California Diploma Project Technical Report II: Alignment Study

Alignment Study of the Health Sciences and Medical Technology Draft Standards and California's Exit Level Common Core State Standards

Prepared for
Policy Analysis for California Education (PACE)
by the
Educational Policy Improvement Center (EPIC) and WestEd
EPIC Project Staff:

Charis McGaughy, PhD
Alicia de González

June 2012

Table of Contents

Introduction

The California Department of Education is in the process of revising the Career and Technical Education (CTE) Model Curriculum Standards. The Educational Policy Improvement Center (EPIC) conducted an investigation of the draft version of the Health Sciences and Medical Technology Standards (Health Science). The purpose of the study is to understand how the Health Science Standards relate to college and career readiness and foundational English language arts (ELA) and mathematics content, as represented by California's exit level augmented Common Core State Standards (CCSS). This study utilized an alignment methodology analyzing the relationship between the Health Sciences Standards and (a) California's grade 11–12 CCSS in English Language Arts and Literacy and (b) California's High School CCSS in Mathematics and the Standards for Mathematical Practice.

The augmented Common Core State Standards (CCSS)[1,2] were adopted by the California State Board of Education (SBE) on August 2, 2010. The augmented CCSS represent a set of expectations for student knowledge and skills that high school graduates need to master to succeed in college and careers. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills necessary for success in college and careers.[3]

The goal of the updated CTE Model Curriculum Standards is to provide a clear and coherent message about what students need to know and be able to do in order to be successful in postsecondary education or job training programs within 15 industry sectors. These standards aim to provide a framework of what to teach without stipulating how to teach it. In this pilot study, however, only the standards within the Health Sciences and Medical Technology Sector were examined.

At the time of publication, the CTE Model Curriculum Standards were still under development by the California Department of Education. The results of this study can be used to inform further revisions of the Health Science Standards to ensure greater consistency with and alignment to the augmented CCSS.

This alignment study examines two dimensions of alignment, looking at both content and cognitive complexity. Using a modified version of the methodology developed by the Regional Educational Laboratory Southwest, this study addresses the following research questions:

- To what extent are the knowledge and skills found in the CA CTE Health Science Standards the same or different (aligned) to the augmented CCSS?
- How does the cognitive complexity of the CA CTE Health Science Standards compare to the augmented CCSS?

[1] Common Core State Standards Initiative & California Department of Education. (2012a). *California's Common Core State Standards for English Language Arts, Literacy in History/Social Studies, Science, and Technical Subjects.* Retrieved from http://www.scoe.net/castandards/agenda/2010/ela_ccs_recommendations.pdf

[2] Common Core State Standards Initiative & California Department of Education. (2012b). *K-12 California's Common Core Content Standards for Mathematics.* Retrieved from http://www.scoe.net/castandards/agenda/2010/math_ccs_recommendations.pdf

[3] Common Core State Standards Initiative. (2011). *Mission Statement.* Retrieved from http://www.corestandards.org/

Methodology

This study employed a modified version of the content alignment methodology used in a series of REL Southwest studies[4,5,6] to assess the alignment between Health Sciences and Medical Technology Standards and (a) California's grade 11–12 Common Core State Standards in English Language Arts and Literacy and (b) California's High School Common Core State Standards in Mathematics and the Standards for Mathematical Practice. Overall, this study analyzed the relationship between 331 Health Science and Medical Technology statements and 32 Common Core English Language Arts and Literacy Standards, and 232 Mathematics Standards.

To begin, EPIC developed two instruments for data collection. The tools were spreadsheet tables containing the standards and scales, formatted to ensure the fidelity of the data gathered. The alignment process utilizes experienced content experts to make criterion-based professional judgments about the different set of standards. This process consists of seven steps:

Step 1 – Reviewer selection. A total of four experts are selected based on their experience with education standards and alignment studies. Representation from the three content areas in the current study are recruited. Included are one mathematics, one English language arts, and two health science and medical technology experts.

Step 2 – Reviewer orientation. All reviewers are trained via web conference by EPIC staff on the study's methodology, purpose, and decision criteria.

Step 3 – Cognitive complexity ratings (see Table 1). Reviewers worked individually to assess the cognitive complexity of each Health Science statement and each Common Core State Standard.[7]

Step 4 – Consensus on cognitive complexity ratings. EPIC staff facilitate reviewers working in groups to reach consensus on cognitive complexity ratings for each rated statement in both standard sets.

Step 5 – Content matching. Using the alignment table, reviewers work individually and systematically read each Health Science statement and search all of the Common Core State Standards for corresponding content. Each CCSS standard with related content is listed next to the Health Science statement as a match. There are no limits to the number of CCSS matches that can be listed with any one Health Science standard.

Step 6 – Assessment of alignment relationship (Table 2) and rationale statement (Table 3). After completing the matching exercise, each Health Science statement and its corresponding matches are evaluated and assigned an alignment relationship (and rationale statement when appropriate).

Step 7 – Consensus on alignment relationships and rationale statements. EPIC Staff facilitate reviewers working in groups to reach consensus on determining final matches and ratings.

---

[4] Rolfhus, E., Cook, H. G., Brite, J. L., and Hartman, J. (2010). *Are Texas English language arts and reading standards college ready?* (Issues & Answers Report, REL 2010-No. 091). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved from http://ies.ed.gov/ncee/edlabs

[5] Rolfhus, E., Decker, L. E., Brite, J. L., & Gregory, L. (2010). *A systematic comparison of the American Diploma Project English language arts college readiness standards with those of the ACT, College Board, and Standards for Success.* (Issues & Answers Report, REL 2010-No. 086). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved from http://ies.ed.gov/ncee/edlabs

[6] Timms, M., Schneider, S., Lee, C., & Rolfhus, E. (2007). *Aligning science assessment standards: Texas and the 2009 National Assessment of Educational Progress (NAEP)* (Issues & Answers Report, REL 2007–No. 011). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved from http://ies.ed.gov/ncee/edlabs

[7] Common Core State Standards cognitive complexity ratings were used from a previous study updated by content experts; the Health Science experts reviewed and practiced using the already determined CCSS ratings.

As described in steps 3 and 4, expert reviewers first work individually and then collaboratively to reach consensus about the level of cognitive complexity for each standard. The four levels of cognitive complexity are described in Table 1. This data then allows for a comparison of the cognitive complexity between the two sets of standards.

Table 1. Cognitive Complexity Rating Scale

DOK Level	Description
Level 1 (Recall)	Recall of a fact, information, or procedure.
Level 2 (Skill/Concept)	Use information or conceptual knowledge, two or more steps, etc.
Level 3 (Strategic Thinking)	Requires reasoning, developing plan or a sequence of steps, some complexity, more than one possible answer.
Level 4 (Extended Thinking)	Requires an investigation, time to think and process multiple conditions of the problem.

For steps 5 through 7, the expert reviewers then determine the level of content alignment between the two sets of standards. First, the expert reviewers map the content of the CCSS to the Health Science Standards. Then, for each Health Science standard determined to have some alignment to the CCSS, the expert reviewers rate the relationship between the standards, as described by the alignment relationship scale in Table 2.

Table 2. Alignment Relationship Scale

Scale	Description
Complete Match	All content in the CCSS fully align with the Health Sciences Standard
Partial Match	Some of the content in a standard from one set of standards relates to some or all of the content in another standard from the comparison set of standards.
No Match	None of the content in the CCSS aligns with any of the content in the Health Sciences Standard

To more deeply understand the relationships, those standards rated as partially aligned are then assigned a rationale statement, as described in Table 3. Once all expert reviewers have completed their content review, EPIC staff facilitate the group working together to reach consensus on all ratings. This data is then used to describe the content relationship between the two sets of standards.

Table 3. Rationale Statements (selected if standards rated with Partial Match alignment relationship)

Rationale Statement	Description
1	Health Science Standard content is prerequisite to the CCSS
2	CCSS content is prerequisite to the Health Science Standard
3	Part of the Health Science Standard matches all of the CCSS
4	Part of the CCSS matches all of the Health Science Standard
5	Part of the Health Science Standard matches part of the CCSS

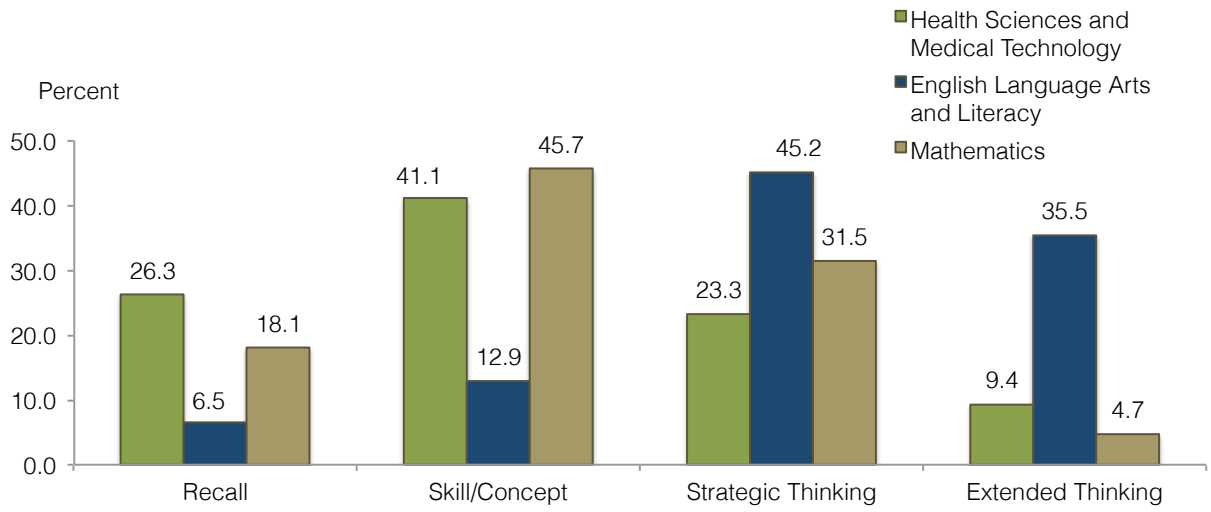
Findings

The remainder of the report discusses the findings of the study, first by looking overall at the ELA and Literacy and Mathematics cognitive complexity and content alignment results, and then at each Health Science and Medical Technology pathway individually.

Cognitive Complexity

Cognitive complexity represents the challenge level of the interaction with the content within a standard, ranging on a four-point scale from recall to extended thinking. To be consistent, the two sets of standards should have comparable levels of cognitive complexity. Figure 1 shows the distribution of the cognitive complexity ratings for Health Sciences, ELA and Literacy, and Mathematics standard sets. The distribution of Health Sciences shows the majority of ratings at the first three levels of cognitive complexity, with 41 percent at level two (Skill/Concept) and 26 and 23 percent at levels one (Recall) and three (Strategic Thinking), respectively. The Mathematics standards also have the highest percentage at level two (46%), and 18 and 32 percent at levels one and three respectively. Both Health Sciences and Mathematics have few statements at level four (Extended Thinking), which is characterized by requiring time, investigation, and processing of multiple conditions of a problem. Whereas the Mathematics and Health Sciences Standards are more concentrated at level two, the ELA and Literacy Standards have a majority rated at level three and four (81% total), then levels one and two (19% total), with the most concentrated at level three (45%).

Figure 1. Distribution of cognitive complexity level ratings across the four Depth of Knowledge levels



Content Alignment

Content alignment describes the relationship of the knowledge and skills represented by the CCSS and the Health Science Standards. The level of alignment ranges from complete match, partial match, and no match, determined between the intersection of each CCSS and each Health Science Standard. Because the two sets of standards represent fundamentally different content areas (ELA, Mathematics, and Health Science), most of the intersections would not be expected to match. What is useful, however, is to consider where the standards do have a full or partially aligned match to ascertain if the literacy and mathematical skills necessary for the Health Science are consistent with the CCSS, and if there are any gaps that might require further examination.

Table 4 presents the results of the content alignment analysis organized at the Content Area level of the CCSS, representing the percent of the CCSS within each Content Area that had matched or partially matched alignment to the Health Science Standards. Overall, 96.8 percent of the ELA and Literacy CCSS were aligned to the Health Science Standards, with the only standards not aligned from Language. For Mathematics, only 14.2 percent of the CCSS were aligned to the Health Science Standards. This reveals large gaps between the CCSS Mathematics content addressed by the Health Sciences.

Table 4: Percent of Common Core State Standards by Content Area with Aligned Health Science Standards

Common Core State Standards	Percent of CCSS with Related Health Science Standards	N	Total number of CCSS
English/Language Arts and Literacy			
Reading for Literacy in Science and Technical Subjects	100.0	10	10
Writing for Literacy in History/Social Studies, Science, and Technical Subjects	100.0	9	9
Speaking and Listening	100.0	6	6
Language	83.3	5	6
ELA total	**96.8**	**30**	**31**
Mathematics			
Standards for Mathematical Practice	62.5	5	8
Number and Quantity	11.1	3	27
Algebra	3.3	1	30
Functions	10.8	4	37
Geometry	1.9	1	53
Statistics and Probability	54.8	17	31
Advanced Placement Probability and Statistics	10.5	2	19
Calculus	0.0	0	27
Mathematics total	**14.2**	**33**	**232**

Overview English Language Arts and Literacy Content Alignment

This section further describes how the content of the ELA and Literacy CCSS aligns to the Health Sciences Standards. Since these two sets of standards target two different content areas, few Complete Matches and many No Matches would be expected. What is interesting is to explore the content relationship between the two areas, making sure the desired levels of content coverage are addressed in the Health Science Standards. In addition, this section summarizes the additional analysis of the partially aligned standards, enabling deeper examination at the individual standard statement level of the content relationship.

Figure 2 shows the distribution (by percentages) of the Health Science Standards that are completely aligned (0.9 percent), partially aligned (67.4 percent), and not aligned (31.7 percent) to the ELA and Literacy CCSS. Figure 3 shows the distribution of rationale statements for those statements that are partially aligned. Less than one percent of the Health Sciences statements are completely matched to the ELA and Literacy Standards. The majority (67%) of the Health Sciences rated statements have a partially matched alignment relationship to the ELA and Literacy Standards.

Figure 2. Percentage of Health Sciences and Medical Technology Standards (n = 331) that are Completely, Partially, or Not Aligned with the Common Core ELA and Literacy Standards

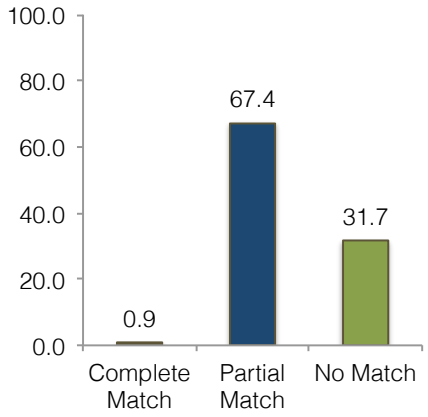
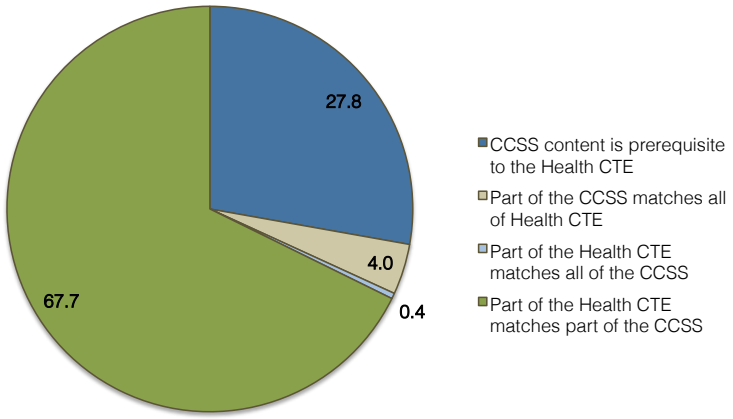


Figure 3. Distribution of rationale statements for Health Sciences and Medical Technology Standards that have a Partial Match (n = 223) alignment relationship to the ELA and Literacy Common Core State Standards



As shown in Figure 3, for the 223 partially matched statements, a rationale statement was chosen. These rationale statements further explain the Partial Match relationship. The rationale selected for the majority of the partially matched statements (68%) was that part of the Health CTE statement matches part of the CCSS. To gain additional insight into this description, our reviewers provided notes on a standard-by-standard basis. These notes can be viewed in the full alignment tables provided as a supplement to this report. Another 28 percent of the partially matched health science statements have a rationale statement that indicated that the matched ELA and Literacy CCSS content is prerequisite to the Health Sciences content. The remaining four percent of rationale statements are instances where part of either the CCSS or the Health Science Standards addressed all of the other standard. These results are useful in determining how much ELA content should be included in the Health Sciences Standards, and the greater level of annotated detail provided by the rationale statements and reviewers comments enables greater specification for the developers of the Health Science Standards.

Overview Mathematics Content Alignment

This section further describes the finding of how the content of the Mathematics CCSS aligns to the Health Sciences Standards. Figure 4 shows the distribution (by percentages) of the Health Science Standards that are completely aligned (none), partially aligned (27.2 percent), and not aligned (72.8 percent) to the ELA and Literacy CCSS. Figure 5 shows the distribution of rationale statements for those statements that are partially aligned. In Mathematics there are no Health Science statements that have a completely aligned alignment relationship to the CCSS.

Of the 90 partially matched Health Science statements, 51 percent (46) of the rationale statements indicated that the matched CCSS content is prerequisite to the Health Science content. For another 45 percent, the rationale states that part of the Health CTE statement matches part of a Mathematics CCSS. To gain additional insight into this description, the reviewers provided notes on a standard-by-standard basis. These detailed notes can be viewed in the full alignment tables provided as a supplement to this report. The remaining three percent of rationale statements are instances where part of either the CCSS or the Health Science Standards covered all of the other. Again, these results are useful in determining how much mathematics content should be included in the Health Sciences Standards, and the greater level of annotated detail provided by the rationale statements and reviewers comments enables greater specification for the developers of the Health Science Standards.

Figure 4. Percentage of Health Sciences and Medical Technology Standards (n = 331) that are Completely, Partially, or Not Aligned with the Common Core Mathematics Standards

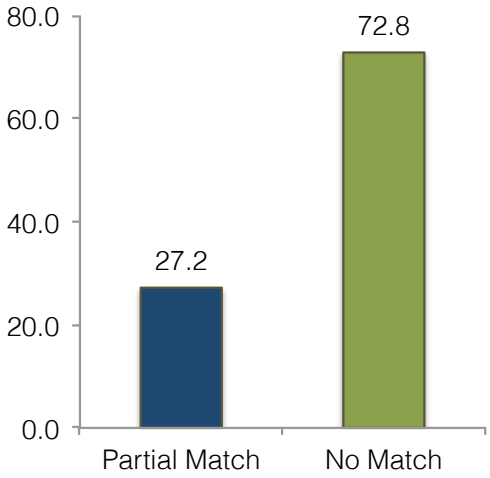
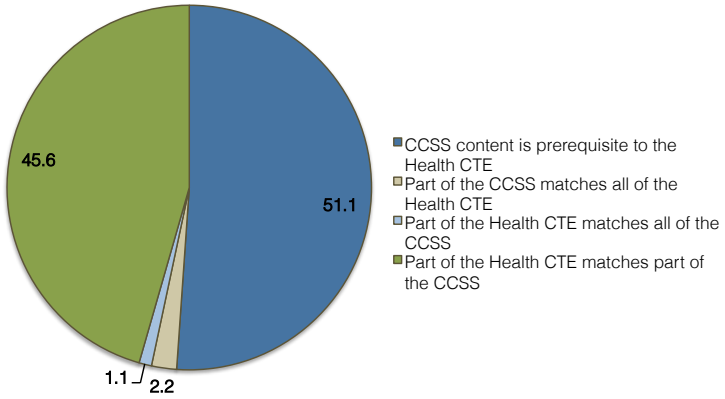


Figure 5. Distribution of rationale statements for Health Sciences and Medical Technology Standards that have a Partial Match (n = 90) alignment relationship to the Mathematics Common Core State Standards



Results by Health Science Pathway

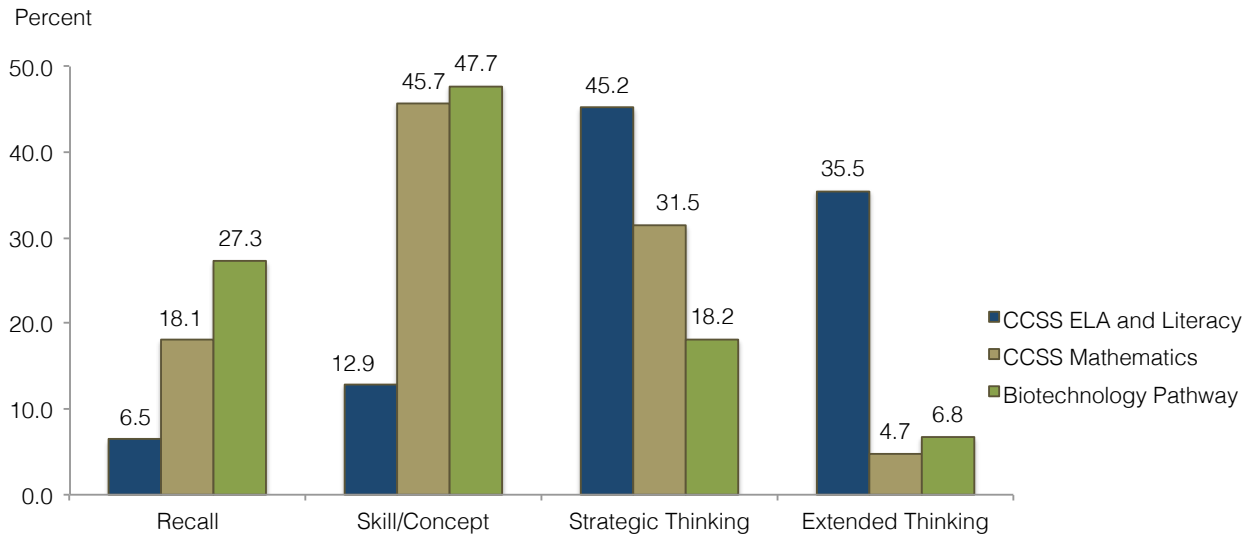
This section summarizes the results of the analysis of the cognitive complexity and the content alignment results by the six pathways within the Health Science career cluster[8]. The Health Science career cluster is diverse in occupational opportunities; this analysis allows for the exploration and specification of the desired literacy and mathematics skills by individual pathway, and for an examination of the consistency of the Health Science Standards with the CCSS for each pathway. For example, students pursuing the Biotechnology Pathway might require different literacy and mathematics skills than students pursuing the Patient Care Pathway.

Biotechnology Pathway ELA and Literacy and Mathematics Results

Cognitive Complexity

The distribution of the levels of cognitive complexity for the Biotechnology Pathway compared to the ELA and Literacy and Mathematics standards can be seen in Figure 6. ELA and Literacy has a majority of standards at Strategic and Extended Thinking (Levels 3 and 4), while the majority of the Biotechnology Pathway statements are at Recall or Skill/Concept (Levels 1 and 2). Mathematics and

Figure 6. Distribution of cognitive complexity level ratings across the four Depth of Knowledge levels for ELA and Literacy, Mathematics, and Biotechnology



Biotechnology both have the highest percent at Level 2 (Skill/Concept) and less than 7 percent of statements at Level 4 (Extended Thinking). Biotechnology has fewer statements than the Mathematics standards at Level 3 (Strategic Thinking) and more at Level 1 (Recall).

[8] Tables displaying individual standard results (for both cognitive complexity and alignment), by Health Science pathway can be accessed from the links below.
ELA results: http://epiconline.org/publications/documents/CDP_ELADataTables.xlsx?force_download=true
Mathematics results: http://epiconline.org/publications/documents/CDP_MathDataTables.xlsx?force_download=true

Alignment Relationship and Rationale

Figure 7 shows that no Biotechnology statements are rated as completely aligned to the CCSS ELA and Literacy Standards, but the majority (77.3%) are partially aligned with one more CCSS. Ten Biotechnology statements (22.7%) have no content match to the ELA and Literacy CCSS. As detailed in the methodology, each Biotechnology statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 8). In Biotechnology, 68 percent of the 34 partially matched statements are rated as having part of the Health CTE content matching part of the ELA and Literacy CCSS content. Another 27 percent of the partially matched statements are rated as the ELA and Literacy CCSS being prerequisite to the Biotechnology specific statements.

Figure 7. Percentage of Biotechnology Pathway Standards (n = 44) that are Completely, Partially, or Not Aligned with the Common Core ELA and Literacy Standards

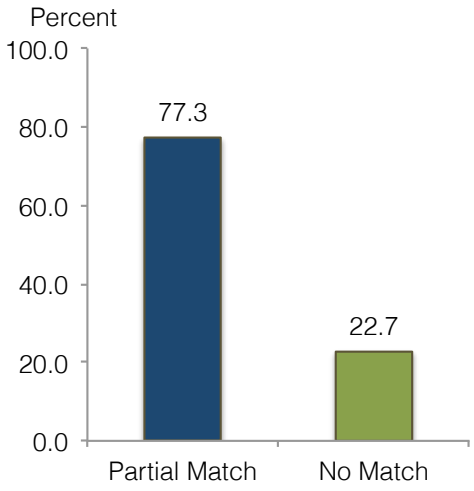


Figure 8. Distribution of rationale statements for Biotechnology Pathway Standards that have a Partial Match (n = 34) alignment relationship to the ELA and Literacy Common Core State Standards

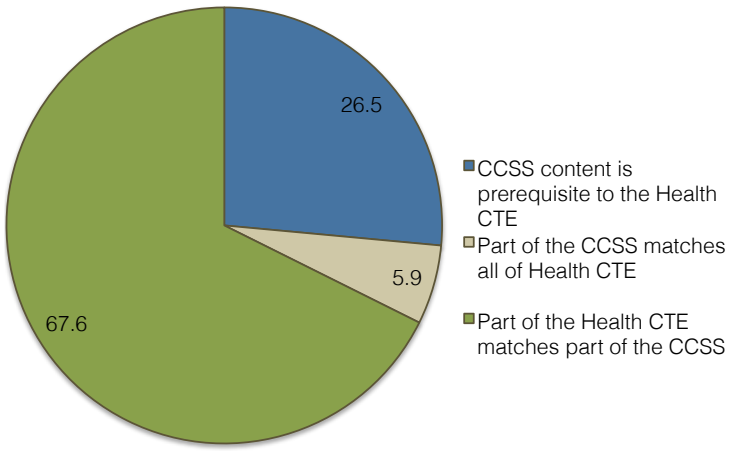


Figure 9 shows that no Biotechnology statements are rated as completely aligned to the Mathematics CCSS and 40.9 percent are partially aligned with one or more Mathematics standards. Twenty-six Biotechnology statements (59.1%) have no content match to the CCSS. As detailed in the methodology, each Biotechnology statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 10). The Mathematics CCSS are prerequisite to most of the Biotechnology technology statements they match (61.1% of the 18 partially matched statements). Another 22 percent of the partially matched statements are rated as having part of their content match part of the content in the CCSS. In addition, when selecting the rationale statements, the expert content reviewers annotated the partial alignment relationship in comment boxes. For this additional detail at the individual standard level, please refer to the supplemental tables to this technical report.

Figure 9. Percentage of Biotechnology Pathway Standards (n = 44) that are Completely, Partially, or Not Aligned with the Common Core Mathematics Standards

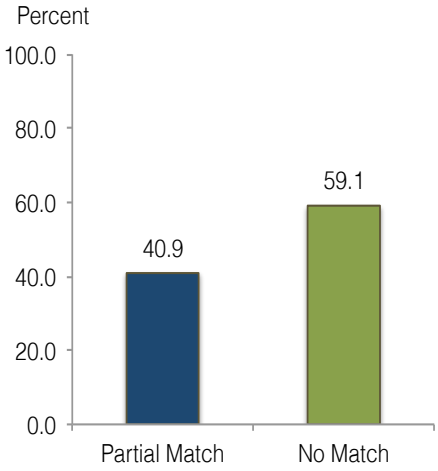
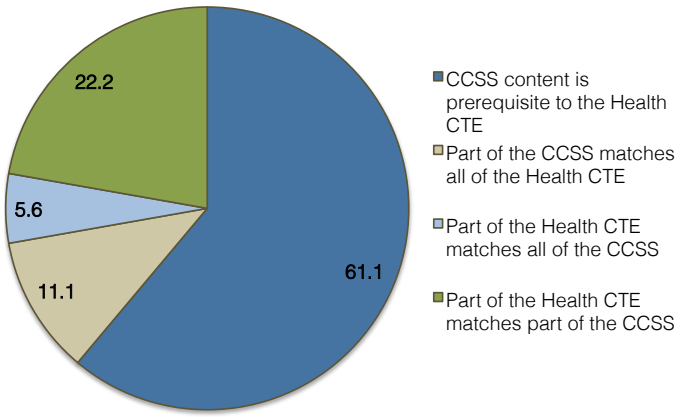


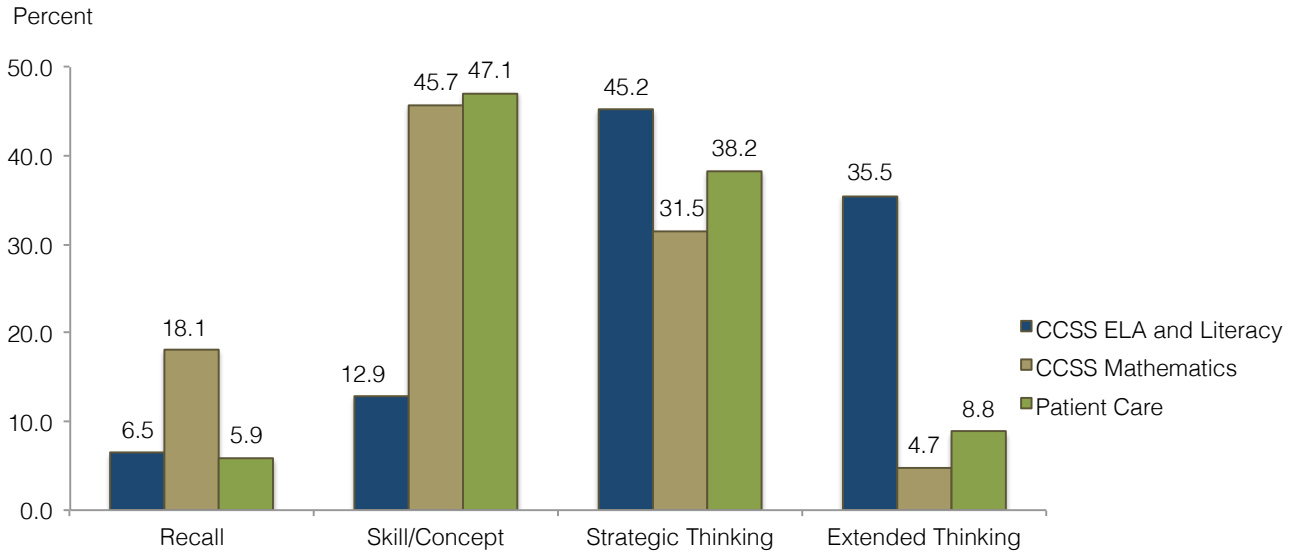
Figure 10. Distribution of rationale statements for Biotechnology Pathway Standards that have a Partial Match (n = 18) alignment relationship to the Mathematics Common Core State Standards



Cognitive Complexity

The distribution of the levels of cognitive complexity can be seen in Figure 11. ELA and Literacy has a majority of standards at Strategic and Extended Thinking (Levels 3 and 4), while the majority of the Patient Care Pathway statements are at Skill/Concept and Strategic Thinking (Levels 2 and 3). Mathematics and Patient Care both have the highest percent at Level 2 (Skill/Concept) and fewer statements for both are at Level 1 (Recall) and Level 4 (Extended Thinking).

Figure 11. Distribution of cognitive complexity level ratings across the four Depth of Knowledge levels for ELA and Literacy, Mathematics, and Patient Care



Alignment Relationship and Rationale

Figure 12 shows that no Patient Care statements are rated as completely aligned to the ELA and Literacy CCSS, but 21 of the 34 statements (61.8%) are partially aligned with one or more CCSS. There are 13 Patient Care statements (38.2%) that have no content match to the CCSS. As detailed in the methodology, each Patient Care statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 13). In Patient Care, 52 percent of the 34 partially matched statements are rated as the ELA and Literacy CCSS being prerequisite to the Patient Care specific statements. Another 38 percent are rated as having part of the Health CTE content matching part of the ELA and Literacy CCSS content. The remaining 10 percent are instances where part of the content in the ELA and Literacy CCSS covered all of the Patient Care statement.

Figure 12. Percentage of Patient Care Pathway Standards (n = 34) that are Completely, Partially, or Not Aligned with the Common Core English Language Arts and Literacy Standards

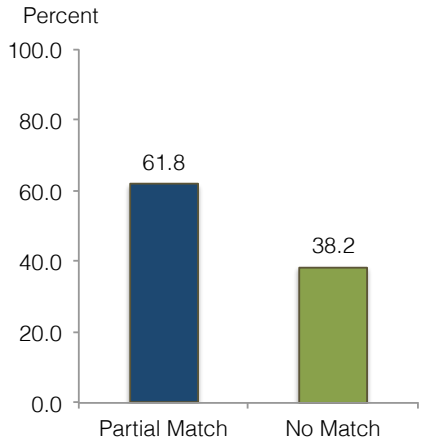


Figure 13. Distribution of rationale statements for Patient Care Pathway Standards that have a Partial Match (n = 21) alignment relationship to the ELA and Literacy Common Core State Standards

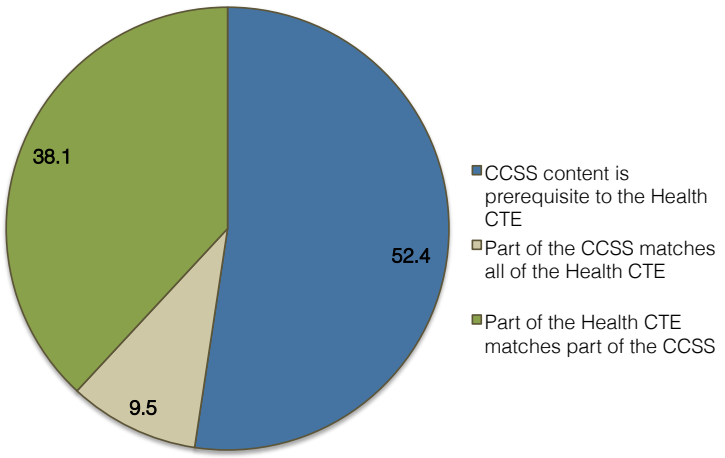


Figure 14 shows that no Patient Care statements are rated as completely aligned to the Mathematics CCSS and 26.5 percent are partially aligned with one or more Mathematics standards. There are 25 (73.5%) Patient Care statements with no content match to the CCSS. As detailed in the methodology, each Patient Care statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 15). A majority of the matches are rated as part of the Patient Care statement matching part of the Mathematics CCSS standard (66.7% of the 9 partially matched statements). Another 33 percent of the partially matched statements are rated as the CCSS content being prerequisite to the Patient Care statements. In addition, when selecting the rationale statements, the expert content reviewers annotated the partial alignment relationship in comment boxes. For this additional detail at the individual standard level, please refer to the supplemental tables to this technical report.

Figure 14. Percentage of Patient Care Pathway Standards (n = 34) that are Completely, Partially, or Not Aligned with the Common Core Mathematics Standards

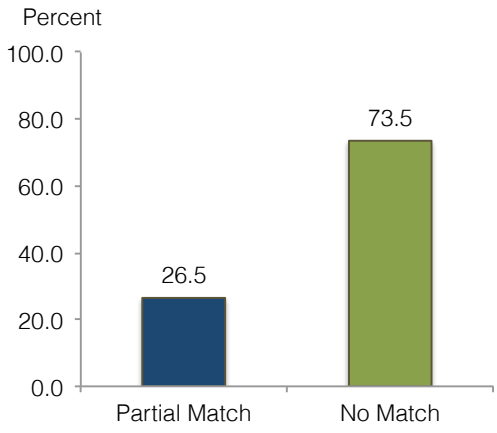
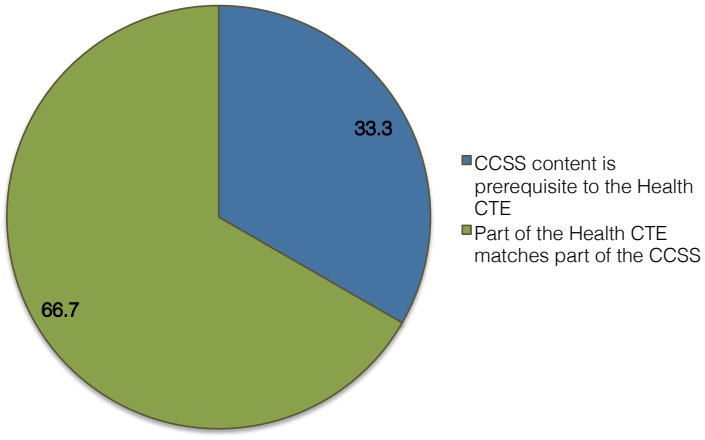


Figure 15. Distribution of rationale statements for Patient Care Pathway Standards that have a Partial Match (n = 9) alignment relationship to the Mathematics Common Core State Standards

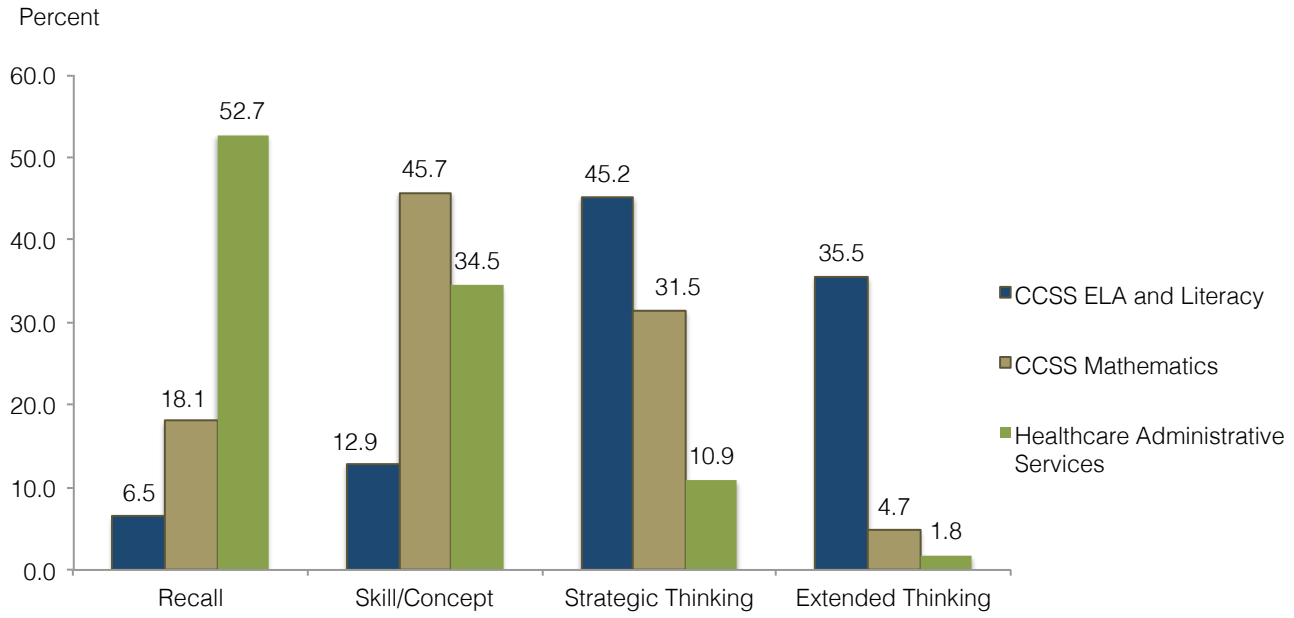


Healthcare Administrative Services Pathway ELA and Literacy and Mathematics Results

Cognitive Complexity

The distribution of the levels of cognitive complexity can be seen in Figure 16. ELA and Literacy CCSS have a majority of standards at Strategic and Extended Thinking (Levels 3 and 4), while the majority of the Healthcare Administrative Services Pathway statements are at Recall or Skill/Concept (Levels 1 and 2). Mathematics CCSS has the highest percent at Level 2 (Skill/Concept) followed by Level 3 (Strategic Thinking) and fewer statements at Level 4 (Extended Thinking). Healthcare Administrative Services has 53 percent at Level 1 (Recall) and 35 percent at Level 2 (Skill/Concept).

Figure 16. Distribution of cognitive complexity level ratings across the four Depth of Knowledge levels for ELA and Literacy, Mathematics, and Healthcare Administrative Services



Alignment Relationship and Rationale

Figure 17 shows that two Healthcare Administrative Services statements are rated as completely aligned to the ELA and Literacy CCSS, and 40% are partially aligned with one or more CCSS. A majority of the Healthcare Administrative Services statements (56%) have no content match to the ELA and Literacy CCSS. As detailed in the methodology, each Healthcare Administrative Services statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 18). In Healthcare Administrative Services, 68 percent of the 22 partially matched statements are rated as having part of the Health CTE content matching part of the CCSS content. Another 27 percent of the partially matched statements are rated as the ELA and Literacy CCSS being prerequisite to the Healthcare Administrative Services specific statements.

Figure 17. Percentage of Healthcare Administrative Services Pathway Standards (n = 55) that are Completely, Partially, or Not Aligned with the Common Core ELA and Literacy Standards

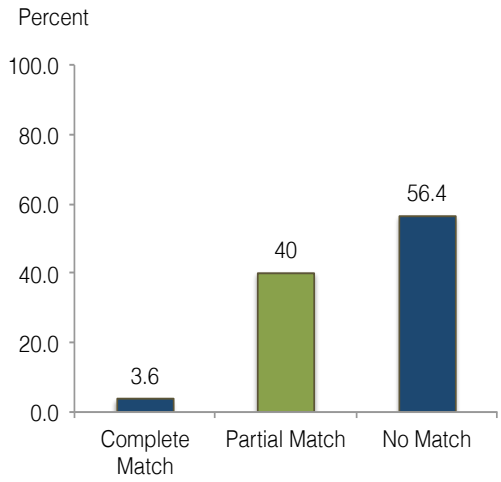


Figure 18. Distribution of rationale statements for Healthcare Administrative Services Pathway Standards that have a Partial Match (n = 22) alignment relationship to the ELA and Literacy Common Core State Standards

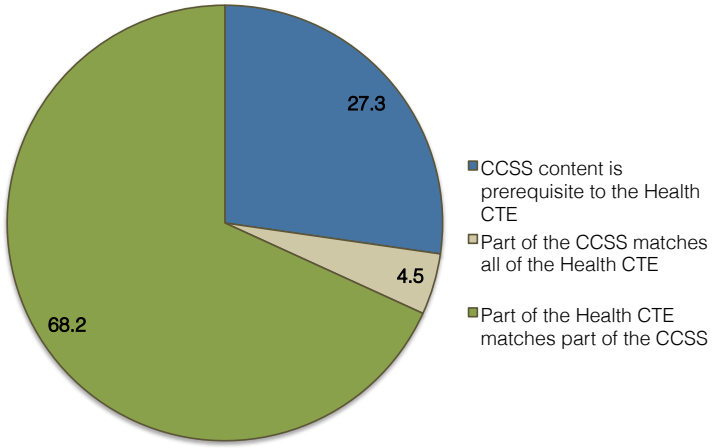


Figure 19 shows that no Healthcare Administrative Services statements are rated as completely aligned to the Mathematics CCSS and 26 percent are partially aligned with one or more Mathematics standards. There are 41 (75%) Healthcare Administrative Services statements that have no content match to the CCSS. As detailed in the methodology, each Healthcare Administrative Services statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 20). About 64 percent of the partially matched statements are rated as having part of each of the standards match. The remaining 36 percent of the Mathematics CCSS are prerequisite to the Healthcare Administrative Services technology statements they match. In addition, when selecting the rationale statements, the expert content reviewers

Figure 19. Percentage of Healthcare Administrative Services Pathway Standards (n = 55) that are Completely, Partially, or Not Aligned with the Common Core Mathematics Standards

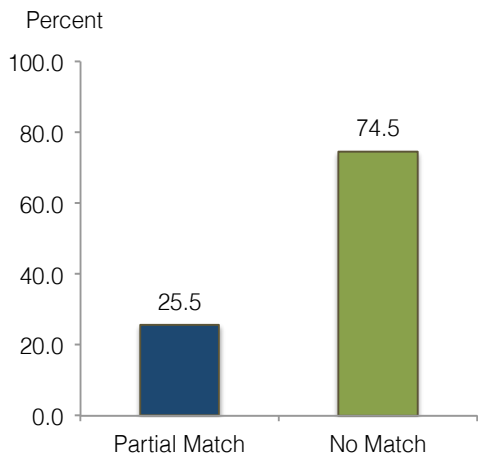
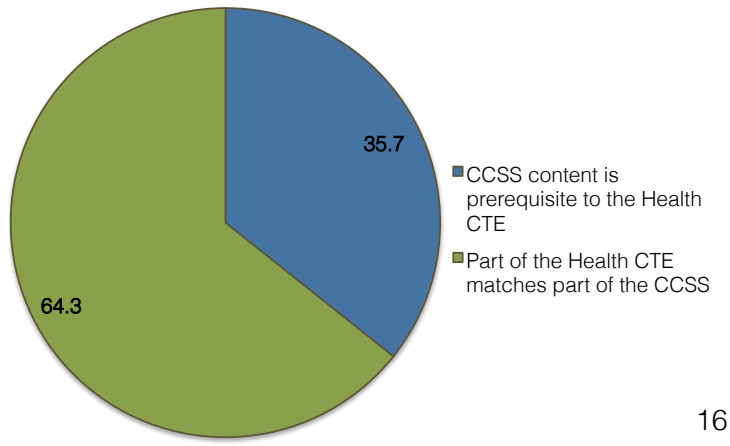


Figure 20. Distribution of rationale statements for Healthcare Administrative Services Pathway Standards that have a Partial Match (n = 14) alignment relationship to the Mathematics Common Core State Standards



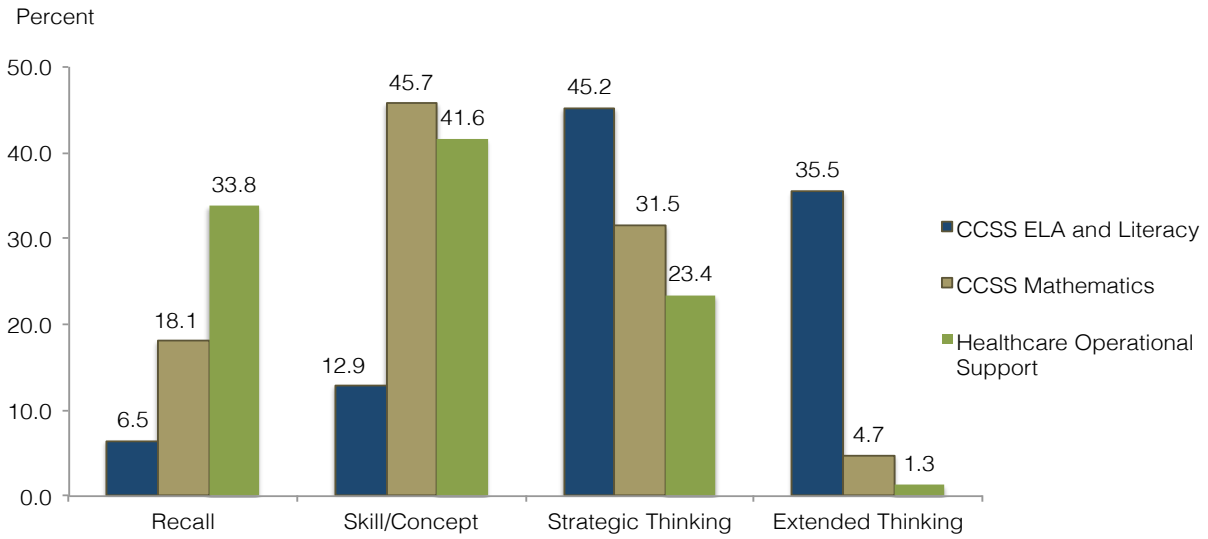
annotated the partial alignment relationship in comment boxes. For this additional detail at the individual standard level, please refer to the supplemental tables to this technical report.

Healthcare Operational Support Services Pathway ELA and Literacy and Mathematics Results

Cognitive Complexity

The distribution of the levels of cognitive complexity can be seen in Figure 21. ELA and Literacy has a majority of standards at Strategic and Extended Thinking (Levels 3 and 4), while the majority of the Healthcare Operational Support Pathway statements are at Recall or Skill/Concept (Levels 1 and 2). Mathematics and Healthcare Operational Support both have the highest percent at Level 2 (Skill/Concept) and fewer standards and statements at Level 4 (Extended Thinking). Healthcare Operational Support has fewer statements than the Mathematics standards at Level 3 (Strategic Thinking) and more at Level 1 (Recall).

Figure 21. Distribution of cognitive complexity level ratings across the four Depth of Knowledge levels for ELA and Literacy, Mathematics, and Healthcare Operational Support Services



Alignment Relationship and Rationale

Figure 22 shows that no Healthcare Operational Support statements are rated as completely aligned to the ELA and Literacy CCSS, but the majority (49 statements or 64%) are partially aligned with one or more CCSS. There are 28 (36%) Healthcare Operational Support statements have no content match to the ELA and Literacy CCSS. As detailed in the methodology, each Healthcare Operational Support statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 23). In Healthcare Operational Support, nearly 80 percent of the 49 partially matched statements are rated as having part of the Healthcare Operational Support content matching part of the ELA and Literacy CCSS content. Another 16 percent of the partially matched statements are rated as the CCSS being prerequisite to the Healthcare Operational Support specific statements. The remaining 4 percent consisted of standards where the ELA and Literacy CCSS matched all of the Healthcare Operational Support statements.

Figure 22. Percentage of Healthcare Operational Support Services Pathway Standards (n = 77) that are Completely, Partially, or Not Aligned with the Common Core ELA and Literacy Standards

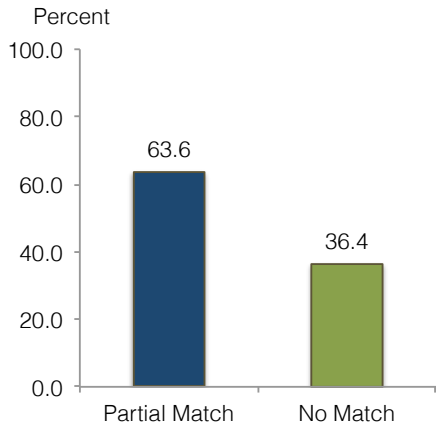


Figure 23. Distribution of rationale statements for Healthcare Operational Support Services Pathway Standards that have a Partial Match (n = 49) alignment relationship to the ELA and Literacy Common Core State Standards

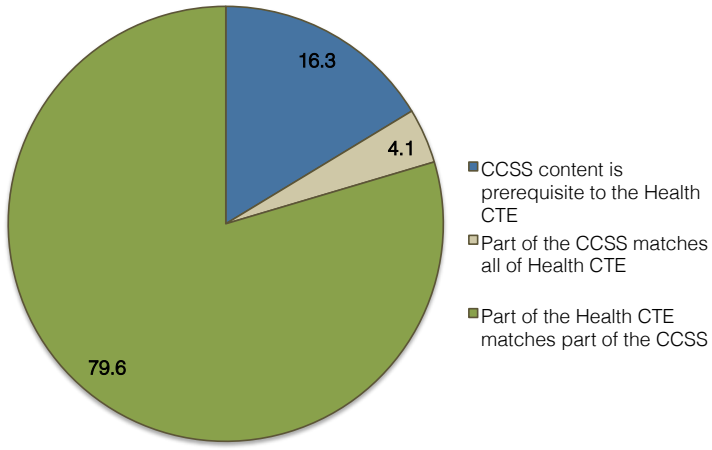


Figure 24 shows that no Healthcare Operational Support statements are rated as completely aligned to the Mathematics CCSS and 33 percent are partially aligned with one or more Mathematics standards. There are 52 (68%) of the Healthcare Operational Support statements that have no content match to the Mathematics CCSS. As detailed in the methodology, each Healthcare Operational Support statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match. A majority (64% of the 25 partially matched statements) have a corresponding rationale statement that states that part of their content matched part of the content in the CCSS. Figure 25 shows that 36 percent of the Mathematics CCSS are prerequisite to the Healthcare Operational Support statements they match. In addition, when selecting the rationale statements, the expert content reviewers annotated the partial alignment relationship in comment boxes. For this additional detail at the individual standard level, please refer to the supplemental tables to this technical report.

Figure 24. Percentage of Healthcare Operational Support Services Pathway Standards (n = 77) that are Completely, Partially, or Not Aligned with the Common Core Mathematics Standards

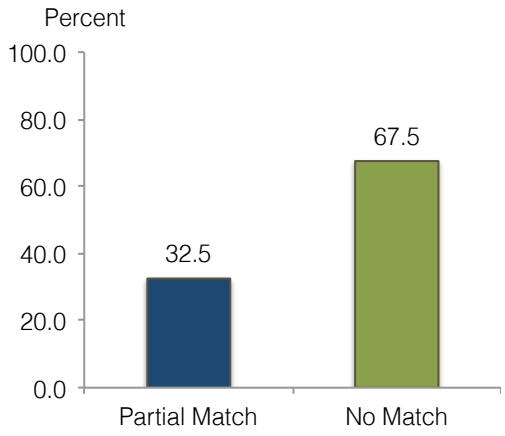
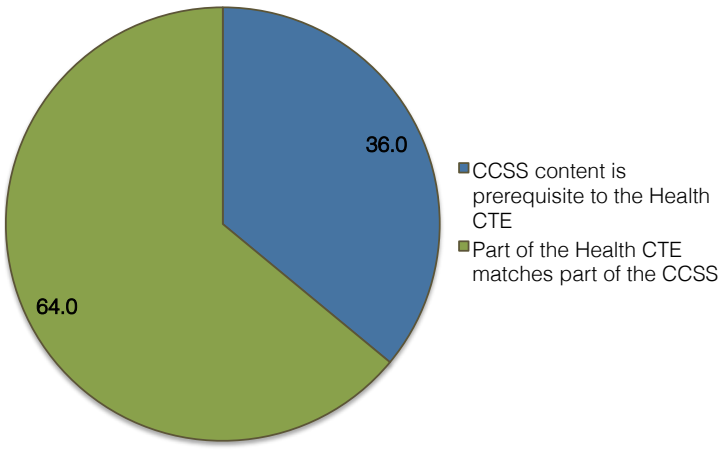


Figure 25. Distribution of rationale statements for Healthcare Operational Support Services Pathway Standards that have a Partial Match (n = 25) alignment relationship to the Mathematics Common Core State Standards

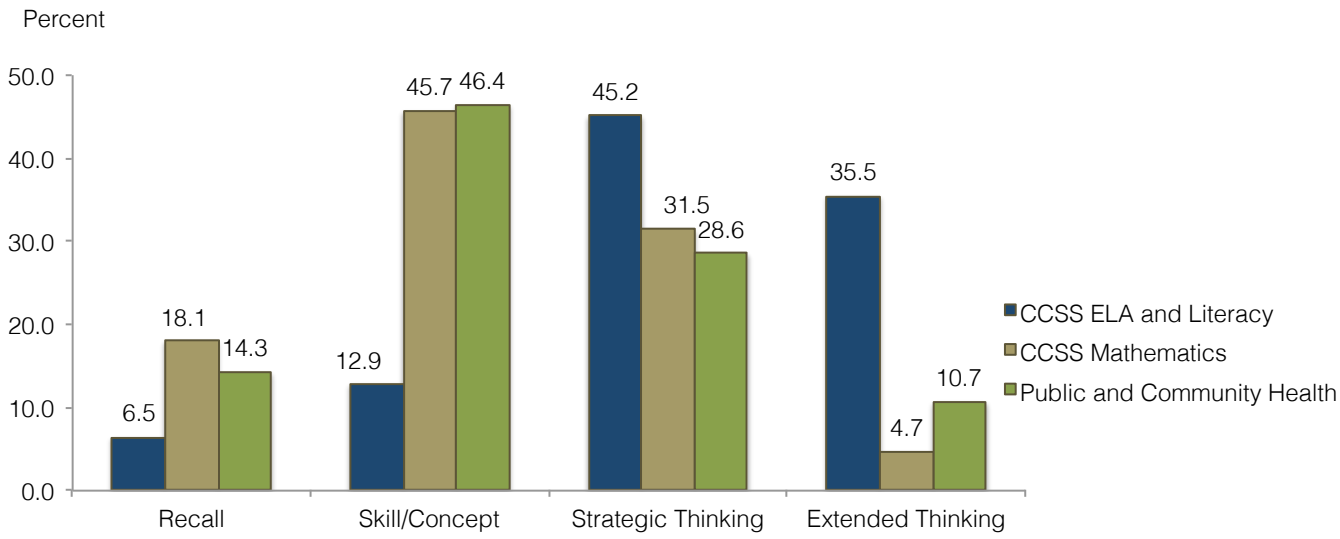


Public and Community Health Pathway ELA and Literacy and Mathematics Results

Cognitive Complexity

The distribution of the levels of cognitive complexity can be seen in Figure 26. ELA and Literacy has a majority of standards at Strategic and Extended Thinking (Levels 3 and 4). The majority of the Public and Community Health Pathway statements are at Skill/Concept and Strategic Thinking (Levels 1 and 2). Mathematics and Public and Community Health both have the highest percent at Level 2 (Skill/Concept). More Public and Community Health statements are at Level 4 (Extended Thinking) than the CCSS for Mathematics.

Figure 26. Distribution of cognitive complexity level ratings across the four Depth of Knowledge levels for ELA and Literacy, Mathematics, and Public and Community Health



Alignment Relationship and Rationale

Figure 27 shows that no Public and Community Health statements are rated as completely aligned to the CCSS, but the majority (86%) are partially aligned with one or more ELA and Literacy CCSS. There are eight (14.3%) Community Health statements that have no content match to the CCSS. As detailed in the methodology, each Public and Community Health statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 28). In Public and Community Health, 67 percent of the 48 partially matched statements are rated as having ELA and Literacy CCSS being prerequisite to the Public and Community Health specific statements. Another 29 percent of the partially matched statements are rated as having part of the Public and Community Health content match part of the ELA and Literacy CCSS content. The remaining four percent are instances where part of the CCSS content matches all of the Public and Community Health Statement.

Figure 27. Percentage of Public and Community Health Pathway Standards (n = 56) that are Completely, Partially, or Not Aligned with the Common Core ELA and Literacy Standards

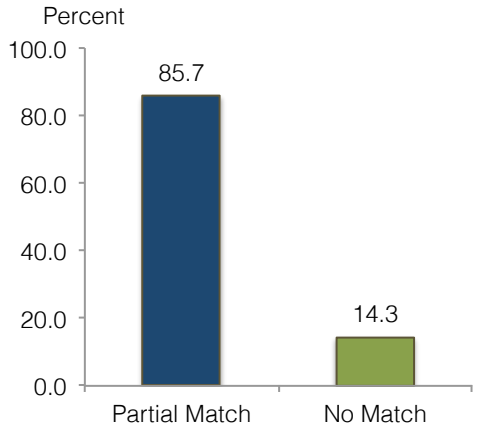


Figure 28. Distribution of rationale statements for Public and Community Health Pathway Standards that have a Partial Match (n = 48) alignment relationship to the ELA and Literacy Common Core State Standards

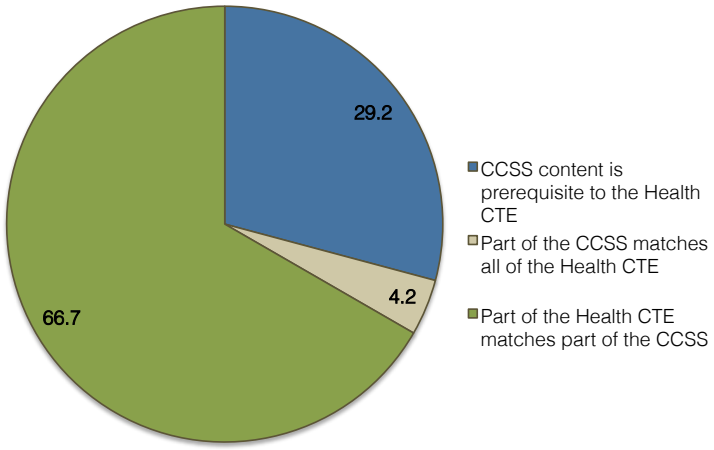


Figure 29. shows that no Public and Community Health statements are rated as completely aligned to the Mathematics CCSS and 23 percent are partially aligned with one or more Mathematics standards. There are 43 (77%) Public and Community Health statements that have no content match to the CCSS. As detailed in the methodology, each Public and Community Health statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 30). The Mathematics CCSS are prerequisite to most of the Public and Community Health statements they match (85% of the 13 partially matched statements). Another 25 percent of the partially matched statements are rated as having part of their content match part of the content in the Mathematics CCSS. In addition, when selecting the rationale statements, the expert content reviewers annotated the partial alignment relationship in comment boxes. For this additional detail at the individual standard level, please refer to the supplemental tables to this technical report.

Figure 29. Percentage of Public and Community Health Pathway Standards (n = 56) that are Completely, Partially, or Not Aligned with the Common Core Mathematics Standards

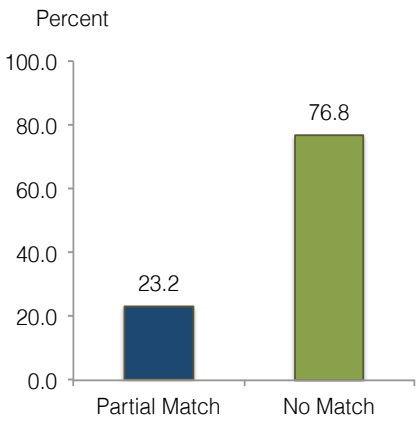
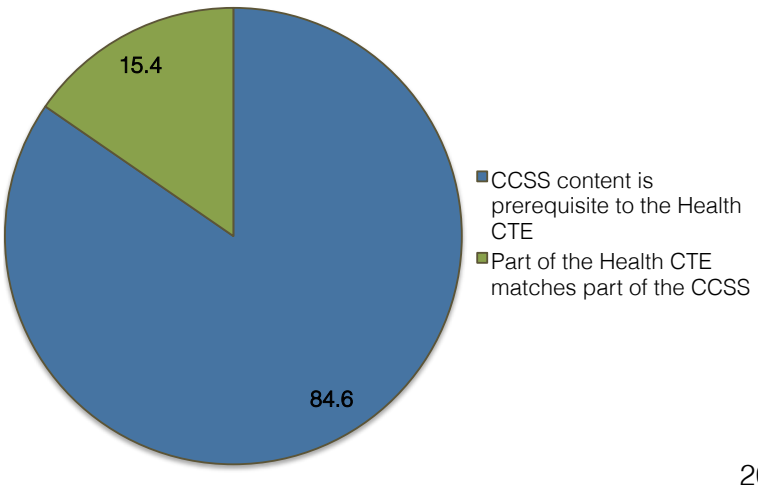


Figure 30. Distribution of rationale statements for Public and Community Health Pathway Standards that have a Partial Match (n = 13) alignment relationship to the Mathematics Common Core State Standards

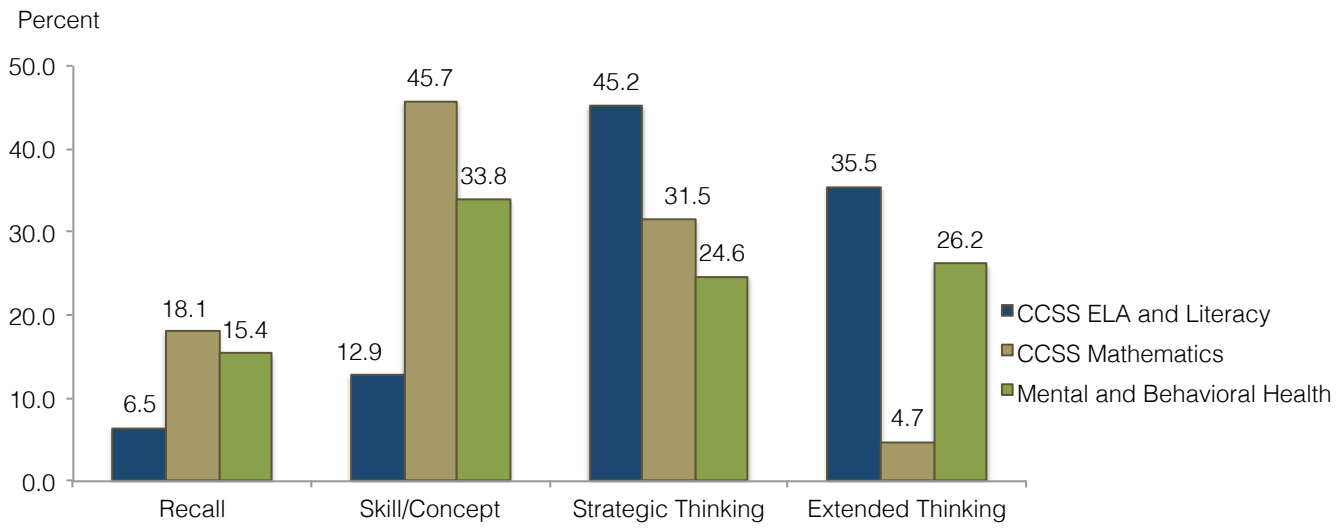


Mental and Behavioral Health Pathway ELA and Literacy and Mathematics Results

Cognitive Complexity

The distribution of the levels of cognitive complexity can be seen in Figure 31. ELA and Literacy has a majority of standards at Strategic and Extended Thinking (Levels 3 and 4). The Mental and Behavioral Health statements have a higher percentage than in other pathways at Level 4 (Extended Thinking), but still not quite as many as has ELA and Literacy at the same level. Mathematics and Mental and Behavioral Health both have the highest percent at Level 2 (Skill/Concept). Mental and Behavioral Health has more statements at Level 4 (Extended Thinking) than does Mathematics

Figure 31. Distribution of cognitive complexity level ratings across the four Depth of Knowledge levels for ELA and Literacy, Mathematics, and Mental and Behavioral Health



Alignment Relationship and Rationale

Figure 32 shows that one Mental and Behavioral Health statement is rated as completely aligned to the ELA and Literacy CCSS, but the majority (75%) are partially aligned with one or more CCSS. There are 15 (23%) Mental and Behavioral Health statements that have no content match to the ELA and Literacy CCSS. As detailed in the methodology, each Mental and Behavioral Health statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 33). In Mental and Behavioral Health, 69 percent of the 49 partially matched statements are rated as having part of the Health CTE content match part of the ELA and Literacy CCSS content. Another 29 percent of the partially matched statements are rated as the ELA and Literacy CCSS being prerequisite to the Mental and Behavioral Health specific statements. The other 2 percent are rated as having part of the Mental and Behavioral Health statements match all of the CCSS content.

Figure 32. Percentage of Mental and Behavioral Health Pathway Standards (n = 65) that are Completely, Partially, or Not Aligned with the Common Core ELA and Literacy Standards

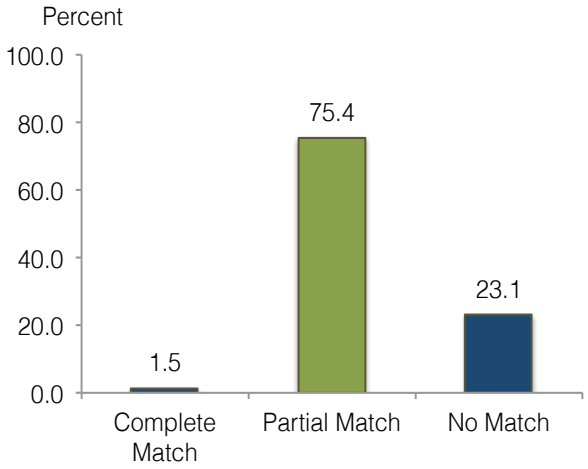


Figure 33. Distribution of rationale statements for Mental and Behavioral Health Pathway Standards that have a Partial Match (n = 49) alignment relationship to the ELA and Literacy Common
Core State Standards

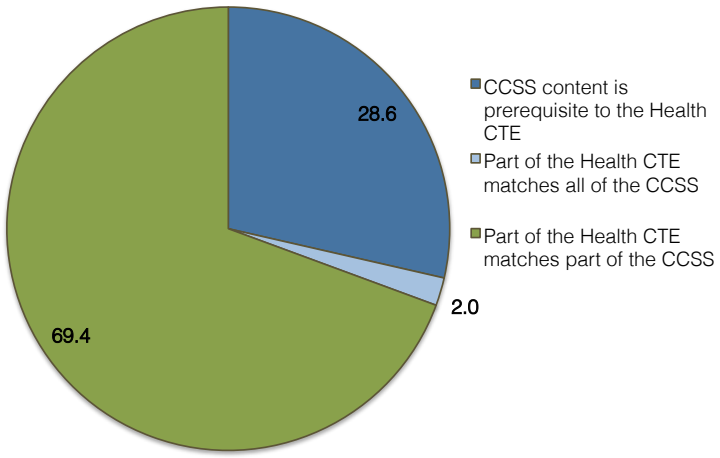


Figure 34 shows that no Mental and Behavioral Health statements are rated as completely aligned to the Mathematics CCSS and 17 percent are partially aligned with one or more Mathematics standards. There are 54 (83%) Mental and Behavioral Health statements that have no content match to the CCSS. As detailed in the methodology, each Mental and Behavioral Health statement that was rated as having a Partial Match alignment relationship was then given a rationale statement to describe further the partial match (Figure 35). The Mathematics CCSS are prerequisite to most of the Mental and Behavioral Health technology statements they match (64% of the 11 partially matched statements). Another 36 percent of the partially matched statements are rated as having part of their content match part of the content in the CCSS. In addition, when selecting the rationale statements, the expert

Figure 34. Percentage of Mental and Behavioral Health Pathway Standards (n = 65) that are Completely, Partially, or Not Aligned with the Common Core Mathematics Standards

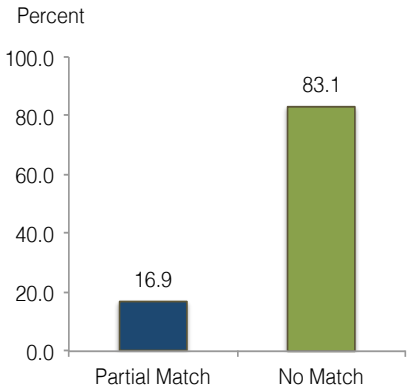
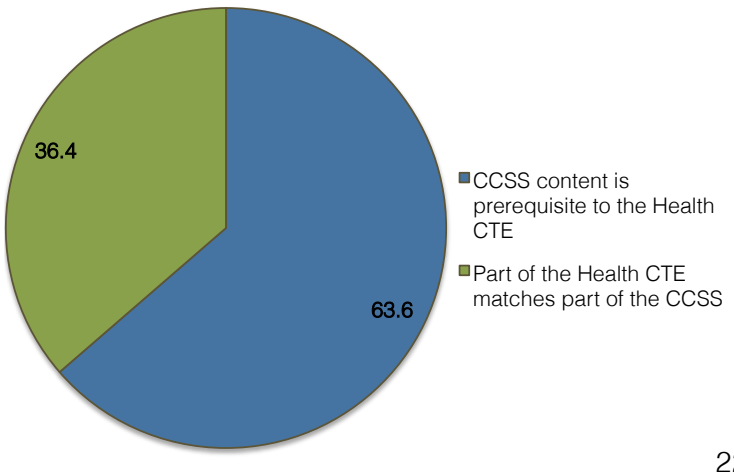


Figure 35. Distribution of rationale statements for Mental and Behavioral Health Pathway Standards that have a Partial Match (n = 11) alignment relationship to the Mathematics Common Core State Standards



content reviewers annotated the partial alignment relationship in comment boxes. For this additional detail at the individual standard level, please refer to the supplemental tables to this technical report.

Discussion

The purpose of this study was to help further inform the development of the revised Health Science Standards for the California Department of Education. When examining the results, three main areas for consideration emerged:

1. *Cognitive Complexity*: On the whole, the Health Science Standards were found to be less cognitively complex than the CCSS, particularly in ELA and Literacy. This finding indicates that the CDE might want to consider the level of desired cognitive complexity of the Health Sciences Standards. To be comparable to the CCSS, particularly within ELA and Literacy, the Health Science Standards would need to be revised to be more cognitively complex, moving more into strategic thinking and extended thinking.

2. *Content Gaps*: In terms of overall content alignment, 96.8 percent of the ELA and Literacy CCSS were aligned to the Health Science Standards, with the only standards not aligned from Language. For math, only 14.2 percent of the CCSS standards were aligned to the Health Science Standards. This reveals large gaps between the CCSS Mathematics content addressed by the Health Science Standards. When reconsidering the content of the Health Science Standards, each of the six pathways should be viewed through the lens of these gaps to see if further specification is desired, particularly in Mathematics.

3. *Partial Relationships*: The determination of a partial match, in combination with the requisite rationale statements and annotations, offer a deep dive into further understanding the content relationship between the two sets of standards. For the ELA and Literacy, there were 223 partially matched statements. In Mathematics, there were 90 partially matched statements. The majority of the rationales selected for the partial matches indicated that part of the Health CTE statement matches part of the CCSS, or that the matched CCSS content is prerequisite to the Health Science content. In the supplemental tables to this report, the expert reviewers annotated which part of the Health Science standard matched which part of the CCSS. Interested individuals can review these annotations to determine the desired level of match, such as deciding that, to increase consistency, more of the CCSS standard should be addressed in that Health Science standard. In addition, when the partial match is indicated as a prerequisite relationship, a determination of the sufficiency of that prerequisite knowledge and skill should be considered. This level of detail enables greater specification in relation to the CCSS for the developers of the Health Science Standards.

In conclusion, the results of this report have been utilized by the California Department of Education to inform the revision of the Health Science Standards. Upon generation of the results, the supplemental tables reporting the individual standard level ratings and annotations were supplied to the California Department of Education before the completion of writing the report. CDE staff then used these results to help inform their revision of the Health Sciences Standards. The results of the revisions, therefore, have been included in Appendix B of this report. The red text represents the changes that were made to the Health Science Standards after receiving the data generated by this alignment analysis.

Appendix A – Standards Used in Study

Common Core State Standards

Table A1. California's Common Core English Language Arts Standards and Depth of Knowledge Levels*

Content Area	Domain	Tag	Standard Text	DOK Level
Reading for Literacy in Science and Technical Subjects	Key Ideas and Details	RST.1	1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (RST.1)	3
		RST.2	2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (RST.2)	2
		RST.3	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. (RST.3)	3
	Craft and Structure	RST.4	4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades11-12 texts and topics. (RST.4)	1
		RST.5	5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. (RST.5)	3
		RST.6	6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. (RST.6)	3
	Integration of Knowledge and Ideas	RST.7	7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (RST.7)	4
		RST.8	8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (RST.8)	4
		RST.9	9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (RST.9)	4
	Range of Reading and Level of Text Complexity	RST.10	10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently. (RST.10)	3

* Please note that red text indicates augmentations to the Common Core State Standards adopted by the California State Board of Education.

Writing for Literacy in History/Social Studies, Science, and Technical Subjects	Text Types and Purposes	WHST.1	1. Write arguments focused on discipline-specific content. a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented. (WHST.1)	4
		WHST.2	2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts. d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers. e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). (WHST.2)	3
		WHST.3	3. (not applicable as a separate requirement) (WHST.3)	N/A
	Production and Distribution of Writing	WHST.4	4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (WHST.4)	3
		WHST.5	5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (WHST.5)	3
		WHST.6	6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. (WHST.6)	4

	Research to Build and Present Knowledge	WHST.7	7. Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (WHST.7)	4
		WHST.8	8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (WHST.8)	4
		WHST.9	9. Draw evidence from informational texts to support analysis, reflection, and research. (WHST.9)	3
	Range of Writing	WHST.10	10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. (WHST.10)	4
Speaking and Listening	Comprehen-sion and Collaboration	S.1	1. Initiate and participate effectively in a range of collaborative discussions (one on- one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas. b. Work with peers to promote civil, democratic discussions and decision making, set clear goals and deadlines, and establish individual roles as needed. c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. (S.1)	4
		S.2	2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. (S.2)	4
		S.3	3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used. (S.3)	3

	Presentation of Knowledge and Ideas	S.4	4. Present information, findings, and supporting evidence (e.g., reflective, historical investigation, response to literature presentations), conveying a clear and distinct perspective and logical argument, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. Use appropriate eye contact, adequate volume and clear pronunciation. a. Plan and deliver a reflective narrative that: explores the significance of a personal experience, event, or concern; uses sensory language to convey a vivid picture; includes appropriate narrative techniques (e.g., dialog, pacing, description); and draws comparisons between the specific incident and broader themes. (11th or 12th grade) b. Plan and present an argument that: supports a precise claim; provides a logical sequence for claims, counterclaims, and evidence; uses rhetorical devices to support assertions (e.g., analogy, appeal to logic through reasoning, appeal to emotion or ethical belief); uses varied syntax to link major sections of the presentation to create cohesion and clarity; and provides a concluding statement that supports the argument presented (11th or 12th grade). (S.4)	4
		S.5	5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (S.5)	3
		S.6	6. Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.) (S.6)	3
Language	Conventions of Standard English	L.1	1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. a. Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested. b. Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed. (L.1)	2
		L.2	2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. a. Observe hyphenation conventions. b. Spell correctly. (L.2)	1
	Knowledge of Language	L.3	3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening. a. Vary syntax for effect, consulting references (e.g., Tufte's Artful Sentences) for guidance as needed; apply an understanding of syntax to the study of complex texts when reading. (L.3)	2

	Vocabulary Acquisition and Use	L.4	4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies. a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase. b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable). Apply knowledge of Greek, Latin, and Anglo-Saxon roots and affixes to draw inferences concerning the meaning of scientific and mathematical terminology. c. Consult general and specialized reference materials (e.g., college level dictionaries, rhyming dictionaries, bilingual dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage. d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary). (L.4)	2
		L.5	5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings. a. Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text. b. Analyze nuances in the meaning of words with similar denotations. (L.5)	3
		L.6	6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. (L.6)	3

Table A2. Standards for Mathematical Practice and California's Common Core State Standards for High School and Depth of Knowledge Levels

The high school standards specify the mathematics that all students should study in order to be college and career ready. Additional mathematics that students should learn in order to take advanced courses is indicated by (+).

Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★).

Content Area	Domain	Cluster	Tag	Standard Text	DOK Level
Standards for Mathematical Practice			MP.1	Make sense of problems and persevere in solving them. (MP.1)	4
			MP.2	Reason abstractly and quantitatively. (MP.2)	3
			MP.3	Construct viable arguments and critique the reasoning of others. (MP.3)	3
			MP.4	Model with mathematics. (MP.4)	4
			MP.5	Use appropriate tools strategically. (MP.5)	3
			MP.6	Attend to precision. (MP.6)	2
			MP.7	Look for and make use of structure. (MP.7)	2
			MP.8	Look for and express regularity in repeated reasoning. (MP.8)	2
Number and Quantity	The Real Number System	Extend the properties of exponents to rational exponents.	N.RN.1	1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{1/3}$ *to be the cube root of 5 because we want* $(5^{1/3})^3 = 5^{(1/3)3}$ *to hold, so* $(5^{1/3})^3$ *must equal 5.* (N.RN.1)	2
			N.RN.2	2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. (N.RN.2)	1
		Use properties of rational and irrational numbers.	N.RN.3	3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. (N.RN.3)	3
	Quantities	Reason quantitatively and use units to solve problems.	N.Q.1	1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (N.Q.1)	2
			N.Q.2	2. Define appropriate quantities for the purpose of descriptive modeling. (N.Q.2)	2
			N.Q.3	3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (N.Q.3)	2

	The Complex Number System	Perform arithmetic operations with complex numbers.	N.CN.1	1. Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real. (N.CN.1)	1
			N.CN.2	2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. (N.CN.2)	1
			N.CN.3	3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. (N.CN.3)	2
		Represent complex numbers and their operations on the complex plane.	N.CN.4	4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. (N.CN.4)	2
			N.CN.5	5. (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example*, $(-1 + \sqrt{3}\, i)^3 = 8$ *because* $(-1 + \sqrt{3}\, i)$ *has modulus* 2 *and argument* 120°. (N.CN.5)	2
			N.CN.6	6. (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints. (N.CN.6)	1
		Use complex numbers in polynomial identities and equations.	N.CN.7	7. Solve quadratic equations with real coefficients that have complex solutions. (N.CN.7)	1
			N.CN.8	8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$. (N.CN.8)	2
			N.CN.9	9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. (N.CN.9)	2
	Vector and Matrix Quantities	Represent and model with vector quantities.	N.VM.1	1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $\lvert\boldsymbol{v}\rvert$, $\lVert\boldsymbol{v}\rVert$, $\boldsymbol{v}$). (N.VM.1)	1
			N.VM.2	2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. (N.VM.2)	1
			N.VM.3	3. (+) Solve problems involving velocity and other quantities that can be represented by vectors. (N.VM.3)	2

		Perform operations on vectors.	N.VM.4	4. (+) Add and subtract vectors. a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. c. Understand vector subtraction $\boldsymbol{v} - \boldsymbol{w}$ as $\boldsymbol{v} + (-\boldsymbol{w})$, where $-\boldsymbol{w}$ is the additive inverse of $\boldsymbol{w}$, with the same magnitude as $\boldsymbol{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise. (N.VM.4)	1
			N.VM.5	5. (+) Multiply a vector by a scalar. a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$. b. Compute the magnitude of a scalar multiple $c\boldsymbol{v}$ using $\|c\boldsymbol{v}\| = \|c\|\boldsymbol{v}$. Compute the direction of $c\boldsymbol{v}$ knowing that when $\|c\|\boldsymbol{v} \neq 0$, the direction of $c\boldsymbol{v}$ is either along $\boldsymbol{v}$ (for $c > 0$) or against $\boldsymbol{v}$ (for $c < 0$). (N.VM.5)	1
		Perform operations on matrices and use matrices in applications.	N.VM.6	6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. (N.VM.6)	2
			N.VM.7	7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. (N.VM.7)	1
			N.VM.8	8. (+) Add, subtract, and multiply matrices of appropriate dimensions. (N.VM.8)	1
			N.VM.9	9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. (N.VM.9)	1
			N.VM.10	10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. (N.VM.10)	1
			N.VM.11	11. (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors. (N.VM.11)	1
			N.VM.12	12. (+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area. (N.VM.12)	2

Algebra	Seeing Structure in Expressions	Interpret the structure of expressions	A.SSE.1	Interpret expressions that represent a quantity in terms of its context.★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.* (A.SSE.1)	3
			A.SSE.2	2. Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$. a. Use the distributive property to express a sum of terms with a common factor as a multiple of a sum of terms with no common factor. For example, express $xy^2 + x^2$ as $xy(y + x)$. b. Use the properties of operations to express a product of a sum of terms as a sum of products. *For example, use the properties of operations to express* $(x + 5)(3 - x + c)$ as $-x^2 + cx - 2x + 5c + 15$. (A.SSE.2)	2
			A.SSE.2.1	Apply basic factoring techniques to second-and simple third degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. (A.SSE.2.1)	2
		Write expressions in equivalent forms to solve problems	A.SSE.3	3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* d. Prove simple laws of logarithms. e. Use the definition of logarithms to translate between logarithms in any base. f. Understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. (A.SSE.3)	3
			A.SSE.4	4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★ (A.SSE.4)	2
		Perform arithmetic operations on polynomials	A.APR.1	1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials and divide polynomials by monomials. Solve problems in and out of context. (A.APR.1)	1

	Arithmetic with Polynomials and Rational Expressions	Understand the relationship between zeros and factors of polynomials	A.APR.2	2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$. (A.APR.2)	2
			A.APR.3	3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. (A.APR.3)	2
		Use polynomial identities to solve problems	A.APR.4	4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.* (A.APR.4)	3
			A.APR.5	5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1] [1]The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument. (A.APR.5)	1
		Rewrite rational expressions	A.APR.6	6. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. (A.APR.6)	2
			A.APR.7	7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. (A.APR.7)	2
	Creating Equations ★	Create equations that describe numbers or relationships	A.CED.1	1. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems in and out of context including equations arising from linear functions. (A.CED.1)	3
			A.CED.1.1	Judge the validity of an argument according to whether the properties of real numbers, exponents, and logarithms have been applied correctly at each step. (A.CED.1.1)	3
			A.CED.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (A.CED.2)	3
			A.CED.3	3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* (A.CED.3)	3
			A.CED.4	4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* (A.CED.4)	1

	Reasoning with Equations and Inequalities	Understand solving equations as a process of reasoning and explain the reasoning	A.REI.1	1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. (A.REI.1)	3
			A.REI.2	2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. (A.REI.2)	2
		Solve equations and inequalities in one variable	A.REI.3	3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. (A.REI.3)	1
			A.REI.3.1	Solve equations and inequalities involving absolute value. (A.REI.3.1)	2
			A.REI.4	4. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. (A.REI.4)	2
		Solve systems of equations	A.REI.5	5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. (A.REI.5)	3
			A.REI.6	6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (A.REI.6)	2
			A.REI.7	7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line* $y = -3x$ *and the circle* $x^2 + y^2 = 3$. (A.REI.7)	2
			A.REI.8	8. (+) Represent a system of linear equations as a single matrix equation in a vector variable. (A.REI.8)	1
			A.REI.9	9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater). (A.REI.9)	2
		Represent and solve equations and inequalities graphically	A.REI.10	10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). (A.REI.10)	1

			A.REI.11	11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★ (A.REI.11)	2
			A.REI.12	12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. (A.REI.12)	2
Functions	Interpreting Functions	Understand the concept of a function and use function notation	F.IF.1	1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then $f(x)$ denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation $y = f(x)$. (F.IF.1)	1
			F.IF.2	2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. (F.IF.2)	2
			F.IF.3	3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$. (F.IF.3)	1
		Interpret functions that arise in applications in terms of the context	F.IF.4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★ (F.IF.4)	2
			F.IF.5	5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★ (F.IF.5)	2
			F.IF.6	6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★ (F.IF.6)	2

		Analyze functions using different representations	F.IF.7	7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (F.IF.7)	2
			F.IF.8	8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.* (F.IF.8)	2
			F.IF.9	9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* (F.IF.9)	2
			F.IF.10	Demonstrate an understanding of functions and equations defined parametrically and graph them. (F.IF.10)	2
	Building Functions	Build a function that models a relationship between two quantities	F.BF.1	1. Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* c. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* (F.BF.1)	3

			F.BF.2	2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★ (F.BF.2)	3
		Build new functions from existing functions	F.BF.3	3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* (F.BF.3)	3
			F.BF.3.1	Solve problems involving functional concepts, such as composition, defining the inverse function and performing arithmetic operations on functions. (F.BF.3.1)	2
			F.BF.4	4. Find inverse functions. a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. *For example, f(x) =2 x^3 or f(x) = (x+1)/(x–1) for x ≠ 1.* b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain. (F.BF.4)	2
			F.BF.5	5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. (F.BF.5)	2
	Linear, Quadratic, and Exponential Models★	Construct and compare linear, quadratic, and exponential models and solve problems	F.LE.1	1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. (F.LE.1)	3
			F.LE.2	2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). (F.LE.2)	2
			F.LE.3	3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. (F.LE.3)	2
			F.LE.4	4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. (F.LE.4)	2

		Interpret expressions for functions in terms of the situation they model	F.LE.5	5. Interpret the parameters in a linear or exponential function in terms of a context. (F.LE.5)	2
			F.LE.6	Apply quadratic equations to physical problems, such as the motion of an object under the force of gravity. (F.LE.6)	2
	Trigono-metric Functions	Extend the domain of trigonometric functions using the unit circle	F.TF.1	1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. (F.TF.1)	1
			F.TF.1.1	Understand the notion of angle and how o measure it, in both degrees and radians. Convert between degrees and radians. (F.TF.1.1)	1
			F.TF.2	2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. (F.TF.2)	3
			F.TF.3	3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number. (F.TF.3)	2
			F.TF.3.1	Know the definitions of the tangent and cotangent functions and graph them. (F.TF.3.1)	1
			F.TF.3.2	Know the definitions of the secant and cosecant functions and graph them. (F.TF.3.2)	1
			F.TF.4	4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. (F.TF.4)	3
		Model periodic phenomena with trigonometric functions	F.TF.5	5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★ (F.TF.5)	2
			F.TF.6	6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. (F.TF.6)	1
			F.TF.6.1	Know the definitions of the inverse trigonometric functions and graph the functions. (F.TF.6.1)	1
			F.TF.6.2	Compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points. (F.TF.6.2)	1
			F.TF.7	7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.★ (F.TF.7)	2
		Prove and apply trigonometric identities	F.TF.8	8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. (F.TF.8)	3
			F.TF.9	9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems. (F.TF.9)	4
			F.TF.10	Demonstrate an understanding of half-angle and double-angle formulas for sines and cosines and can use those formulas to prove and/or simplify other trigonometric identities. (F.TF.10)	3

Geometry	Congruence	Experiment with transformations in the plane	G.CO.1	1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. (G.CO.1)	1
			G.CO.2	2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). (G.CO.2)	2
			G.CO.3	3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. (G.CO.3)	2
			G.CO.4	4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. (G.CO.4)	2
			G.CO.5	5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. (G.CO.5)	3
		Understand congruence in terms of rigid motions	G.CO.6	6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. (G.CO.6)	2
			G.CO.7	7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. (G.CO.7)	3
			G.CO.8	8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. (G.CO.8)	3
		Prove geometric theorems	G.CO.9	9. Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.* (G.CO.9)	4
			G.CO.10	10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.* (G.CO.10)	4
			G.CO.10.1	Know and use the triangle inequality theorem. (G.CO.10.1)	2

			G.CO.11	11. Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.* (G.CO.11)	4
		Make geometric constructions	G.CO.12	12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* (G.CO.12)	3
			G.CO.13	13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. (G.CO.13)	3
	Similarity, Right Triangles, and Trigono-metry	Understand similarity in terms of similarity transformations	G.SRT.1	1. Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. (G.SRT.1b)	2
			G.SRT.2	2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. (G.SRT.2)	3
			G.SRT.3	3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. (G.SRT.3)	2
		Prove theorems involving similarity	G.SRT.4	4. Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.* (G.SRT.4)	4
			G.SRT.5	5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. (G.SRT.5)	4
		Define trigonometric ratios and solve problems involving right triangles	G.SRT.6	6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. (G.SRT.6)	1
			G.SRT.7	7. Explain and use the relationship between the sine and cosine of complementary angles. (G.SRT.7)	2
			G.SRT.8	8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.★ (G.SRT.8)	2
			G.SRT.8.1	Know and use angle and side relationships in problems with special right triangles, such as 30°, 60°, and 90° triangles and 45°, 45°, and 90° triangles. (G.SRT.8.1)	2

		Apply trigonometry to general triangles	G.SRT.9	9. (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. (G.SRT.9)	3
			G.SRT.10	10. (+) Prove the Laws of Sines and Cosines and use them to solve problems. (G.SRT.10)	4
			G.SRT.11	11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). (G.SRT.11)	3
	Circles	Understand and apply theorems about circles	G.C.1	1. Prove that all circles are similar. (G.C.1)	3
			G.C.2	2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.* (G.C.2)	3
			G.C.3	3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. (G.C.3)	3
			G.C.4	4. (+) Construct a tangent line from a point outside a given circle to the circle. (G.C.4)	2
		Find arc lengths and areas of sectors of circles	G.C.5	5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. (G.C.5)	3
	Expressing Geometric Properties with Equations	Translate between the geometric description and the equation for a conic section	G.GPE.1	1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. (G.GPE.1)	2
			G.GPE.2	2. Derive the equation of a parabola given a focus and directrix. (G.GPE.2)	2
			G.GPE.3	3. (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant. (G.GPE.3)	2
			G.GPE.3.1	Demonstrate and explain how the geometry of the graph of a conic section (e.g., asymptotes, foci, eccentricity) depends on the coefficients of the quadratic equation representing it. (G.GPE.3.1)	2
			G.GPE.3.2	Give a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, use the method for completing the square to put the equation into standard form and recognize whether the graph of the equation is a circle, eclipse, parabola, or hyperbola. Then graph the equation. (G.GPE.3.2)	2
			G.GPE.3.3	Be familiar with conic sections, both analytically and geometrically. (G.GPE.3.3)	1

		Use coordinates to prove simple geometric theorems algebraically	G.GPE.4	4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).* (G.GPE.4)	3
			G.GPE.5	5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). (G.GPE.5)	3
			G.GPE.6	6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. (G.GPE.6)	2
			G.GPE.7	7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.★ (G.GPE.7)	2
	Geometric Measure-ment and Dimension	Explain volume formulas and use them to solve problems	G.GMD.1	1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* (G.GMD.1)	3
			G.GMD.2	2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. (G.GMD.2)	3
			G.GMD.3	3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★ (G.GMD.3)	2
		Visualize relationships between two-dimensional and three-dimensional objects	G.GMD.4	4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. (G.GMD.4)	2
			G.GMD.5	Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids. (G.GMD.5)	1
	Modeling with Geometry	Apply geometric concepts in modeling situations	G.MG.1	1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).★ (G.MG.1)	2
			G.MG.2	2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).★ (G.MG.2)	2
			G.MG.3	3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★ (G.MG.3)	4
	Polar Coordinates and Curves	Graph polar coordinates and curves	G.PCC.1	Be familiar with polar coordinates. In particular, determine polar coordinates of a point given in rectangular coordinates and vice versa. (G.PCC.1)	2
			G.PCC.2	Represent equations given in rectangular coordinates in terms of polar coordinates. (G.PCC.2)	2
			G.PCC.3	Be familiar with, and apply polar coordinates and vectors in the plane. In particular, translate between polar and rectangular coordinates and	2

				interpret polar coordinates and vectors graphically. (G.PCC.3)	
	Definitions and Examples		G.DE.1	Demonstrate an understanding by identifying and giving examples of undefined terms, axioms, theorems and inductive and deductive reasoning. (G.DE.1)	2
Statistics and Probability ★	Interpreting Categorical and Quantitative Data	Summarize, represent, and interpret data on a single count or measurement variable	S.ID.1	1. Represent data with plots on the real number line (dot plots, histograms, and box plots). (S.ID.1)	1
			S.ID.2	2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (S.ID.2)	2
			S.ID.3	3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (S.ID.3)	2
			S.ID.4	4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. (S.ID.4)	2
		Summarize, represent, and interpret data on two categorical and quantitative variables	S.ID.5	5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. (S.ID.5)	2
			S.ID.6	6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. (S.ID.6)	3
		Interpret linear models	S.ID.7	7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. (S.ID.7)	2
			S.ID.8	8. Compute (using technology) and interpret the correlation coefficient of a linear fit. (S.ID.8)	2
			S.ID.9	9. Distinguish between correlation and causation. (S.ID.9)	2
	Making Inferences and Justifying Conclusions		S.IC.1	1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (S.IC.1)	1

		Understand and evaluate random processes underlying statistical experiments	S.IC.2	2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?* (S.IC.2)	3
		Make inferences and justify conclusions from sample surveys, experiments, and observational studies	S.IC.3	3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. (S.IC.3)	2
			S.IC.4	4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. (S.IC.4)	2
			S.IC.5	5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. (S.IC.5)	3
			S.IC.6	6. Evaluate reports based on data. (S.IC.6)	3
	Conditional Probability and the Rules of Probability	Understand independence and conditional probability and use them to interpret data	S.CP.1	1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). (S.CP.1)	2
			S.CP.2	2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. (S.CP.2)	2
			S.CP.3	3. Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. (S.CP.3)	2
			S.CP.4	4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* (S.CP.4)	2
			S.CP.5	5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* (S.CP.5)	2
			S.CP.6	6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. (S.CP.6)	2

		Use the rules of probability to compute probabilities of compound events in a uniform probability model	S.CP.7	7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. (S.CP.7)	2
			S.CP.8	8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. (S.CP.8)	2
			S.CP.9	9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. (S.CP.9)	2
	Using Probability to Make Decisions	Calculate expected values and use them to solve problems	S.MD.1	1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. (S.MD.1)	2
			S.MD.2	2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. (S.MD.2)	2
			S.MD.3	3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.* (S.MD.3)	2
			S.MD.4	4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?* (S.MD.4)	2
		Use probability to evaluate outcomes of decisions	S.MD.5	5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.* b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.* (S.MD.5)	3
			S.MD.6	6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). (S.MD.6)	2

		S.MD.7	7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). (S.MD.7)	4
Advanced Placement Probability and Statistics Standards	This discipline is a technical and in-depth extension of probability and statistics. In particular, mastery of academic content for advanced placement gives students the background to succeed in the Advanced Placement examination in the subject.	AP.PS.1	1.0 Students solve probability problems with finite sample spaces by using the rules for addition, multiplication, and complementation for probability distributions and understand the simplifications that arise with independent events. (AP.PS.1)	3
		AP.PS.2	2.0 Students know the definition of conditional probability and use it to solve for probabilities in finite sample spaces. (AP.PS.2)	3
		AP.PS.3	3.0 Students demonstrate an understanding of the notion of discrete random variables by using this concept to solve for the probabilities of outcomes, such as the probability of the occurrence of five or fewer heads in 14 coin tosses. (AP.PS.3)	3
		AP.PS.4	4.0 Students understand the notion of a continuous random variable and can interpret the probability of an outcome as the area of a region under the graph of the probability density function associated with the random variable. (AP.PS.4)	3
		AP.PS.5	5.0 Students know the definition of the mean of a discrete random variable and can determine the mean for a particular discrete random variable. (AP.PS.5)	2
		AP.PS.6	6.0 Students know the definition of the variance of a discrete random variable and can determine the variance for a particular discrete random variable. (AP.PS.6)	2
		AP.PS.7	7.0 Students demonstrate an understanding of the standard distributions (normal, binomial, and exponential) and can use the distributions to solve for events in problems in which the distribution belongs to those families. (AP.PS.7)	3
		AP.PS.8	8.0 Students determine the mean and the standard deviation of a normally distributed random variable. (AP.PS.8)	1
		AP.PS.9	9.0 Students know the central limit theorem and can use it to obtain approximations for probabilities in problems of finite sample spaces in which the probabilities are distributed binomially. (AP.PS.9)	3
		AP.PS.10	10.0 Students know the definitions of the mean, median, and mode of distribution of data and can compute each of them in particular situations. (AP.PS.10)	1
		AP.PS.11	11.0 Students compute the variance and the standard deviation of a distribution of data. (AP.PS.11)	1
		AP.PS.12	12.0 Students find the line of best fit to a given distribution of data by using least squares regression. (AP.PS.12)	1
		AP.PS.13	13.0 Students know what the correlation coefficient of two variables means and are	2

			familiar with the coefficient's properties. (AP.PS.13)	
		AP.PS.14	14.0 Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line graphs and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots. (AP.PS.14)	2
		AP.PS.15	15.0 Students are familiar with the notions of a statistic of a distribution of values, of the sampling distribution of a statistic, and of the variability of a statistic. (AP.PS.15)	1
		AP.PS.16	16.0 Students know basic facts concerning the relation between the mean and the standard deviation of a sampling distribution and the mean and the standard deviation of the population distribution. (AP.PS.16)	1
		AP.PS.17	17.0 Students determine confidence intervals for a simple random sample from a normal distribution of data and determine the sample size required for a desired margin of error. (AP.PS.17)	3
		AP.PS.18	18.0 Students determine the P- value for a statistic for a simple random sample from a normal distribution. (AP.PS.18)	2
		AP.PS.19	19.0 Students are familiar with the chi- square distribution and chi- square test and understand their uses. (AP.PS.19)	2
		C.1	1.0 Students demonstrate knowledge of both the formal definition and the graphical interpretation of limit of values of functions. This knowledge includes one-sided limits, infinite limits, and limits at infinity. Students know the definition of convergence and divergence of a function as the domain variable approaches either a number or infinity: 1.1 Students prove and use theorems evaluating the limits of sums, products, quotients, and composition of functions. 1.2 Students use graphical calculators to verify and estimate limits. 1.3 Students prove and use special limits, such as the limits of (sin(x))/x and (1-cos(*x*))/*x* as *x* tends to 0. (C.1)	3
		C.2	2.0 Students demonstrate knowledge of both the formal definition and the graphical interpretation of continuity of a function. (C.2)	3
		C.3	3.0 Students demonstrate an understanding and the application of the intermediate value theorem and the extreme value theorem. (C.3)	3

Calculus Standards	When taught in high school, calculus should be presented with the same level of depth and rigor as are entry-level college and university calculus courses. These standards outline a complete college curriculum in one variable calculus. Many high school programs may have insufficient time to cover all of the following content in a typical academic year. For example, some districts may treat differential equations lightly and spend substantial time on infinite sequences and series. Others may do the opposite. Consideration of the College Board syllabi for the Calculus AB and Calculus BC sections of the Advanced Placement Examination in Mathematics may be helpful in making curricular decisions. Calculus is a widely applied area of mathematics and involves a beautiful intrinsic theory. Students mastering this content will be exposed to both aspects of the subject.	C.4	4.0 Students demonstrate an understanding of the formal definition of the derivative of a function at a point and the notion of differentiability: 4.1 Students demonstrate an understanding of the derivative of a function as the slope of the tangent line to the graph of the function. 4.2 Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function. 4.3 Students understand the relation between differentiability and continuity. 4.4 Students derive derivative formulas and use them to find the derivatives of algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions. (C.4)	3
		C.5	5.0 Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions. (C.5)	3
		C.6	6.0 Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth. (C.6)	3
		C.7	7.0 Students compute derivatives of higher orders. (C.7)	1
		C.8	8.0 Students know and can apply Rolle's theorem, the mean value theorem, and L'Hôpital's rule. (C.8)	3
		C.9	9.0 Students use differentiation to sketch, by hand, graphs of functions. They can identify maxima, minima, inflection points, and intervals in which the function is increasing and decreasing. (C.9)	3
		C.10	10.0 Students know Newton's method for approximating the zeros of a function. (C.10)	2
		C.11	11.0 Students use differentiation to solve optimization (maximum-minimum problems) in a variety of pure and applied contexts. (C.11)	3
		C.12	12.0 Students use differentiation to solve related rate problems in a variety of pure and applied contexts. (C.12)	3
		C.13	13.0 Students know the definition of the definite integral by using Riemann sums. They use this definition to approximate integrals. (C.13)	3
		C.14	14.0 Students apply the definition of the integral to model problems in physics, economics, and so forth, obtaining results in terms of integrals. (C.14)	3
		C.15	15.0 Students demonstrate knowledge and proof of the fundamental theorem of calculus and use it to interpret integrals as antiderivatives. (C.15)	3
		C.16	16.0 Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution, length of a curve, and work. (C.16)	3

		C.17	17.0 Students compute, by hand, the integrals of a wide variety of functions by using techniques of integration, such as substitution, integration by parts, and trigonometric substitution. They can also combine these techniques when appropriate. (C.17)	3
		C.18	18.0 Students know the definitions and properties of inverse trigonometric functions and the expression of these functions as indefinite integrals. (C.18)	3
		C.19	19.0 Students compute, by hand, the integrals of rational functions by combining the techniques in standard 17.0 with the algebraic techniques of partial fractions and completing the square. (C.19)	3
		C.20	20.0 Students compute the integrals of trigonometric functions by using the techniques noted above. (C.20)	3
		C.21	21.0 Students understand the algorithms involved in Simpson's rule and Newton's method. They use calculators or computers or both to approximate integrals numerically. (C.21)	3
		C.22	22.0 Students understand improper integrals as limits of definite integrals. (C.22)	3
		C.23	23.0 Students demonstrate an understanding of the definitions of convergence and divergence of sequences and series of real numbers. By using such tests as the comparison test, ratio test, and alternate series test, they can determine whether a series converges. (C.23)	3
		C.24	24.0 Students understand and can compute the radius (interval) of the convergence of power series. (C.24)	2
		C.25	25.0 Students differentiate and integrate the terms of a power series in order to form new series from known ones. (C.25)	3
		C.26	26.0 Students calculate Taylor polynomials and Taylor series of basic functions, including the remainder term. (C.26)	3
		C.27	27.0 Students know the techniques of solution of selected elementary differential equations and their applications to a wide variety of situations, including growth-and-decay problems. (C.27)	3

Draft Model Curriculum Development CTE Health Science and Medical Technology Standards

Table A3. Biotechnology Pathway Standards Used in Study

Domain	Tag	Standard Text	DOK
A1.0 Define Biotechnology and recognize the diverse applications in society. Assess biotechnology's impact on society.	A1.1	Explain how biotechnology fields such as pharmaceuticals, agriculture, diagnostics, industrial products, instrumentation and research and development are impacting human life.	3
	A1.2	Describe the use of model organisms in biotechnology research and manufacturing.	2
	A1.3	Research and discover public misunderstandings related to biotechnology; discern the source of these misunderstandings.	4
	A1.4	Evaluate the impact of biotechnological applications on both developing and industrial societies, including legal and judicial practices.	4
	A1.5	Recognize the role of innovation in creation of emerging biotechnology careers, including those in nanotechnology, biofuels and forensics.	2
A2.0. Demonstrate competencies in the fundamentals of molecular cell biology, including DNA and proteins and standard techniques for their purification and manipulation.	A2.1	Define and describe the structure and function of deoxyribonucleic acid (DNA), ribonucleic acid (RNA) and proteins, explain the consequences of DNA mutations on proteins.	3
	A2.2	Employ standard techniques of DNA extraction, purification, restriction digests, bacterial cell culture, agarose gel electrophoresis; document and evaluate results.	3
	A2.3	Employ standard protein techniques including antibody production, enzyme assays, spectrophotometry, gel electrophoresis, chromatography; document and evaluate results.	3
	A2.4	Predict outcomes of DNA and protein separation protocols.	3
	A2.5	Describe enzyme structure and function, diagram impact of enzymes and catalysis on reaction rates; recognize the emerging role of enzymes in replacing industrial chemicals.	2
A3.0. Recognize basic concepts in cell biology and become familiar with the laboratory tools used for their analysis.	A3.1	Distinguish between prokaryotic cells, eukaryotic cells, and viruses.	2
	A3.2	List and describe the structure and function of cellular organelle.	1
	A3.3	Describe conditions that promote cell growth under aseptic conditions in the laboratory and workplace.	2
	A3.4	Use various methods to monitor the growth of cell cultures.	2
	A3.5	Explain the basic concepts of cell growth and reproduction, DNA replication, mitosis, meiosis, and protein synthesis.	2
	A3.6	Discuss the structure and function of the macromolecules that compose cells, including carbohydrates, lipids, DNA, RNA, and protein molecules.	3
	A3.7	Conduct indicator tests for the common macromolecules of the cell.	2
A4.0. Integrate computer skills into program components.	A4.1	Use the Internet and World Wide Web to collect and share scientific information.	2
	A4.2	Use a variety of methods including literature searches, in libraries in computer databases, and on-line, for gathering background information, making observations, and collecting and organizing data.	2

	A4.3	Compile labs (results, tables graphs) in a legal scientific notebook and/or a Google site or webpage.	2
A5.0. Implement use of the metric system, orders of magnitude and the pH scale in preparation of reagents, analysis of data and graphing.	A5.1	Prepare solutions based on both percent and weight composition to demonstrate proficiency in use of mechanical and digital microbalances.	3
	A5.2	Calculate and prepare solutions of various molarity; calculate and prepare buffers of various pH; prepare serial dilutions.	1
	A5.3	Apply knowledge of symbols, algebra, and statistics to graphical data presentation.	2
	A5.4	Create data tables and graphs using Excel for the purpose of collecting and analyzing data.	2
A6.0. Understand the function of regulatory agencies for the biotechnology industry and the lasting impact of routine laboratory and communication practices on product development, manufacturing.	A6.1	Identify agencies at the local, state and federal levels. impact of routine laboratory and communication practices on product development, manufacturing.	2
	A6.2	Be aware of the role of agencies in promoting patient safety, quality control and entrepreneurship.	1
	A6.3	Describe intellectual property.	1
	A6.4	Understand what a patent is; use on-line resources to search a patent database.	2
	A6.5	Demonstrate accurate record keeping and follow good laboratory practice (GLP) for lab notebooks.	1
	A6.6	Articulate issues of ethical concern, including: plagiarism, copyright, trademark and patent; use on-line resources and searchable databases to investigate a copyright, trademark or patent.	4
A7.0. Follow sustainable and safe practices with high regard for quality control.	A7.1	Follow written protocols and oral directions to perform a variety of laboratory and technical tasks.	1
	A7.2	Recognize laboratory safety hazards and avoid them. Identify the location and use of emergency equipment.	1
	A7.3	Outline the appropriate responses to a laboratory accident.	2
	A7.4	Practice laboratory and personal safety (gloves, goggles, no food or drink, no open toe-shoes).	1
	A7.5	Properly and safely use and monitor a variety of scientific equipment, including pH meters, microscopes, spectrophotometers, pipets, micropipettes, balances.	1
	A7.6	Determine which equipment is appropriate to use for a given task and what units of measurement are used.	2
	A7.7	Locate and use Material Safety Data Sheets (MSDS) safety sheets.	1
	A7.8	Perform specimen collection, label samples, and prepare samples for testing. Handle, transport, and store samples safely.	1
A8.0. Understand that manufacturing represents inter-connectedness between science and production.	A8.1	Outline the steps in production and delivery of a product made through recombinant DNA technology.	2
	A8.2	Describe the major steps of a product's move through a company's product pipeline.	2
	A8.3	Identify several products obtained through recombinant DNA technology.	1
	A8.4	Cite examples of plant parts or extracts used as pharmaceuticals.	2
	A8.5	Evaluate the impact of robotics and automation on aseptic processes.	3
	A8.6	Use the Internet to find information about, traditional pharmaceuticals, herbal remedies and recombinant pharmaceuticals.	2

Table A4. Patient Care Pathway Standards Used in Study

Domain	Tag	Standard Text	DOK Level
B1.0. Communication using appropriate terminology, methods, and technology in a multidisciplinary healthcare industry.	B1.1	Use medical terminology in patient care appropriate to communicate information and observations.	1
	B1.2	Maintain guidelines of Health Insurance Portability and Accountability Act (HIPAA) in all communications.	1
	B1.3	Evaluate and report through the use of current technology relevant information effectively to the appropriate personnel.	3
B2.0. Communicate procedures and goals to patients; use various communication strategies to respond to questions and concerns.	B2.1	Observe the ability of patients to comprehend and understand procedures and how to determine how to adjust communication techniques.	4
	B2.2	Use active listening skills (e.g., reflection, restatement, and clarification) and communication techniques to gather information from the patient.	2
	B2.3	Formulate appropriate responses to address their concerns and questions in a positive manner.	3
	B2.4	Report patient's progress and response to treatment goals.	3
B3.0. Apply observation techniques to detect changes in the health status of patients.	B3.1	Demonstrate observation techniques.	2
	B3.2	Document the patient findings and report information appropriately.	2
	B3.3	Differentiate between normal and abnormal patient health status findings.	2
	B3.4	Plan basic care practices within the scope of practice to assist with patient comfort.	2
B4.0. Demonstrate the principles of body mechanics as they apply to the positioning, transferring, and transporting of patients.	B4.1	Explain the principles of body mechanics.	2
	B4.2	Evaluate equipment for possible hazards.	3
	B4.3	Practice Range of Motion appropriate for condition of patient.	3
	B4.4	Determine appropriate equipment for transportation and transfer, including the modification of equipment and techniques, to accommodate the health status of patients.	3
	B4.5	Demonstrate appropriate transport and transfer methods to accommodate the health status of patients.	3
	B4.6	Integrate proper body mechanics, ergonomics, safety equipment, and techniques to prevent personal injury to patients and clients.	3
B5.0. Evaluate requests for procedures and know how to interpret the requests, plan the coordination and implementation of services, and prepare for specific procedures.	B5.1	Understand scope of practice, evaluate requests for appropriateness, and coordinate interdisciplinary services.	3
	B5.2	Differentiate appropriate guidelines for implementation of various procedures.	2
	B5.3	Comply with patient-identification protocols to validate correct procedure or service.	2
	B5.4	Evaluate the purpose and components of a treatment plan related to the patient's health status.	3
	B5.5	Explain the components of a treatment plan.	2
	B6.1	Integrate modifications to treatment plans on the basis of information gathered.	3

B6.0. Adhere to the roles and responsibilities, within their scope of practice, that contribute to the design and implementation of a treatment plan.	B6.2	Prioritize and organize work in accordance with the patient's treatment plan.	2
	B6.3	Determine the resources available for the effective implementation of treatment plans for patients.	2
	B6.4	Select appropriate equipment and instruments in accord with the treatment plan.	2
	B6.5	Understand the roles of a patient advocate to ensure treatment quality and resources.	2
B7.0. Recognize and respect the various cultures of a community and other factors that indicate its diversity in all aspects of communicating the design and implementation patient care.	B7.1	Communicate and listen effectively across cultures and all levels of care.	3
	B7.2	Identify and understand the patterns of communication including the use of languages.	2
	B7.3	Know when and how to use trained interpreters.	2
B8.0. Research factors that define cultural differences between and among different ethnic, racial and special populations.	B8.1	Utilize culturally appropriate community resources.	3
	B8.2	Develop ethnographic skills, by location and information retrieval, carefully observe social behavior, manage stress and time.	4
	B8.3	Ask questions, establish friendships, and explore aspects of global significance.	4
	B8.4	Analyze data using relevant concepts.	2

Table A5. Healthcare Administrative Services Pathway Standards Used in Study

Domain	Tag	Standard Text	DOK Level
C1.0. Understand healthcare systems as the organization of people, institutions, funding and resources as well as the broad scope of operations in which health care services are delivered to meet the health needs of target populations.	C1.1	Understand the full process of healthcare delivery (e.g. from the patient getting sick to getting well).	2
	C1.2	Recognize the resources necessary for a health system (e.g. financial, health informatics, diagnostic equipment, pharmaceuticals and other therapeutic resources).	1
	C1.3	Recognize the different general methods of funding healthcare (e.g. out-of-pocket payments, health insurance, government funding, charities).	1
	C1.4	Understand common U.S. models for structuring healthcare funding (e.g. Health Maintenance Organizations [HMOs], Preferred Provider Organization [PPOs], Managed Care Organization [MCOs], and Independent Physician Association [IPAs]).	2
	C1.5	Recognize major specific payment systems (e.g. Medicare, Medicaid, and Workers Compensation).	1
	C1.6	Recognize the varied vital roles that healthcare administrative workers serve in the healthcare process.	1
	C1.7	Diagram healthcare organizations and processes.	2
C2.0. Understand the various healthcare provider and support roles in patient care as an integrated, comprehensive healthcare system, to offer the very best options for treatment for patients.	C2.1	Distinguish between different patient care provider and support roles (e.g. the difference between a doctor, physician assistant [PA], nurse practitioner, Registered Nurse [RN], Licensed Vocational Nurse [LVN], Certified Nursing Assistant [CAN]).	2
	C2.2	Recognize healthcare identifiers (e.g. NPI, DEA numbers, and CLIA numbers).	1
	C2.3	Understand the major forms of health care interventions (e.g. preventive, curative, palliative).	2

	C2.4	Describe common medical record documentation formats (e.g. SOAP notes, admission notes).	1
C3.0. Follow the model of medical safety practices and processes that can help prevent system medication errors and understand the consequences of mistakes.	C3.1	Recognize the major consequences mistakes in healthcare may cause (e.g. deaths, lawsuits).	1
	C3.2	Recognize the critical nature of accurate and complete documentation (e.g. medical allergies, conflicting prescriptions).	1
	C3.3	Identify patients accurately using appropriate strategies (e.g. continual verification).	1
	C3.4	Delineate the process for assessing information required by patients, staff, and the community to determine the best course of action.	1
C4.0. Understand the resources, routes and flow of information within the health care system and participate in the design and implementation of effective systems or processes.	C4.1	Create and edit patient records.	3
	C4.2	Enter information within the parameters of the information system. (E.g. entering appropriate data types in the appropriate fields).	1
	C4.3	Follow security guidelines to protect patient data.	1
	C4.4	Describe an effective health care information system, including resources, routes, and flow of information.	1
	C4.5	Evaluate the effectiveness of health information systems and determine improvement strategies.	3
C5.0. Use an electronic health care patient information system to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.	C5.1	Compare and contrast the relative advantages and disadvantages of paper vs. electronic records.	2
	C5.2	Distinguish which type of documents must have hard copies kept, and which may be stored only in digital form.	2
	C5.3	File records using various methodologies (e.g. alphabetically, by patient record number).	1
	C5.4	Archive and purge documents following policies and regulatory guidelines.	1
C6.0. Understand common file formats for document and medical imaging, digitizing paper records and storing medical images.	C6.1	Understand basic document and medical imaging concepts (e.g. resolution, color-depth, compression).	2
	C6.2	Understand common file formats for document and medical imaging (e.g. tagged image file format [TIFF], joint photographic experts group [JPEG], 2000).	2
	C6.3	Demonstrate how to scan paper records.	1
	C6.4	Calculate the approximate storage needs for digitized records and images.	1
	C6.5	Attach digitized records and medical images to patient records.	1
C7.0. Know how to schedule and manage appointments for providers.	C7.1	Understand prioritizing methods (e.g. first come first served, emergency appointments).	2
	C7.2	Recognize the logistical challenges of appointments (e.g. quality of care vs. cost of care).	1
	C7.3	Manage provider general schedules (e.g. what days and times providers are available).	2
	C7.4	Schedule patient appointments for providers.	1
	C7.5	Communicate the status of an appointment to the provider.	1
C8.0. Understand how to use health information effectively.	C8.1	Recognize the major uses of health information (e.g. patient care, billing, research).	1
	C8.2	Determine which data components are necessary for the successful completion of tasks.	2

	C8.3	Formulate and report information clearly and concisely.	2
	C8.4	Disseminate information to various audiences.	1
C9.0. Understand the need to communicate health/medical information accurately and within legal/regulatory bounds across the organization.	C9.1	Determine which communication methods patients have approved (e.g., email, phone, leaving voicemails).	1
	C9.2	Determine who has been approved for receiving patient communications beyond the patient (e.g. family members, lawyers).	1
	C9.3	Communicate with patients compassionately, accurately and effectively.	3
	C9.4	Use technology for mass communications (e.g. mail merge, email, auto-dialers).	1
C10.0. Understand how to transfer information to third-parties.	C10.1	Recognize the types of third parties that may need patient information (e.g. specialists, pharmacies, insurance companies).	1
	C10.2	Understand the laws and regulations regarding the transfer of information to a third party (e.g. when is a company a covered entity, when is a business agreement required).	2
	C10.3	Use various technologies to transmit information securely (e.g. fax, email, postal mail).	1
C11.0. Code health information and bill payers using industry standard methods of classification of diseases, current procedural terminology, and common healthcare procedure coding system.	C11.1	Understand the basic concepts of accrual-based accounting (e.g. accounts payable, accounts receivable, credits, debits).	2
	C11.2	Understand medical record documentation (e.g. chart notes, injections, medications).	2
	C11.3	Extract required information from a medical record and other medical documents for a variety of purposes, upon regulatory or legal request.	3
	C11.4	Code services (e.g. diagnostic procedures, surgeries) using industry standard methods (e.g. International Classification of Diseases-9th Ed. [ICD-9], Current Procedural Terminology-4th Ed. [CPT-4], Healthcare Common Procedure Coding System [HCPCS]).	3
	C11.5	Bill third-party payers (e.g. insurance companies, Medicare).	1
	C11.6	Receive and process information from third-party payers (e.g. Explanation of Benefits [EOB], Remittance Advice).	2
	C11.7	Audit coding done by others to determine proper billing.	3
C12.0. Use a systematic method of continual process improvement.	C12.1	Learn new knowledge and skills regularly (e.g. on-the-job-training [OJT], continuing education).	2
	C12.2	Use a systematic method of continual process improvement (e.g. Plan, Do, Study, Act [PDSA], Total Quality [TQ], or Continuous Quality Improvement [CQI]).	2
	C12.3	Discover new knowledge through primary research methodologies (e.g. experiments, surveys, data analysis).	4

Table A6. Healthcare Operational Support Services Pathway Standards Used in Study

Domain	Tag	Standard Text	DOK Level
D1.0. Understand the responsibilities of their roles and perform their tasks safely by using appropriate guidelines.	D1.1	Evaluate and determine the process operational systems improvement.	3
	D1.2	Know how to provide support to standardization, consolidation, and re-engineering processes.	2
	D1.3	Explain the importance of coordinating intradepartmental activities, including event planning and logistics, with outside agencies and contractors.	2

	D1.4	Describe the process for monitoring clients' expectations by using plans to promote satisfaction and measurement tools to ensure sufficiency of products and delivery of services.	2
D2.0. Assess basic operating procedures of support services.	D2.1	Investigate systems and procedures that minimize customer cost of ordering, storing and using supplies, services and equipment.	3
	D2.2	Integrate infection control standards with design and construction activities.	3
	D2.3	Implement purchasing and procurement techniques.	2
	D2.4	Develop a preventative maintenance program for equipment and services.	3
	D2.5	Identify activities that require coordination between various departments.	1
	D2.6	Discuss the relationships among organization structures, policies, procedures and quality assurance.	2
	D2.7	Explain staffing needs and productivity.	2
	D2.8	Develop reporting mechanisms for measuring productivity.	3
D3.0. Comply with legal regulations and facility standards for design, construction, maintenance, and improvement of health care facilities and environments.	D3.1	Adhere to the federal, state, and local regulations that apply to accreditation, design and construction of a health care facility.	2
	D3.2	Describe the process for evaluating compliance with corporate, legal, regulatory, and accreditation standards, ethics, and codes.	2
	D3.3	Analyze the therapeutic and functional aspects of color, decor, and furnishings as well as the process for coordinating facility furnishings and finishes in accordance with appropriate safety codes.	4
	D3.4	Evaluate how risk management can apply to support services functions.	3
	D3.5	Recognize physical, procedural and electronic barriers.	1
	D3.6	Use appropriate action to maintain a facility in good repair (e.g., report, make recommendations or repair).	2
D4.0. Comply with protocols and practices necessary to maintain a clean and healthy work environment.	D4.1	Evaluate potential causes and methods of transmitting infections and how to apply standard precautionary guidelines.	3
	D4.2	Demonstrate the use of appropriate Personal Protective Equipment (PPE).	1
	D4.3	Demonstrate proper hand hygiene.	1
	D4.4	Analyze sanitation and infection control procedures.	3
	D4.5	Use various manual and mechanical decontamination and sterilization techniques and procedures.	1
	D4.6	Comply with hazardous waste disposal policies and procedures, including documentation, to ensure that regulated waste is handled, packaged, stored, and disposed of in accordance with federal, state, and local regulations.	2
	D4.7	Implement a waste management program, including the recycling and reduction of regulated medical, solid, hazardous, chemical, and radioactive waste materials.	3
	D4.8	Describe the care needed when handling chemicals.	1
	D4.9	Describe basic emergency procedures used to respond to a hazardous spill.	1
	D4.10	Demonstrate protection from blood-borne pathogens and identify unsafe conditions for corrective action.	2

	D4.11	Explain how waste is handled, packaged, stored and disposed of in accordance with federal state and local regulations including hazardous chemicals, biohazards and radioactive materials.	2
D5.0. Use principles and techniques of resource management to make appropriate decisions.	D5.1	Follow procedures and processes for the selection, acquisition, distribution, and maintenance of equipment and understand preventive maintenance for buildings and equipment.	2
	D5.2	Evaluate competitive pricing, terms, and service levels to support product recommendations.	3
	D5.3	Demonstrate the process for developing inventory-reduction targets to achieve the financial goals of health care organizations.	2
	D5.4	Use distribution strategies and systems to ensure the optimal flow of materials.	2
	D5.5	Identify components of a comprehensive training program for health care, including safety, infection control, handling of hazardous materials, and use of equipment.	1
	D5.6	Understand the department's labor distribution reports to ensure the proper allocation of resources for projects and operations.	2
D6.0. Collect and distribute essential patient information to appropriate team members.	D6.1	Recognize and report unusual or unsafe environmental conditions.	1
	D6.2	Maintain confidentiality according to the facility's protocol as well as HIPAA.	1
	D6.3	Recognize ethical conflicts related to assessment practices (e.g., labeling, confidentiality).	1
	D6.4	Document actions according to the facility's protocol and regulatory guidelines.	1
D7.0. Assess and maintain materials for quality management.	D7.1	Use appropriate inventory and control systems to purchase materials, supplies, and capital equipment.	1
	D7.2	Perform quality control activities.	1
	D7.3	Use manuals and follow directions appropriately.	1
	D7.4	Maintain equipment (e.g., imaging, laboratory).	1
	D7.5	Send, receive and distribute material for services.	1
	D7.6	Organize inventory, purchase orders and products.	2
	D7.7	Describe risk management strategies.	2
	D7.8	Inspect facilities to ensure compliance with standards, regulations and codes.	3
	D7.9	Assess procedures and processes to select, acquire and maintain inventory.	3
	D7.10	Describe the use of calibration.	1
	D7.11	Evaluate cost effectiveness of alternative methods.	3
	D7.12	Discuss policies and procedures to monitor, distribute and consume materials.	2
D8.0. Demonstrate handling and storage of materials.	D8.1	Use appropriate safety equipment.	1
	D8.2	Demonstrate appropriate inventory control systems (e.g., distribution, consumption, intentional loss of materials or supplies).	2
	D8.3	Demonstrate proper care in handling and storage of sterile and non-sterile items.	2
	D8.4	Explain inventory control.	2

	D8.5	Describe and implement a program to purchase materials, supplies and capital equipment with allocated resources.	3
D9.0. Analyze the business structure of supply and service management.	D9.1	Describe the components of a purchasing agreement.	1
	D9.2	Discuss the cost benefits of supply and service selection.	2
	D9.3	Explain bids and quotes for supply and service selection.	2
	D9.4	Explain competitive pricing.	2
	D9.5	Analyze the impact of timely order placement and supplier performance.	3
	D9.6	Assess integration of resource functions.	3
	D9.7	Assess purchasing and procurement techniques that improve quality and supply.	3
	D9.8	Describe the supply chain process.	1
	D9.9	Utilize technology to support the supply chain process.	2
D10.0. Demonstrate the ability to prepare, assemble and deliver a high quality, nutritious meal for the clients they serve.	D10.1	Prepare food following dietary orders.	1
	D10.2	Prepare a food tray with the proper diet and needed utensils.	1
	D10.3	Deliver trays to the specified area of the health care facility.	1
	D10.4	Using National Health Occupations Students of America (HOSA) Nursing Assisting guidelines, prepare the patient for a meal.	2
	D10.5	Using state and federal standards for food temperatures, follows guidelines for inspecting the safety of food.	2
D11.0. Demonstrate and use the correct transport equipment.	D11.1	Assess the issue of transporting a patient to surgery versus a patient to radiology.	3
	D11.2	Practice proper body mechanics and safety measures while transferring a patient from an emergency room to the assigned room. Document results of transfer.	2
	D11.3	Demonstrate safe patient transport for interdepartmental transfers or upon discharge.	2
D12.0. Determine role in emergency preparedness plan.	D12.1	Describe different types of emergency preparedness plans (e.g., homeland security, natural disaster, pandemic, crisis planning).	1
	D12.2	Explain emergency procedures for staff and supplies in the event of an internal or external disaster.	2
	D12.3	Participate in educational and training programs related to emergency preparedness plan.	1
	D12.4	Discuss the Emergency Preparedness Plan.	2

Table A7. Public and Community Health Pathway Standards Used in Study

Domain	Tag	Standard Text	DOK Level
E1.0. Understand the context and scope of Public Health on improving health and quality of life in personal, community and the global population.	E1.1	Understand the history, philosophy, and services and careers in public health.	2
	E1.2	Describe the environmental, behavioral, biological, and socio-economic factors as well as access, quality, intervention and cost of medical care that are central to communities and the population.	3
	E1.3	Explain how public health can utilize health information and health communications to improve the health of populations.	2
	E1.4	Explain how public health can utilize social and behavioral interventions to improve the health of populations.	2

	E1.5	Explain how public health can utilize health policy and law to improve the health of populations.	2
	E1.6	Explain how public health assesses the options for intervention to improve the health of a population.	2
	E1.7	Compare the scope of current public health policies with past practices.	3
	E1.8	Explain the impact of the environment and communicable diseases on the health of populations.	2
	E1.9	Identify the roles and responsibilities of public health in addressing populations, health disparity and disaster prevention and management.	2
	E1.10	Defend health decisions, individual rights and social responsibilities.	3
E2.0. Design, promote and implement community health programs which result in health-positive behaviors among all individuals, families, groups in a community and the global environment.	E2.1	Understand various strategies to improve the health status of individuals and the community.	2
	E2.2	Understand the many health disparities barriers to access among underserved communities.	2
	E2.3	Develop specific competencies for work in underserved and/or linguistically isolated communities.	3
	E2.4	Know public policies that have an impact on people's health.	1
	E2.5	Identify factors influencing people's health status through a strong grounding in social and behavioral theory.	2
	E2.6	Demonstrate competency in working with diverse cultures and communities.	3
	E2.7	Explain fiscal and organizational resources to ensure optimal health programs and service delivery in communities.	2
	E2.8	Expand health knowledge to provide information and referrals and advocacy on a range of health topics more effectively.	2
	E2.9	Conduct outreach and health education at community sites with various cultural groups.	4
	E2.10	Evaluate the process and outcome of community-based health education programs.	3
	E2.11	Research the social, cultural, and behavioral factors influencing health outcomes.	4
	E2.12	Demonstrate ways in which enhancing and maintaining personal health and well-being is established.	2
E3.0. Examine gerontology and its social implications using a life span perspective focusing on older adults' needs/concerns along life's continuum in various environments.	E3.1	Understand how the demographics of the older population affect various aspects of our society.	3
	E3.2	Recognize the contributions that aging persons make to their communities.	1
	E3.3	Differentiate between normal changes in functioning due to aging and pathological changes leading to disease.	3
	E3.4	Define the life course perspective and describe how age, gender, race and ethnicity influence the life course.	3
	E3.5	Understand health disparities among older adults and their impact on society.	2
	E3.6	Understand the role of service providers and community recreation and health services in their involvement with older persons.	2
	E3.7	Understand common threats to loss of independence: falls, medication management, and lifestyle.	2

	E3.8	Identify a range of available services for elders in most communities.	1
	E3.9	Advocate for technology to enhance older adults' function, independence, and safety.	4
	E3.10	Assess how policies, regulations, and programs differentially impact older adults and their caregivers, particularly among historically disadvantaged populations.	3
	E3.11	Analyze the impact of an aging society on the nation's health care system.	4
E4.0. Promote the protection, sustainability and enhancement of the overall environmental quality of life.	E4.1	Interpret the principles of environmental health practices.	2
	E4.2	Identify the various environmental factors that affect a community's health and safety such as water quality, air quality, food supply, industrial hygiene, and solid and hazardous waste disposal.	2
	E4.3	Identify human health hazards that may cause sickness or impaired health/well-being.	1
	E4.4	Identify the carriers or vectors that promote the transfer of these agents from the environment to the human.	1
	E4.5	Summarize health conditions that is caused or aggravated by environmental conditions.	2
	E4.6	Discuss emerging global environmental health problems.	3
	E4.7	Analyze current legislation and regulation regarding environmental issues.	4
	E4.8	Explore approaches to control of the major environmental health problems.	3
E5.0. Predict and evaluate rates, risk factors and health status indicators of morbidity and mortality, disease determinants, causation.	E5.1	Describe the historical roots of epidemiology thinking and its contribution to the evolution of the scientific method.	3
	E5.2	Describe the basic epidemiological concepts of rates, causation and public health surveillance.	2
	E5.3	Generate hypotheses of patterns of disease and injuries regarding person, place and time.	3
	E5.4	Research data regarding disease or injuries including rates, risk factors disease determinants and causation of morbidity and mortality.	4
	E5.5	Explore the effects of disease, injury and violence on longevity and quality of life.	3
	E5.6	Evaluate methods to prevent, detect, cure and minimize disease, injury and violence in the population.	3
E6.0. Integrate knowledge and skills necessary as a member of a Community Emergency Response Team (CERT) to demonstrate the response required to meet your community's immediate needs in an emergencies or disasters.	E6.1	Describe the roles and responsibilities of a member of a Community Emergency Response Team in immediate response.	1
	E6.2	Explain how the community has a role in disaster preparedness and response.	2
	E6.3	Demonstrate preparation strategies to improve the quality of personal or community.	2
	E6.4	Describe potential hazards and their effect on the community.	2
	E6.5	Describe prevention strategies in homes, workplaces, and communities.	1
	E6.6	Employ basic assessment, triage and treatment as defined by CERT Protocols under simulated disaster conditions.	2

	E6.7	Identify planning and size-up requirements for potential search and rescue situations.	1
	E6.8	Demonstrate working as a team to apply safe techniques for debris removal and victim extrication.	2
	E6.9	Describe the post-disaster emotional environment and the steps that rescuers can take to relieve their own stressors and trauma and those of disaster survivors.	2

Table A8. Mental and Behavioral Health Pathway Standards Used in Study

Domain	Tag	Standard Text	DOK Level
F1.0. Recognize and interpret principles of community engagement.	F1.1	Define the psychoeducation approach and describe how it is used as a tool to help consumers and their families learn more about managing their mental illness.	1
	F1.2	Apply community-based participatory research methods to increase community participation and resources.	4
	F1.3	Develop basic outreach approaches that can be successful in increasing awareness about mental health services.	3
	F1.4	Research and organize community resources that promote community wellness.	4
	F1.5	Advocate for community inclusion and social roles such as; supported housing, employment, education, parenting, citizenship, and anti-stigma.	4
F2.0. Demonstrate the ability to build relationships through empathic communication.	F2.1	Describe the elements of active listening.	1
	F2.2	Demonstrate active listening by connecting new knowledge or experiences with prior knowledge and solving.	2
	F2.3	Differentiate between giving advice and active listening by constructing real-life examples.	3
	F2.4	Build strong verbal knowledge to frame language in ways that increases engagement.	4
	F2.5	Build on communication by using motivational interviewing as an engagement tool.	4
F3.0. Develop and employ collaboration skills that engage others and build trust.	F3.1	Define collaboration in a mental health context and build on prior knowledge by recalling collaborative experiences.	1
	F3.2	Employ aspects of collaborative leadership that enhances decision-making and consensus building.	3
	F3.3	Explore and practice collaborative methods to work with special populations to increase their community capacity.	3
	F3.4	Design innovative strategies to monitor and evaluate engagement.	4
F4.0. Recognize and differentiate between the stages of mental health recovery.	F4.1	Define the four stages of mental health recovery (hope, empowerment, self-responsibility, and meaningful role in life) and demonstrate impact on complex mental health problems.	2
	F4.2	Demonstrate the ability to formulate goals related to each of the four stages of recovery using a multiple-step process of goal setting.	3
	F4.3	Compare and contrast the recovery model that supports each individual's potential for recovery verses a medical model that views abnormal behavior as the result of physical problems and should be treated medically.	3
	F4.4	Integrate and apply four stages of recovery by designing a recovery plan based on goals that require real-world scenarios.	4

	F4.5	Assess the implementation of the recovery plan and formulate alternative approaches to reach desired outcomes.	3
	F4.6	Advocate for hope and respect, and believe that all individuals have the capacity for learning and growth.	4
	F4.6	Examine ways in which one's recovery from mental illness can be measured.	3
F5.0. Communicate and practice leadership and accountability behaviors.	F5.1	Identify strategies to work under pressure and cope with stress.	1
	F5.2	Develop a basic understanding of various leadership styles that promote positive change in mental health services.	2
	F5.3	Compare and contrast different leadership styles and accountability in mental health.	3
	F5.4	Construct multiple steps to solve complex problems using real-world scenarios in mental health services.	4
F6.0. Analyze and interpret elements of positive psychology (e.g., hope, resilience, strengths, creativity, community building, and supportive spirituality).	F6.1	Recall the recovery model and communicate how positive psychology impacts a mental health consumer's recovery.	2
	F6.2	Interpret key terms from the positive psychology perspective in relationship to holistic wellness.	2
	F6.3	Assess the impact of positive psychology's elements on risk reduction and integrated primary care.	3
	F6.4	Build on the discovered strengths and capabilities of individuals.	4
F7.0. Formulate and implement quality care and treatment plans.	F7.1	Define and describe practices that help individuals improve the quality of all aspects of their lives; including social, occupational, educational, spiritual and financial.	2
	F7.2	Identify an effective collaborative approach in mental health recovery that is inclusive of the individual in need.	2
	F7.3	Practice promoting health and wellness, encouraging individuals to develop and use individualized wellness plans.	3
	F7.4	Design a treatment plan that addresses the unique needs of individuals, consistent with their values, hopes and aspirations.	4
	F7.5	Adhere to consistent documentation of implemented interventions and progress.	1
F8.0. Synthesize, understand, and predict the impact of mental health disparities across consumer populations.	F8.1	Define mental health disparities.	1
	F8.2	Organize and summarize knowledge on the impact of mental health disparities among different populations.	2
	F8.3	Analyze causes for mental health disparities using current research methods and literature.	4
	F8.4	Synthesize research articles related to mental health disparities and produce a statement problem on what causes such disparities.	4
F9.0. Design a practice model of a personal support network by utilizing prior knowledge of recovery concepts and using natural supports within communities.	F9.1	Identify community-based self-help/peer support groups.	1
	F9.2	Communicate with self-help/peer support groups in the community and generate information about their specific functions and responsibilities to the community they serve.	2
	F9.3	Compare and contrast self-help/peer support groups to determine strengths and gaps in service delivery.	3
	F9.4	Design a practice self-help/peer support group model that fills in the identified gaps and builds on the identified strengths.	4
	F9.5	Examine the role that natural supports such as religious organizations, community centers, and other community-related resources play in an individual's mental health recovery.	3

F10.0. Formulate an argument and predict how electronic health records can transform quality of care and promote a green economy.	F10.1	Access and become familiar with basic electronic health records functions.	1
	F10.2	List and describe at least five reasons electronic health records will transform quality of care.	2
	F10.3	List and describe at least five ways that electronic health records will advance a green economy.	2
	F10.4	Distinguish between interoperability at the local primary care level and interoperability with statewide mental health systems in using electronic health records.	2
F11.0. Recognize and respect the various cultures of a community and other factors that indicate it's diversity in all aspects of communication, designing and implementing patient care.	F11.1	Identify and understand the patterns of communication including the use of languages.	2
	F11.2	Communicate and listen effectively across cultures and all levels of care.	2
	F11.3	Demonstrate appropriate judgment on when and how to use trained interpreters.	3
	F11.4	Research factors that define cultural differences between and among different ethnic, racial and special populations.	4
	F11.5	Illustrate how to incorporate culturally appropriate community resources.	2
	F11.6	Design and execute ethnographic approach focusing on information retrieval, observing social behavior, and managing stress and time; ask questions, explore aspects of global significance, analyze data using relevant concepts.	4
F12.0. Evaluate the purpose and components of a treatment plan related to the consumer's health status.	F12.1	Understand the roles of a patient advocate to ensure treatment quality and resources.	2
	F12.2	Explain the components of a treatment plan.	1
	F12.3	Adhere to the roles and responsibilities, within scope of practice, that contribute to the design and implementation of a treatment plan.	1
	F12.4	Prioritize and organize work in accordance with the patients' treatment plans.	2
	F12.5	Determine the resources available for the effective implementation of treatment plans for patients.	2
	F12.6	Select appropriate equipment and instruments in accord with the treatment plan.	2
F13.0. Identify and apply leadership styles in personal growth and development.	F13.1	Develop goal setting that leads to professional and career growth.	3
	F13.2	Build and employ self-confidence to empower self and others.	2
	F13.3	Refine and upgrade technical and clinical skills.	2
	F13.4	Participate in student leadership and skill development activities such as Cal-HOSA.	2
	F13.5	Employ self-regulation strategies that include self-monitoring and self-evaluation in approaching new and challenging tasks.	3
	F13.6	Create and design a working portfolio that will be used for interviews.	4

Appendix B – Revised Standards

Revised Draft Model Curriculum Development CTE Health Science and Medical Technology Standards

Table B1. Revised Biotechnology Pathway Standards*

Domain	Tag	Standard Text
A1.0 Define and assess biotechnology and recognize the diverse applications and impact on society.	A1.1	Use data to explain how biotechnology fields such as pharmaceuticals, agriculture, diagnostics, industrial products, instrumentation, and research and development are impacting human life.
	A1.2	Describe the use of model organisms in biotechnology research and manufacturing.
	A1.3	Recognize the role of innovation in creation of emerging biotechnology careers, including those in nanotechnology, biofuels, and forensics.
	A1.4	Research and identify public misunderstandings related to biotechnology and discern the source of these misunderstandings.
	A1.5	Evaluate the impact of biotechnological applications on both developing and industrial societies, including legal and judicial practices.
	A1.6	Explore and outline the various science and non-science fields and careers associated with biotechnology.
A2.0 Understand the ethical, moral, legal, and cultural issues related to the use of biotechnology research and product development.	A2.1	Know the relationship between morality and ethics in the development of biotechnology healthcare products.
	A2.2	Know the difference between personal, professional, and organizational ethics.
	A2.3	Understand the necessity for accurate documentation and record keeping.
	A2.4	Understand the critical need for ethical polices and procedures for institutions engaged in biotechnology research and product development.
	A2.5	Describe the dilemma of healthcare costs related to advancements in biotechnology and public access to treatments.
	A2.6	Prepare a presentation comparing the benefits and harm that can be the result of biotechnology innovations in both the research and application phases and which course of action will result in the best outcomes.
A3.0. Demonstrate competencies in the fundamentals of molecular cell biology, including deoxyribonucleic acid (DNA) and proteins and standard techniques for their purification and manipulation.	A3.1	Define and describe the structure and function of DNA, ribonucleic acid (RNA) and proteins, explain the consequences of DNA mutations on proteins.
	A3.2	Describe enzyme structure and function, diagram the impact of enzymes and catalysis on reaction rates, and recognize the emerging role of enzymes in replacing industrial chemicals.
	A3.3	Employ standard techniques of DNA extraction, purification, restriction digests, bacterial cell culture, and agarose gel electrophoresis and document and evaluate results.

* Please note that red text denotes changes made to the Health Science Standards after the results of this study were shared with the California Department of Education.

	A3.4	Employ standard protein techniques including antibody production, enzyme assays, spectrophotometry, gel electrophoresis, and chromatography and document and evaluate results.
	A3.5	Predict outcomes of DNA and protein separation protocols.
A4.0. Recognize basic concepts in cell biology and become familiar with the laboratory tools used for their analysis.	A4.1	List and describe the structure and function of cellular organelle.
	A4.2	Describe conditions that promote cell growth under aseptic conditions in the laboratory and workplace.
	A4.3	Use various methods to monitor the growth of cell cultures.
	A4.4	Explain the basic concepts of cell growth and reproduction, DNA replication, mitosis, meiosis, and protein synthesis.
	A4.5	Discuss the structure and function of the macromolecules that compose cells, including carbohydrates, lipids, DNA, RNA, and protein molecules.
	A4.6	Distinguish between prokaryotic cells, eukaryotic cells, and viruses.
	A4.7	Conduct indicator tests for the common macromolecules of the cell.
A5.0. Integrate computer skills into program components.	A5.1	Use the Internet and World Wide Web to collect and share scientific information.
	A5.2	Use a variety of methods, including literature searches, in libraries in computer databases, and online for gathering background information, making observations, and collecting and organizing data.
	A5.3	Compile labs (results, tables graphs) in a legal scientific notebook and/or an Internet site or webpage.
A6.0. Implement use of the metric system, orders of magnitude, and the pH scale in preparation of reagents, analysis of data and graphing.	A6.1	Apply knowledge of symbols, algebra, and statistics to graphical data presentation.
	A6.2	Prepare solutions based on both percent and weight composition to demonstrate proficiency in use of mechanical and digital microbalances.
	A6.3	Calculate and prepare solutions of various molarity; calculate and prepare buffers of various pH; and prepare serial dilutions.
	A6.4	Create data tables and graphs using Excel for the purpose of collecting and analyzing data.
A7.0. Understand the function of regulatory agencies for the biotechnology industry and the lasting impact of routine laboratory and communication practices on product development, and manufacturing.	A7.1	Identify agencies at the local, state, and federal levels.
	A7.2	Be aware of the role of agencies in promoting patient safety, quality control, and entrepreneurship.
	A7.3	Describe intellectual property.
	A7.4	Understand a patent and use online resources to search a patent database.
	A7.5	Demonstrate accurate record keeping and follow good laboratory practice (GLP) for lab notebooks.
	A7.6	Articulate issues of ethical concern, including plagiarism, copyright, trademark, and patent and use online data resources and searchable databases to investigate a copyright, trademark, or patent.
A8.0. Follow sustainable and safe practices with high regard for quality control.	A8.1	Follow written protocols and oral directions to perform a variety of laboratory and technical tasks.
	A8.2	Recognize laboratory safety hazards using safe practices to avoid accidents.
	A8.3	Locate and use Material Safety Data Sheets (MSDS).
	A8.4	Outline the appropriate responses to a laboratory accident including identification of location and use of emergency equipment.

	A8.5	Practice laboratory and personal safety including the location and use of emergency equipment (personal protective equipment, no food or drink, no open-toe shoes).
	A8.6	Properly and safely use and monitor a variety of scientific equipment, including pH meters, microscopes, spectrophotometers, pipets, micropipets, and balances.
	A8.7	Determine which equipment is appropriate to use for a given task and the units of measurement are used.
	A8.8	Perform specimen collection, label samples, and prepare samples for testing.
	A8.9	Handle, transport, and store samples safely.
A9.0. Understand that manufacturing represents inter-connectedness between science and production.	A9.1	Describe the major steps of a product's move through a company's product pipeline.
	A9.2	Identify several products obtained through recombinant DNA technology.
	A9.3	Outline the steps in production and delivery of a product made through recombinant DNA technology.
	A9.4	Cite examples of plant parts or extracts used as pharmaceuticals.
	A9.5	Use the Internet to find information about, traditional pharmaceuticals, herbal remedies, and recombinant pharmaceuticals.
	A9.6	Evaluate the impact of robotics and automation on aseptic processes.
	A9.7	Design a flow chart describing the steps for creating a new drug from hypothesis to distribution.

Table B2. Revised Patient Care Pathway Standards

Domain	Tag	Standard Text
B1.0 Recognize the integrated systems approach to healthcare delivery services: prevention, diagnosis, pathology, and treatment.	B1.1	Know relationship and use of an integrated healthcare delivery system.
	B1.2	Understand the range between prevention, diagnosis, pathology, and treatment procedures.
	B1.3	Understand the significance of nontraditional approaches to healthcare in relationship to delivery systems.
	B1.4	Illustrate the value of preventive and early intervention in relationship to healthcare practices.
	B1.5	Describe the importance of reimbursement systems in relationship to the delivery of patient care.
B2.0 Understand the basic structure and function of the human body and relate normal function to common disorders.	B2.1	Know the basic human body structure and function in relationship to specific care between prevention, diagnosis, pathology, and treatment.
	B2.2	Describe the basic stages of growth and development.
	B2.3	Recognize common diseases and disorder of the human body.
	B2.4	Compare normal function of the human body to the diagnosis and treatment of disease and disorders.
B3.0 Know how to apply mathematical computations used in healthcare delivery system.	B3.1	Apply mathematical computations related to healthcare procedures (metric and household, conversions, and measurements).
	B3.2	Analyze diagrams, charts, graphs, and tables to interpret healthcare results.
	B3.3	Record time using the 24-hour clock.

B4.0 Recognize and practices components of an intake assessment relevant to patient care.	B4.1	Conduct basic interview to acquire new knowledge (e.g., medical and family histories).
	B4.2	Identify and summarize major life events as they impact healthcare practices and patient outcomes.
	B4.3	Observe patient actions, interests, and behaviors while documenting responses.
	B4.4	Collect and synthesize information or data about the patient's symptoms and vital signs.
	B4.5	Evaluate information gathered and connect patient data to appropriate system of care.
B5.0. Know the definition, spelling, pronunciation, and use of appropriate terminology in the healthcare setting.	B5.1	Use medical terminology in patient care appropriate to communicate information and observations.
	B5.2	Accurately spell and define occupationally specific terms related to healthcare.
	B5.3	Use roots, prefixes, and suffixes to communicate information.
	B5.4	Use medical abbreviations to communicate information.
	B5.5	Know the basic structure of medical terms.
	B5.6	Demonstrated the correct pronunciations of medical terms.
	B5.7	Practice word building medical terminology skills.
B6.0. Communicate procedures and goals to patients using various communication strategies to respond to questions and concerns.	B6.1	Observe and document the ability of patients to comprehend and understand procedures and determine how to adjust communication techniques.
	B6.2	Use active listening skills (e.g., reflection, restatement, and clarification) and communication techniques to gather information from the patient.
	B6.3	Formulate appropriate responses to address the patients concerns and questions in a positive manner.
	B6.4	Employ sensitivity and withhold bias when communicating with patients.
	B6.5	Report patient's progress and response to treatment goals.
	B6.6	Maintain written guidelines of Health Insurance Portability and Accountability Act (HIPAA) in all communications.
B7.0. Apply observation techniques to detect changes in the health status of patients.	B7.1	Demonstrate observation techniques.
	B7.2	Differentiate between normal and abnormal patient health status.
	B7.3	Document the patient findings and report information appropriately.
	B7.4	Plan basic care procedures within the scope of practice to assist with patient comfort.
B8.0. Demonstrate the principles of body mechanics as they apply to the positioning, transferring, and transporting of patients.	B8.1	Explain the principles of body mechanics.
	B8.2	Determine appropriate equipment for transportation and transfer, including the modification of equipment and techniques, to accommodate the health status the patient.
	B8.3	Demonstrate appropriate transport and transfer methods to accommodate the health status of the patient.
	B8.4	Evaluate equipment for possible hazards.

	B8.5	Integrate proper body mechanics, ergonomics, safety equipment, and techniques to prevent personal injury to patients and clients.
B9.0 Implement wellness strategies for the prevention of injury and disease.	B9.1	Know and implement practices to prevent injury and protect health for self and others.
	B9.2	Determine effective health and wellness routines for healthcare workers (i.e., stress management, hygiene, diet, rest, and drug use).
	B9.3	Identify practices to prevent injuries and protect health, for self and others (i.e., seatbelts, helmets, and body mechanics).
	B9.4	Know how to access available wellness services (i.e., screening exams and immunizations).
	B9.5	Identify alternative/complementary health practices as used for injury and disease prevention.
	B9.6	Explore consequences of not utilizing available wellness services and behaviors that prevent injury and illness.
B10.0 Comply with protocols and preventable health practices necessary to maintain a safe and healthy environment for patients, healthcare workers, coworkers, and self within the healthcare setting.	B10.1	Describe the infection control cycle with consideration of the various types of microorganisms.
	B10.2	Demonstrate use of facility policies and procedures of infection control with performing patient care.
	B10.3	Evaluate potential causes and methods of transmitting infections and how to apply standard precautionary guidelines.
	B10.4	Demonstrate the use of appropriate Personal Protective Equipment (PTE).
	B10.5	Practice proper hand hygiene.
	B10.6	Use various manual and mechanical decontamination and sterilization techniques and procedures.
	B10.7	Document and analyze sanitation and infection control procedures.
B11.0 Comply with hazardous waste disposal policies and procedures, including document to ensure that regulated waste is handled, packaged, stored and disposed of in accordance with federal, state, and local regulations.	B11.1	Describe basic emergency procedures used to respond to a hazardous spill.
	B11.2	Explain how waste is handled, packaged, stored, and disposed of in accordance with federal, sate, and local regulations including hazardous chemicals, biohazards, and radioactive materials.
	B11.3	Adhere to the healthcare setting's waste management program (e.g., recycling and reduction medical, solid, hazardous, chemical, and radioactive waste materials).
	B11.4	Apply protective practice and procedure for airborne and blood-borne pathogens for equipment and facilities and identify unsafe conditions for corrective action.
B12.0. Adhere to the roles and responsibilities, within the scope of practice, that contribute to the design and implementation of a treatment planning.	B12.1	Understand the scope of practice and related skills within prevention, diagnosis, pathology, and treatment occupations.
	B12.2	Describe the various roles and responsibilities of healthcare workers as team members in an integrated healthcare delivery system.
	B12.3	Demonstrate the knowledge and delivery of specific skills and procedures as outlined within the scope of practice appropriate for patient care in prevention, diagnosis, pathology, and treatment.
	B12.4	Follow appropriate guidelines for implementation of various procedures.
B13.0. Research factors that define cultural differences between and among different ethnic, racial, and cultural groups and special populations.	B13.1	Utilize culturally appropriate community resources.
	B13.2	Recognize complementary and alternative medicine as practiced within various cultures.
	B13.3	Develop ethnographic skills, by location and information retrieval, carefully observe social behavior, and manage stress and time.
	B13.4	Ask questions and explore aspects of global significance.
	B13.5	Analyze data using relevant concepts.

	B13.6	Know when and how to incorporated trained interpreters to facilitate communication and improve patient outcomes.

Table B3. Revised Healthcare Administrative Services Pathway Standards

Domain	Tag	Standard Text
C1.0. Understand healthcare systems as the organization of people, institutions, funding, and resources as well as the broad scope of operations in which healthcare services are delivered to meet the health needs of target populations.	C1.1	Understand the specific roles and responsibilities of healthcare workers, including the healthcare administrative role of leadership for individuals and the organization within a variety of healthcare delivery systems.
	C1.2	Recognize the resources necessary for a health system (e.g. financial, health informatics, diagnostic equipment, pharmaceuticals, and other therapeutic resources).
	C1.3	Recognize the different general methods of funding healthcare (e.g. out-of-pocket payments, health insurance, government funding, charities).
	C1.4	Recognize major specific payment systems (e.g. Medicare, Medicaid, Workers Compensation).
	C1.5	Recognize the varied vital roles that healthcare administrative workers serve in the healthcare process.
	C1.6	Understand the full process of healthcare delivery (e.g. from patient illness or injury to recovery).
	C1.7	Understand common US models for structuring healthcare funding (e.g., Health Maintenance Organizations [HMOs], Preferred Provider Organization [PPOs], Managed Care Organization [MCOs], and Independent Physician Association [IPAs]).
	C1.8	Diagram a selected healthcare organization.
C2.0. Understand the various healthcare provider and support roles in patient care as an integrated, comprehensive healthcare system, to offer the very best options for treatment of patients.	C2.1	Recognize healthcare identifiers (e.g. National Provider Indicator [NPI], Drug Enforcement Administration [DEA] numbers, and Clinical Laboratory Improvement Amendments [CLIA] numbers).
	C2.2	Describe common medical record documentation formats (e.g. Simple Object Access Protocols [SOAP] notes, admission notes).
	C2.3	Understand the major forms of healthcare interventions (e.g. preventive, curative, palliative).
	C2.4	Understand the difference between patient care provider and support roles (e.g. healthcare administrator, clinical data specialist, health informatics technician, and billing and coding specialist).
C3.0 Understand the overarching concepts of economic and financial management systems, system and information management, and the latest innovations in healthcare as they affect healthcare delivery.	C3.1	Understand the basics of business principles, systems thinking, and business management.
	C3.2	Understand operational planning and management tools for performance and quality improvement.
	C3.3	Understand development of financial statements, statement generation, reimbursement systems, costing process, measurement, and control.
	C3.4	Execute financial mathematics, e.g., time value of money calculations, capital budgeting, return on investment, and project risk analyses.
	C3.5	Perform differential reimbursement calculations by payers (e.g. Medicare/Medicaid, self-pay, managed care) and describe the major principles of health insurance.

	C3.6	Understand and explain economic evaluations (e.g., cost benefit/cost effectiveness analysis).
C4.0 Know the role and relationship of public policies and community engagement of the healthcare delivery system.	C4.1	Understand community needs and values and the role of external relations (e.g., demographic/population contexts for development and management of healthcare services).
	C4.2	Comprehend and explain the legal and regulatory environment for health services.
	C4.3	Recognize and explain quantity of healthcare services.
	C4.4	Analyze public policy context and choices relating to specific healthcare delivery systems.
C5.0 Understand and maintain standards of excellence, professional, ethical, and moral conduct required in management of personnel and policy within the healthcare delivery systems.	C5.1	Understand the alignment of personal and organizational conduct management with ethical and professional standards.
	C5.2	Know the organizational responsibility to the patient and community and commitment to lifelong learning and improvement.
	C5.3	Practice the philosophy of respect for life and the need for a balance of benefit over harm resulting from any intervention.
C6.0 Understand the dynamics of human relations, self-management, organizational, and professional leadership skills necessary within the healthcare administrative system.	C6.1	Identify leadership skills and explain their value to an organization.
	C6.2	Understand image building and public relations techniques.
	C6.3	Know and assess decision-making skills.
	C6.4	Demonstrate effective teamwork and critical analysis applying conflict resolutions techniques.
	C6.5	Examine the value of leadership skills, self-initiation, and confidence through personal reflection.
	C6.6	Demonstrate parliamentary procedure skills through team activities.
	C6.7	Describe human resources management and its importance to the successful operation of an organization.
C7.0. Follow the model of medical safety practices and processes that can help prevent system medication errors and understand the consequences of mistakes.	C7.1	Recognize the major consequences mistakes in healthcare may cause (e.g. deaths, lawsuits).
	C7.2	Recognize the critical nature of accurate and complete documentation (e.g. medical allergies, conflicting prescriptions).
	C7.3	Identify patients accurately using appropriate strategies (e.g. continual verification).
	C7.4	Delineate the process for assessing information required by patients, staff, and the community to determine the best course of action.
C8.0. Understand the resources, routes and flow of information within the healthcare system and participate in the design and implementation of effective systems or processes.	C8.1	Describe an effective healthcare information system, including resources, routes, and flow of information.
	C8.2	Enter information within the parameters of the information system. (e.g. entering appropriate data types in the appropriate fields).
	C8.3	Follow security guidelines to protect patient data.
	C8.4	Evaluate the effectiveness of health information systems and determine improvement strategies.

C9.0. Use an electronic healthcare patient information system to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.	C9.1	File records using various methodologies (e.g. alphabetically, by patient record number).
	C9.2	Enter information within the parameters of the information system (e.g. entering appropriate data types in the appropriate fields).
	C9.3	Archive and purge documents following policies and regulatory guidelines.
	C9.4	Compose a rationale that compares and contrasts the relative advantages and disadvantages of paper vs. electronic records.
	C9.5	Distinguish which type of documents must have hard copies kept, retained, and which may be stored only in digital form.
C10.0. Understand common file formats for document and medical imaging, digitizing paper records, and storing medical images.	C10.1	Understand basic document and medical imaging concepts (e.g. resolution, color-depth, compression).
	C10.2	Understand common file formats for document and medical imaging (e.g. tagged image file format [TIFF], joint photographic experts group [JPEG], 2000).
	C10.3	Demonstrate how to scan paper records.
	C10.4	Calculate the approximate storage needs for digitized records and images.
	C10.5	Attach digitized records and medical images to patient records.
C11.0. Know how to schedule and manage appointments for providers.	C11.1	Understand prioritizing methods (e.g. first come first served, emergency appointments, types of procedures).
	C11.2	Recognize the logistical challenges of appointments (e.g. quality of care vs. cost of care).
	C11.3	Manage provider general schedules (e.g. what days and times providers are available).
	C11.4	Understand how to schedule patient appointments for providers.
	C11.5	Explain how to communicate the status of an appointment to the provider.
C12.0. Understand how to use health information effectively.	C12.1	Recognize the major uses of health information (e.g. patient care, billing, research).
	C12.2	Determine which data components are necessary for the successful completion of tasks.
	C12.3	Formulate and report information clearly and concisely.
	C12.4	Disseminate information to various audiences.
C13.0. Understand the need to communicate health/medical information accurately and within legal/regulatory bounds across the organization.	C13.1	Determine which communication methods patients have approved (e.g. email, phone, voicemails).
	C13.2	Determine who has been approved for receiving patient communications beyond the patient (e.g. family members, lawyers).
	C13.3	Communicate with patients compassionately, accurately and effectively.
	C13.4	Use information technology for mass communications (e.g. mail merge, email, auto-dialers).
C14.0. Understand how to transfer information to third-parties.	C14.1	Recognize the types of third parties that may need patient information (e.g. specialists, pharmacies, insurance companies).
	C14.2	Understand the laws and regulations regarding the transfer of information to a third party (e.g. when a is company a covered entity, when a business agreement is required).
	C14.3	Use various technologies to transmit information securely (e.g., fax, electronic, postal mail).
	C15.1	Understand the basic concepts of accrual-based accounting (e.g. accounts payable, accounts receivable, credits, debits).

C15.0. Code health information and bill payers using industry standard methods of classification of diseases, current procedural terminology, and common healthcare procedure coding system.	C15.2	Understand medical record documentation (e.g., chart notes, injections, medications, lab reports).
	C15.3	Synthesize required information from a medical record and other medical documents for a variety of purposes upon regulatory or legal request.
	C15.4	Translate code services (e.g., diagnostic procedures, surgeries) using industry standard methods (e.g. International Classification of Diseases-ninth Ed. [ICD-9], Current Procedural Terminology-fourth Ed. [CPT-4], Healthcare Common Procedure Coding System [HCPCS]).
	C15.5	Demonstrate how to bill third-party payers (e.g. insurance companies, Medicare).
	C15.6	Receive and process information from third-party payers (e.g. Explanation of Benefits [EOB], Remittance Advice).
	C15.7	Audit and analyze coding done by others to determine proper billing.
C16.0. Use a systematic method of continual process improvement.	C16.1	Learn new knowledge and skills regularly (e.g. on-the-job-training [OJT], continuing education).
	C16.2	Discover new knowledge through primary research methodologies (e.g. experiments, surveys, data analysis).

Table B4. Revised Healthcare Operational Support Services Pathway Standards

Domain	Tag	Standard Text
D1.0 Describe the process for monitoring clients' expectations by using plans to promote satisfaction and measurement tools to ensure sufficiency of products and delivery of services.	D1.1	Understand the responsibilities of their roles and perform their tasks safely by using appropriate guidelines.
	D1.2	Know how to provide support to standardization, consolidation, and re-engineering processes.
	D1.3	Explain the importance of coordinating intradepartmental activities, including event planning and logistics, with outside agencies and contractors.
	D1.4	Evaluate and determine a process operational systems improvement.
D2.0. Assess basic operating procedures of support services.	D2.1	Identify activities that require coordination between various departments.
	D2.2	Implement purchasing and procurement techniques.
	D2.3	Develop a preventative maintenance program for equipment and services.
	D2.4	Explain staffing needs and productivity.
	D2.5	Develop reporting mechanisms for measuring productivity.
	D2.6	Investigate systems and procedures that minimize customer cost of ordering, and storing and using supplies, services, and equipment.
	D2.7	Integrate infection control standards with design and construction activities.
	D2.8	Discuss the relationships among organization structures, policies, procedures and quality assurance.
	D3.1	Recognize physical, procedural, and electronic barriers.
	D3.2	Describe the process for evaluating compliance with corporate, legal, regulatory, and accreditation standards, ethics, and codes.
	D3.3	Adhere to the federal, state, and local regulations that apply to accreditation, design, and construction of a healthcare facility.
	D3.4	Use appropriate action to maintain a facility in good repair (e.g., report, make recommendations, or repair).

D3.0. Comply with legal regulations and facility standards for design, construction, maintenance, and improvement of healthcare facilities and environments.	D3.5	Analyze the therapeutic and functional aspects of color, decor, and furnishings as well as the process for coordinating facility furnishings and finishes in accordance with appropriate safety codes.
	D3.6	Evaluate how risk management can apply to support services functions.
D4.0. Comply with protocols and practices necessary to maintain a clean and healthy work environment.	D4.1	Demonstrate the use of appropriate Personal Protective Equipment (PPE).
	D4.2	Practice proper hand hygiene.
	D4.3	Use various manual and mechanical decontamination and sterilization techniques and procedures.
	D4.4	Evaluate potential causes and methods of transmitting infections and how to apply standard precautionary guidelines.
	D4.5	Document and analyze sanitation and infection control procedures.
	D4.6	Describe the care needed when handling chemicals.
	D4.7	Describe basic emergency procedures used to respond to a hazardous spill.
	D4.8	Explain how waste is handled, packaged, stored, and disposed of in accordance with federal, state, and local regulations including hazardous chemicals, biohazards, and radioactive materials.
	D4.9	Comply with hazardous waste disposal policies and procedures, including documentation, to ensure that regulated waste is handled, packaged, stored, and disposed of in accordance with federal, state, and local regulations.
	D4.10	Implement a waste management program, including the recycling and reduction of regulated medical, solid, hazardous, chemical, and radioactive waste materials.
	D4.11	Demonstrate protection from blood-borne pathogens and identify unsafe conditions for corrective action.
D5.0. Use principles and techniques of resource management to make appropriate decisions.	D5.1	Identify components of a comprehensive training program for healthcare employees, including safety, infection control, handling of hazardous materials, and use of equipment.
	D5.2	Follow procedures and processes for the selection, acquisition, distribution, and maintenance of equipment and understand preventive maintenance for buildings and equipment.
	D5.3	Demonstrate the process for developing inventory-reduction targets to achieve the financial goals of healthcare organizations.
	D5.4	Use distribution strategies and systems to ensure the optimal flow of materials.
	D5.5	Understand a department's labor distribution reports to ensure the proper allocation of resources for projects and operations.
	D5.6	Evaluate competitive pricing, terms, and service levels to support product recommendations.
D6.0. Collect and distribute essential patient information to appropriate team members.	D6.1	Recognize and report unusual or unsafe environmental conditions.
	D6.2	Recognize ethical conflicts related to assessment practices (e.g., labeling, confidentiality).
	D6.3	Document actions according to the facility's protocol and regulatory guidelines.
	D6.4	Maintain confidentiality according to the facility's protocol as well as Healthcare Insurance Portability and Accountability Act (HIPAA).
	D7.1	Describe risk management strategies.
	D7.2	Describe the use of calibration.

D7.0. Assess and maintain materials for quality management.	D7.3	Use appropriate inventory and control systems to purchase materials, supplies, and capital equipment.
	D7.4	Perform quality control activities, using manuals and following directions appropriately.
	D7.5	Maintain equipment (e.g., imaging, laboratory).
	D7.6	Send, receive, and distribute material for services.
	D7.7	Organize inventory, purchase orders, and products.
	D7.8	Inspect facilities to ensure compliance with standards, regulations, and codes.
	D7.9	Assess procedures and processes to select, acquire, and maintain inventory.
	D7.10	Evaluate cost effectiveness of alternative methods for inventory control.
	D7.11	Discuss policies and procedures to monitor, distribute, and consume materials.
D8.0. Demonstrate handling and storage of materials, supplies, and equipment.	D8.1	Describe and implement a program to purchase materials, supplies, and capital equipment with allocated resources.
	D8.2	Use appropriate safety equipment.
	D8.3	Explain inventory control.
	D8.4	Demonstrate appropriate inventory control systems (e.g., distribution, consumption, intentional loss of materials or supplies).
	D8.5	Demonstrate proper care in handling and storage of sterile and non-sterile items.
D9.0. Analyze the business structure of supply and service management.	D9.1	Describe the components of a purchasing agreement.
	D9.2	Describe the supply chain process.
	D9.3	Explain bids and quotes for supply and service selection.
	D9.4	Explain competitive pricing.
	D9.5	Assess integration of resource functions.
	D9.6	Assess purchasing and procurement techniques that improve quality and supply.
	D9.7	Utilize technology and translate how it supports the supply chain process.
	D9.8	Discuss the cost benefits of supply and service selection.
	D9.9	Analyze the impact of timely order placement and supplier performance.
D10.0. Demonstrate the ability to prepare, assemble and deliver a high quality, nutritious meal for the clients they serve.	D10.1	Prepare a food tray with the appropriate utensils and food items as prescribed to meet dietary requirements.
	D10.2	Deliver trays to the specified area of the healthcare facility.
	D10.3	Using National Health Occupations Students of America (HOSA) Nursing Assisting guidelines, prepare the patient for a meal.
	D10.4	Using state and federal standards for examining food temperatures, follow guidelines for inspecting the safety of food.
D11.0. Demonstrate and use the correct transport equipment.	D11.1	Assess the protocol for transporting a patient to surgery versus a patient to radiology.
	D11.2	Practice proper body mechanics and safety measures while transferring a patient from an emergency room to the assigned room and document results of the transfer.
	D11.3	Demonstrate and recite procedures about safe patient transport for interdepartmental transfers or upon discharge.
	D12.1	Describe different types of emergency preparedness plans (e.g., homeland security, natural disaster, pandemic, crisis planning).

D12.0. Understand the need for an effective emergency preparedness plan.	D12.2	Explain emergency procedures for staff, including supplies needed in the event of an internal or external disaster.
	D12.3	Participate in educational and training programs related to emergency preparedness planning.
	D12.4	Assess the Emergency Preparedness Plan.

Table B5. Revised Public and Community Health Pathway Standards

Domain	Tag	Standard Text
E1.0. Understand the context and scope of Public Health on improving health and quality of life in personal, community and the global population.	E1.1	Understand written text about the history, philosophy, services, and careers in public health.
	E1.2	Describe the environmental, behavioral, biological, and socio-economic factors as well as access, quality, intervention and cost of medical care that are central to communities and the population.
	E1.3	Identify the roles and responsibilities of public health in addressing populations, health disparity, and disaster prevention and management.
	E1.4	Explain how public health can utilize health information and health communications to improve the health of populations.
	E1.5	Explain how public health can utilize social and behavioral interventions to improve the health of populations.
	E1.6	Explain how public health can utilize health policy and law to improve the health of populations.
	E1.7	Explain how public health assesses the options for intervention to improve the health of a population.
	E1.8	Explain the impact of the environment and communicable diseases on the health of populations.
	E1.9	Compare the scope of current public health policies with past practices.
	E1.10	Defend health decisions, individual rights, and social responsibilities.
E2.0. Design, promote, and implement community health programs which result in health-positive behaviors among all individuals, families, groups in a community and the global environment.	E2.1	Know public policies that have an impact on people's health.
	E2.2	Identify and document factors influencing people's health status through a strong grounding in social and behavioral theory.
	E2.3	Understand various strategies to improve the health status of individuals and the community.
	E2.4	Understand the many health disparities barriers to access among underserved communities.
	E2.5	Develop specific competencies for work in underserved and/or linguistically isolated communities.
	E2.6	Demonstrate competency in working with diverse cultures and communities.
	E2.7	Demonstrate ways in which enhancing and maintaining personal health and well-being is established.
	E2.8	Explain fiscal and organizational resources to ensure optimal health programs and service delivery in communities.
	E2.9	Expand health knowledge to provide information and referrals and advocacy on a range of health topics more effectively.
	E2.10	Conduct outreach and health education at community sites with various cultural groups.

	E2.11	Evaluate the process and outcome of community-based health education programs.
	E2.12	Research the social, cultural, and behavioral factors influencing health outcomes.
E3.0. Examine gerontology and its social implications using a life span perspective focusing on older adults' needs/concerns along life's continuum in various environments.	E3.1	Understand how the demographics of the older population affect various aspects of our society.
	E3.2	Recognize the contributions that aging persons make to their communities.
	E3.3	Define the life course perspective and describe how age, gender, race, and ethnicity influence the life course.
	E3.4	Identify a range of available services for elders in most communities.
	E3.5	Understand health disparities among older adults and their impact on society.
	E3.6	Understand the role of service providers and the use of community recreation and health services in their involvement with older persons.
	E3.7	Understand common threats to loss of independence: falls, medication management, and lifestyle.
	E3.8	Advocate for technology to enhance older adults' function, independence, and safety.
	E3.9	Assess how policies, regulations, and programs differentially impact older adults and their caregivers, particularly among historically disadvantaged populations.
	E3.10	Differentiate between normal changes in functioning due to aging and pathological changes leading to disease.
	E3.11	Analyze the impact of an aging society on the nation's healthcare system.
E4.0. Promote the protection, sustainability, and enhancement of the overall environmental quality of life.	E4.1	Identify the various environmental factors that affect a community's health and safety such as water quality, air quality, food supply, industrial hygiene, and solid and hazardous waste disposal.
	E4.2	Identify human health hazards that may cause sickness or impaired health/well-being.
	E4.3	Identify the carriers or vectors that promote the transfer of these agents from the environment to the human.
	E4.4	Interpret the principles of environmental health practices.
	E4.5	Summarize health conditions that are caused or aggravated by environmental conditions.
	E4.6	Discuss emerging global environmental health problems.
	E4.7	Analyze current legislation and regulation regarding environmental issues.
	E4.8	Explore approaches to control of major environmental health problems.
E5.0. Predict and evaluate rates, risk factors, and health status indicators of morbidity and mortality, disease determinants, and causation.	E5.1	Describe the historical roots of epidemiological thinking and its contribution to the evolution of the scientific method.
	E5.2	Describe the basic epidemiological concepts of rates, causation, and public health surveillance.
	E5.3	Generate hypotheses of patterns of disease and injuries regarding person, place, and time.
	E5.4	Research data regarding disease or injuries including rates, risk factors, disease determinants, and causation of morbidity and mortality.
	E5.5	Explore the effects of disease, injury, and violence on longevity and quality of life.

	E5.6	Evaluate methods to prevent, detect, cure, and minimize disease, injury, and violence in the population.
E6.0. Integrate knowledge and skills necessary as a member of a Community Emergency Response Team (CERT) to demonstrate the response required to meet your community's immediate needs in emergencies or disasters.	E6.1	Describe the roles and responsibilities of a member of a Community Emergency Response Team (CERT) in immediate response.
	E6.2	Describe potential hazards and their effect on the community.
	E6.3	Describe prevention strategies in homes, workplaces, and communities.
	E6.4	Identify planning and size-up requirements for potential search and rescue situations.
	E6.5	Explain how the community has a role in disaster preparedness and response.
	E6.6	Demonstrate preparation strategies to improve the quality of life for a person or community.
	E6.7	Employ basic assessment, triage, and treatment as defined by CERT Protocols under simulated disaster conditions.
	E6.8	Demonstrate working as a team, applying safe techniques for debris removal, and victim extrication.
	E6.9	Describe the post-disaster emotional environment and the steps that rescuers can take to relieve their own stressors and trauma and those of disaster survivors.

Table B6. Revised Mental and Behavioral Health Pathway Standards

Domain	Tag	Standard Text
F1.0. Recognize and interpret principles of community engagement.	F1.1	Identify and describe prevention and early intervention barriers to mental healthcare.
	F1.2	Define the psycho-education approach and describe how it is used as a tool to help consumers and their families learn more about managing their mental illness.
	F1.3	Define the principles of community engagement and how they apply to community-based participatory research.
	F1.4	Use and apply community-based participatory research methods to increase community participation and resources.
	F1.5	Develop and explore basic outreach approaches that can be successful in increasing awareness about mental health services.
	F1.6	Research and organize community resources that promote community wellness.
	F1.7	Advocate for community inclusion and social roles such as; supported housing, employment, education, parenting, citizenship, and anti-stigma.
F2.0. Demonstrate the ability to build relationships through empathic communication.	F2.1	Describe the elements of active listening.
	F2.2	Demonstrate active listening by connecting new knowledge or experiences with prior knowledge and problem solving.
	F2.3	Differentiate between giving advice and active listening by constructing real-life examples.
	F2.4	Build strong verbal knowledge to frame language in ways that increase engagement.
	F2.5	Recognize complex language semantics and make appropriate adaptations for the community bing served.
	F2.6	Build on communication by using motivational interviewing as an engagement tool.

F3.0. Develop and employ collaboration skills that engage others and build trust.	F3.1	Define collaboration in a mental health context and build on prior knowledge by recalling collaborative experiences.
	F3.2	Employ aspects of collaborative leadership that enhances decision-making and consensus building.
	F3.3	Explore and practice collaborative methods for working with special populations to increase their community capacity.
	F3.4	Design innovative strategies to monitor and evaluate engagement.
F4.0. Recognize and differentiate between the stages of mental health recovery.	F4.1	Define the four stages of mental health recovery (hope, empowerment, self-responsibility, and meaningful role in life) and demonstrate impact on complex mental health problems.
	F4.2	Demonstrate the ability to formulate goals related to each of the four stages of recovery using a multiple-step process of goal setting.
	F4.3	Compare and contrast a psychosocial rehabilitation and recovery model that supports each individual's potential for recovery verses a medical model that views abnormal behavior as the result of physical problems and should be treated medically.
	F4.4	Integrate and apply four stages of recovery by designing a recovery plan based on goals that require real-world scenarios.
	F4.5	Assess the implementation of the recovery plan and formulate alternative approaches to reach desired outcomes.
	F4.6	Advocate for hope and respect, and believe that all individuals have the capacity for learning and growth.
	F4.7	Examine ways in which one's recovery from mental illness can be measured.
F5.0. Communicate and practice leadership and accountability behaviors.	F5.1	Identify strategies to work under pressure and cope with stress.
	F5.2	Develop a basic understanding of various leadership styles that promote positive change in mental health services.
	F5.3	Compare and contrast different leadership styles and accountability in mental health.
	F5.4	Construct multiple steps to solve complex problems using real-world scenarios in mental health services.
F6.0. Analyze and interpret elements of positive psychology (e.g., hope, resilience, strengths, creativity, community building, and supportive spirituality).	F6.1	Recall the recovery model and communicate how positive psychology impacts a mental health consumer's recovery.
	F6.2	Interpret key terms from the positive psychology perspective in relationship to holistic wellness.
	F6.3	Assess the impact of positive psychology's elements on risk reduction and integrated primary care.
	F6.4	Build on the discovered strengths and capabilities of individuals.
F7.0. Formulate and implement quality care and treatment plans.	F7.1	Define and describe practices that help individuals improve the quality of all aspects of their lives including social, occupational, educational, spiritual, and financial.
	F7.2	Identify and provide evidence for an effective collaborative approach in mental health recovery that is inclusive of the individual in need.
	F7.3	Practice promoting health and wellness, encouraging individuals to develop and use individualized wellness plans.
	F7.4	Design a treatment plan that addresses the unique needs of individuals, consistent with their values, hopes and aspirations.
	F7.5	Adhere to consistent documentation of implemented interventions and progress.
	F8.1	Define mental health disparities.

F8.0. Synthesize, understand, and predict the impact of mental health disparities across consumer populations.	F8.2	Organize and summarize knowledge on the impact of mental health disparities among different populations.
	F8.3	Analyze causes for mental health disparities using current research methods and literature.
	F8.4	Synthesize research articles related to mental health disparities and produce a statement problem on what causes such disparities.
F9.0. Design a practice model of a personal support network by utilizing prior knowledge of recovery concepts and using natural supports within communities.	F9.1	Identify community-based self-help/peer support groups.
	F9.2	Communicate with self-help/peer support groups in the community and generate information about their specific functions and responsibilities to the community they serve.
	F9.3	Compare and contrast self-help/peer support groups to determine strengths and gaps in service delivery.
	F9.4	Design a practice self-help/peer support group model that fills in the identified gaps and builds on the identified strengths.
	F9.5	Examine the role that natural supports such as religious organizations, community centers, and other community-related resources play in an individual's mental health recovery.
F10.0. Formulate an argument and predict how electronic health records can transform quality of care and promote a green economy.	F10.1	Access and become familiar with basic electronic health records functions.
	F10.2	Analyze the effect of electronic health records on the quality of care and a green economy.
	F10.3	List and describe at least five ways that electronic health records will advance a green economy.
	F10.4	Distinguish between interoperability at the local primary care level and interoperability with statewide mental health systems in using electronic health records.
F11.0. Recognize and respect the various cultures of a community and other factors that indicate it's diversity in all aspects of communicating, designing, and implementing patient care.	F11.1	Identify and understand the patterns of communication including the use of languages.
	F11.2	Communicate and listen effectively across cultures and all levels of care.
	F11.3	Demonstrate appropriate judgment on when and how to use trained interpreters.
	F11.4	Research factors that define cultural differences between and among different ethnic, racial, and special populations.
	F11.5	Illustrate how to incorporate culturally appropriate community resources.
	F11.6	Design and execute an ethnographic approach focusing on information retrieval, observing social behavior, and managing stress and time, ask questions, explore aspects of global significance, and analyze data using relevant concepts.
F12.0. Evaluate the purpose and components of a treatment plan related to the consumer's health status.	F12.1	Understand the roles of a patient advocate to ensure treatment quality and resources.
	F12.2	Explain the components of a treatment plan.
	F12.3	Select appropriate equipment and instruments in accord with the treatment plan.
	F12.4	Adhere to the roles and responsibilities, within scope of practice, that contribute to the design and implementation of a treatment plan.
	F12.5	Prioritize and organize work in accordance with the patients' treatment plans.
	F12.6	Determine the resources available for the effective implementation of treatment plans for patients
	F13.1	Develop goal setting that leads to professional and career growth.
	F13.2	Participate in student leadership and skill development activities such as California Health Occupations Students of America (Cal-HOSA).

F13.0. Identify and apply leadership styles in personal growth and development.	F13.3	Employ self-regulation strategies that include self-monitoring and self-evaluation in approaching new and challenging tasks.
	F13.4	Build and employ self-confidence to empower self and others.
	F13.5	Refine and upgrade technical and clinical skills.
	F13.6	Create and design a working portfolio that will be used for interviews for both postsecondary and employment acceptance.