Part Three: Comprehensive Questions

Instructions: Complete each of the prompts below.

1. Provide examples of at least two opportunities for candidates to attain and demonstrate a deep understanding of discipline-specific literacy skills and strategies essential to their endorsement area (e.g., building background knowledge specific to the discipline, deconstructing complex discipline-specific text structures, mapping graphic and scientific representations against explanations in the text, posing discipline-specific questions, providing evidence to support and evaluate claims).

Throughout the program the teacher candidate will be provided multiple opportunities to attain knowledge and demonstrate a deep understanding of scientific literacy skills and strategies essential to the science secondary endorsement area. Those opportunities will allow the candidate to understand science context. Using strategies for understanding science text, the candidate will use strategic processes necessary for comprehension and problem solving.

Building background knowledge specific to science

To build teacher candidates' background knowledge the coursework is designed to activate teacher candidates' prior knowledge as a first step. Prior knowledge will be assessed through a variety of advance organizers. Advance organizers will help teacher candidates clarify what the "big ideas" are, assess what the teacher candidates already know, and develop links between previous and incoming material.

As the content faculty have assessed what teacher candidates know about a scientific concept or idea, they will then use a variety of instructional strategies to introduce the material and address the diversity of learning styles and experiences students may have. Specific opportunities are when science content faculty include the following strategies in coursework; 1) begin by teaching words in categories, 2) use contrasts and comparisons 3) Use analogies, use topic-focused wide reading and 4) use multimedia

Deconstructing complex science text structures

Teacher candidates will be able to locate and organize information in text. When content faculty present information in textural form, teacher candidates retain information in their short-term memory. Students then can process it or connect it to background knowledge and store it in their long term memory. Specific opportunities are when science content faculty include the following strategies in coursework:

- ✓ Introduce an organizational pattern: The content faculty introduces the signal words and phrases that identify each text structure and gives students a graphic organizer for each pattern.
- ✓ Give students opportunities to work on the text: The content faculty provides the teacher candidates with chances to analyze the text structures in informational documents. At this stage, students learn the signal words and phrases in the text that identify each text pattern. They also may use graphic organizers to illustrate these patterns.
- ✓ Allow teacher candidates to write paragraphs using each text structure pattern: This can be whole-class assignment, followed by small-group, partner, and independent writing activities.

Mapping graphic and science representations against explanations in the text

Information is often represented visually in science as a method of organizing, extending, or replacing other methods of presentation. Visual representation in science involves creating and forming models that reflect scientific information. Specific opportunities are when science content faculty include the following strategies in coursework:

- ✓ A semantic map is one type of graphic organizer that can be used to support learning in science. This type of graphic organizer is mainly used to relate conceptual information and could be used to support conceptual learning in science.
- ✓ A semantic feature analysis is another type of graphic organizer. This graphic organizer is characterized by a matrix format, where features or characteristics of objects or concepts are displayed.
- ✓ Visual display is a type of graphic organizer that can be used in science for displaying relationships very clearly. Visual displays can be used for a number of different purposes. This includes making comparisons between objects or concepts using a Venn diagram, or display information temporally using a timeline to compute the answer to a word problem.

Posing discipline-specific questions

Posing scientific thinking questions is a tool for developing and strengthening critical thinking skills. It is an inductive questioning process that structures dialogue in the classroom. Specific opportunities are when science content faculty include the following strategies in coursework:

- ✓ When planning questions, content faculty will keep in mind course goals.
- ✓ Aim for direct, specific questions. During class discussions, rather than beginning with a single question that is multilayered and complex, use a sequence of questions to build depth and complexity.
- ✓ Ask questions throughout class and ask only one question at a time.
- ✓ Ask open-ended questions.
- ✓ Use Bloom's Taxonomy to be sure you are addressing various types of cognitive processes in your questions.
- ✓ Refine and reflect on questions throughout class.

Providing evidence to support and evaluate claims

To provide evidence to support and evaluate claims in science textbooks, evidence strategies will be used by the content faculty. Specific opportunities are when science content faculty include the following strategies in coursework: Rereading, Specify Purpose, Think-Alouds, Text Annotation, Paraphrasing, Use Evidence to Build Arguments and Color-Code.

2. Provide at least two examples of opportunities that are provided for candidates to acquire both academic and discipline-specific vocabulary and communicate using this vocabulary accurately and effectively.

Teacher candidates have multiple opportunities to acquire academic and discipline vocabulary. Once their vocabulary is acquired, they will communicate using this vocabulary accurately and effectively in the P-12 environment.

In order to attain scientific thinking, the teacher candidates need to learn and have a rich understanding of vocabulary. To ensure that candidates are assimilating and using vocabulary knowledge essential to learning science, the science courses will include these basic vocabulary strategies in every lesson:

• Pre-teach science vocabulary

• Model vocabulary when teaching new concepts

• Use appropriate labels clearly and consistently

• Integrate vocabulary knowledge in assessments.

Additional richer vocabulary strategies would include the following;

Frontload Multiple-Meaning Words. Science often uses words with multiple meanings. Multiple meanings can be very confusing for candidates. It is helpful to present these words prior to the lesson and ask candidates to brainstorm various meanings. This revelation can be a relief to students with limited background knowledge.

List-Group-Label, Word Sort, or Circle the Category. Classifying and categorizing vocabulary words are important skills for comprehension and application. A closed sort means the instructor provides terms and categories. An open sort allows for students to be are given the terms but are not given the category titles. It is up to them to create and justify groups and titles for each group. Circle the category is a kinesthetic way to either do an open or closed sort. Candidates receive the words and work collaboratively in formed cooperative groups.

The Frayer Model. The Frayer Model is a graphic organizer for building candidates' science vocabulary. This technique requires candidates to define target vocabulary and apply their knowledge by generating examples and non-examples, giving characteristics, and/or drawing a picture to illustrate the meaning of the word.

Reinforcing the idea that a piece of science text needs to make sense is exceedingly important. In order to understand concepts with the long-term goal of effectively teaching the concepts, the candidates are exposed to additional strategies as they are incorporated throughout the science courses. Such strategies include:

Be*fore reading, the strategic reader*

Previews the text by looking at the title, the pictures, and the print in order to evoke relevant thoughts and memories

Builds background by activating appropriate prior knowledge about what he or she already knows about the topic (or story), the vocabulary, and the form in which the topic (or story) is presented

Sets purposes for reading by asking questions about what he or she wants to learn (know) during the reading episode

While reading, the strategic reader

Checks understanding of the science text by paraphrasing the author's words

Monitors comprehension by using context clues to figure out unknown words and by imagining, inferencing, and predicting

Integrates new concepts with existing knowledge, continually revising purposes for reading

After reading, the strategic reader

Summarizes what has been read by retelling the main concept of the text

Evaluates the concepts contained in the text

Makes applications of the ideas in the text to unique applications, extending the ideas to broader perspectives

As candidates attain the knowledge needed to be successful, they are given opportunities to demonstrate knowledge of disciplinary literacy as well as effective strategies to promote science thinking. Candidates will recognize that part of their job in helping their students become autonomous, self-directed learners is first to help them become strategic, facile readers of science text.

Those opportunities can be seen when the candidates complete required 10 hours of field experience in physics and biology. During the field experience hours, the candidates will complete the following activities within the science content course. During the completion of field experience opportunities for the candidate to demonstrate how reading and writing is used in the science classroom include, but are not limited to:

- Classroom Observations
    - Observe a variety of teaching and learning situations. Write reflective reports aligning effective science learning strategies, including vocabulary and comprehension strategies.
- Classroom Instructional Support
    - Use understanding of effective literacy scientific skills to prepare instructional material. (anchor charts, graphic organizers).
    - Prepare and manage the physical or online environment. This includes allowing students to use interactive science platforms (i.e. ALEXS, Art of Problem Solving, Buzz Science)
    - Assess student papers, exams, quizzes, and include effective clear feedback with opportunities to reteach
- Classroom Instruction (utilizing strategies previously used in candidates' coursework)
    - Delivering short presentations to students.
    - Supervising groups during learning centers.
    - Tutoring individuals or small groups of students.

- Team teaching with cooperating teacher(s) or peer(s).
- Teaching and managing a classroom.
- Creating and implementing lesson plans and assessment strategies associated with classroom instruction.

With the completion of the previously stated activities, the candidates will not only develop physical thinking through effective strategies but will in turn utilize these strategies with their students to focus on how reading and writing is used in the science classroom.

3. Structure clinical experiences to support candidates' ability to prepare 6-12 students to acquire, comprehend, and communicate discipline-specific information through reading, viewing, listening, speaking, and writing.

The EPP has structured the program to provide support to prepare the teacher candidate with the ability to prepare 6-12 students to acquire, comprehend, communicate scientific thinking through reading, viewing, listening, speaking, and writing. In content coursework our EPP gives the teacher candidate opportunity to learn content knowledge through reading, viewing, listening, speaking and writing. With the same strategies, the teacher candidate is expected to be impact on the 6-12 learners. The following demonstrate the strategies both the content instructor and the teacher candidate will use to achieve the desire outcome.

Our EPP support our teacher candidates' ability to prepare 6-12 students to acquire, comprehend and communicate science through reading by including reading strategies on the content lesson plan. With the understanding the 6-12 students are reading to learn content some of the following comprehension strategies will be used:

Before Reading

- ✓ Anticipation Guide
- ✓ Collaborative-Strategic-Reading Learning Logs
- ✓ Concept Sorts
- ✓ First Lines
- ✓ List-Group-Label
- ✓ Listen-Read-Discuss

During Reading

- ✓ Think Alouds
- ✓ Think-Pair-Share Concept Maps
- ✓ Directed Reading Thinking Activity
- ✓ Double-Entry Journals
- ✓ Inferential Reading
- ✓ Inquiry Chart
- ✓ Jigsaw
- ✓ Paragraph Shrinking
- ✓ Partner Reading
- ✓ Power Notes

- ✓ Prediction Relay
- ✓ Reading Guides
- ✓ Reciprocal Teaching
- ✓ SQ3R

After Reading

- ✓ Exit Slips
- ✓ Frame Routine
- ✓ Question the Author
- ✓ Question-Answer Relationship
- ✓ RAFT Writing
- ✓ Summarizing

Our EPP support our teacher candidates' ability to prepare 6-12 students to acquire, comprehend and communicate science through viewing by requiring the teacher candidates to include a viewing component content lesson plans. Because viewing video should be decoded, the teacher candidate will select from the following strategies to help 6-12 learners deconstruct what they see in a video.

- ✓ Anchor Strategies: Viewing Purpose, Preview, Predict, Connect
    - Set a viewing purpose
    - Predict (e.g., sequence of events, video creator's position on a given topic, etc.)
    - Preview video (editing conventions, length, title)
    - Identify media connections (e.g., I read a book on a related topic recently; I saw a tweet that described this same idea but in sarcastic terms, etc.)
    - Make True/False statements about general video topic
    - Begin KWL chart
    - Roughly summarize (e.g., what they know about topic. video creator, channel, etc.)
    - Concept map the video topic in a given or self-selected context
    - Complete Anticipation Guide
    - Create self-produced guiding questions
- ✓ *During viewing* comprehension strategies that promote understanding of video and streaming content.
- ✓ Anchor Strategies: Stop, Clarify, Question, Infer
    - Stop (or pause) the video while viewing based on viewer preference and monitoring of own understanding
    - Rewind to clarify understanding or uncover subtle data/events
    - Rewatch video with new purpose and perspective
    - Form relevant questions based on viewing
    - Clarify (e.g., information, bias, fact/opinion, "author" position, etc.)
    - Monitor & Repair Understanding
    - Evaluate use of primary and secondary modalities
    - Make meaningful and personalized inferences (e.g., primary and secondary audiences)
    - Infer underlying assumptions of video
    - Adjust viewing speed (i.e., use slow-motion) if available (e.g., science videos)

- ✓ *After viewing* comprehension strategies that promote understanding of video and streaming content.
- ✓ Anchor Strategies: Summarize, Analyze, Create, Socialize
    - Retell what happened; Paraphrase "standout" ideas
    - Summarize main idea and key supporting details
    - Recall own thinking and/or emotions during video (metacognition)
    - Modality Analysis (e.g., identify and analyze prevailing modalities and their effect)
    - Metric Analysis (e.g., to infer social context with respect to total views, currently watching, social shares, etc.)
    - Analyze idea organization of video
    - Create a word cloud (e.g., that reflects diction, tone, theme, etc.); Tweet, comment on, blog, or otherwise socialize initial impressions in a way that reflects digital citizenship
    - Socialize extended responses (e.g., in writing, on social media, etc.)
    - Categorize information and perspectives
    - Separate explicit and implicit ideas
- ✓ *Extended* comprehension strategies are meant to provide extended learning around video and streaming content, as well as opportunities for more complex thinking about that content.
- ✓ Anchor Strategies: Reflect, Create, Critique, Design
    - Reflect on "fit" of video with regards to Viewing Purpose
    - Compare & contrast video with similar video content
    - Create Anticipation Guide (for viewers that haven't seen video)
    - Identify "big idea" of video
    - Critique video for which modalities supported video purpose and theme, and which seemed to distract
    - Roughly determine history of topic in similar and dissimilar media
    - RAFT thinking & extension (Role, Audience, Format, Topic/Theme)
    - Prioritize ideas & information from least to most important
    - Distinguish between tone and mood of video
    - Design follow-up medium that extends and deepens purpose of video

Our EPP will support our teacher candidates' ability to prepare 6-12 students to acquire, comprehend and communicate science through listening and speaking by requiring the teacher candidates to have the 6-12 student to prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. This will be done when a discussion component is included on the lesson plan. Specific strategies include;

- ✓ Readers' Theatre
- ✓ Oral Presentations
- ✓ Listening stations
- ✓ Listening Gallery Walk.

Second, students are expected to interact effectively with a wide range of people, not just their friends and others they choose to interact with. Third, students are expected to build on each other's ideas,

maintaining the conversation and continually building on the ideas of others in the discussion. And finally, they need to be able to do all of this while they express their ideas clearly and persuasively.

Our EPP will support our teacher candidates' ability to prepare 6-12 students to acquire, comprehend and communicate science through requiring a writing component on lesson plans. In comparison to writing to learn, writing to record can help science and literacy. This offers 6-12 students the opportunity remembers details, steps, and important definitions. When teacher candidates include writing to record in their instruction, they are giving 6-12 students opportunities to compile accurate and factually correct information for reference. This is done when the teacher candidate allows the 6-12 student to complete a final draft of notes as a class assignment.

Because there are two different purposes for writing in the content areas, teacher candidates will use both in their instruction method. The two main goals are writing for rehearsal and writing for reorganization. Writing for rehearsal occurs when the teacher candidate allows students to fill out a graphic organizer to review test material or when science teacher candidates have the 6-12 students write the steps for solving a problem to help the students internalize it. Rehearsal writing is for revisiting material, reviewing, or putting concise definitions/procedures on paper. Writing for reorganization is more of a thinking tool. Students take note of theories, ideas, and questions they have relating to the text. They write their thought process out in hopes of making connections and building an understanding. Teacher candidates will use both of these techniques to help students, not only with writing skills, but also to understand the concepts.

The EPP understand it is logical to teach content-area teacher candidates that teaching literacy in their classes is their job and a responsibility. Requiring the teacher candidates to integrate literacy into their lessons in order to support content learning is reasonable. Teacher candidates are required to use integration, that is, to make parts into a complete whole by bringing together separate parts to describe what they are doing in science. Integration of science into a whole helps them retain more knowledge.