenge unconscious bias and minimize stereotype threat in CS.</p> <p>2c. Represent diverse perspectives. Incorporate the perspectives and experiences of individuals from marginalized groups in curricular materials.</p> <p>2d. Use data for decision-making to improve equity. Create and implement a plan to improve access, engagement, and full participation in CS using classroom data to inform decision-making.</p> <p>2e. Promote accessible educational CS materials. Learn to effectively evaluate tools and curricula¹ and to leverage resources¹ to improve accessibility for all students.</p> <p>3e. Leverage community resources. Identify and connect resources in the local community and broader Computer Science ecosystem to support student learning in Computer Science.</p>

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Competencies	Ohio Learning Standards	CSTA/ISTE
Computer Science	Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
		<p>3c. Identify and counteract personal bias. Reflect on how their own perspective, privilege, and power impact student success and classroom culture and continuously work to counteract these personal biases.</p> <p>3d. Recognize the value of CS for all students. Refine a personal teaching philosophy reflecting that all students can and should learn CS.</p> <p>4a. Analyze computer science curricula. Analyze computer science curricula for implementation in their classrooms in terms of CS standards alignment, accuracy, completeness of content, cultural relevance, instructional approaches, and accessibility.</p> <p>4b. Develop standards-aligned learning experiences. Design and adapt learning experiences with strong alignment to comprehensive K-12 computer science standards.</p> <p>4c. Design inclusive learning experiences. Ensure that all students can access and engage with content and succeed in learning CS by using Universal Design for Learning (UDL)¹ and Culturally Relevant Pedagogy (CRP)</p> <p>4d. Develop strong student conceptual understanding. Use a toolkit of CS-specific teaching strategies to develop students' strong conceptual</p>

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Competencies	Ohio Learning Standards	CSTA/ISTE
Computer Science	Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
		<p>understanding and to proactively address student misconceptions in CS.</p> <p>4e. Integrate personally meaningful projects. Plan opportunities for students to create open-ended and personally meaningful projects.</p> <p>4f. Inform instruction through assessment. Develop multiple forms of formative and summative assessment to provide feedback and support. Use resulting data for instructional decision-making and differentiation.</p> <p>4g. Build connections between CS and other disciplines. Design learning experiences that highlight connections to other disciplines and real-world contexts.</p> <p>5a. Facilitate inquiry for student learning. Use inquiry-based learning to enhance student understanding of CS content.</p> <p>5b. Cultivate a supportive classroom environment. Cultivate a supportive classroom environment that values and amplifies multiple solutions, approaches, perspectives, and voices.</p> <p>5c. Promote student self-efficacy. Facilitate students' engagement in the learning process and encourage students to take leadership of their own learning by encouraging creativity and use of a variety of resources and problem-solving techniques.</p>

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Competencies	Ohio Learning Standards	CSTA/ISTE
Computer Science	Ohio Learning Standards: K-12 Computer Science	Standards for Computer Science Educators (Second Draft 11-06-2019)
		<p>5d. Support student collaboration with computing. Provide meaningful opportunities for students to work together. Elicit students' ability to provide, receive, and respond to constructive feedback.</p> <p>5e. Encourage student communication about computing. Create meaningful opportunities^l for students to discuss, read, and write about computing.</p> <p>5f. Provide meaningful feedback. Use formative assessments to provide effective feedback to students and to adjust instruction in order to promote stronger achievement in CS.</p>

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Appendix B: Content Validation Survey Results

Appendix B: Computer Science Content Validation Survey Results

Content validation surveys were conducted to gather evidence that showed each OAE assessment framework adequately reflects the knowledge and skills it is intended to measure. Survey participants (practicing teachers and faculty preparing teachers) were asked to rate the importance of the knowledge and skills described by each competency and accompanying descriptive statements on a 5-point scale. The following table depicts the mean ratings for the OAE Computer Science assessment.

Ohio Assessments for Educators (OAE)
Fall 2019 Content Validation Survey
Overall Mean Rating Report
Final Results – Fall 2019

Field	Mean Competency Importance Ratings ¹		Mean Descriptive Statement Ratings ²		Mean Composite Ratings ²	
	Teachers	Faculty	Teachers	Faculty	Teachers	Faculty
054 Computer Science	4.08	4.04	3.98	4.00	4.00	3.33

¹ (1 = No importance, 2 = Little importance, 3 = Moderate importance, 4 = Great importance, 5 = Very great importance)

² (1 = Poorly, 2 = Somewhat, 3 = Adequately, 4 = Well, 5 = Very well)

Developed and Produced by



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