

Differentiated Instruction Teaching/Learning Examples



GRADE 10 SCIENCE, ACADEMIC (SNC2D) BIOLOGY: RESEARCHING DISEASES/ABNORMALITIES—SCIENCE

Three 75-minute periods

Note: This Teaching/Learning Example could be adapted for use in Grade 10 Science, Applied (SNC2P).

1. Centres**/Place Mat (Questions, Cues and Advance Organizers; Cooperative Learning)*
2. Facilitated Discussion/Classification (Identifying Similarities and Differences)*
3. Discussion/Think-Pair-Share (Cooperative Learning)*
4. Guided Viewing/Co-constructing Criteria for the Product
5. Pairs-Compare/Co-constructing Criteria for the Presentation
6. Diseases and Abnormalities RAFT (Role, Audience, Format, Topic)** Research Assignment
5. Self and Peer Assessment (Setting Objectives and Providing Feedback)*

*Marzano's Categories of Instructional Strategies (See Resources, below.)

**Differentiated Instruction Structure

DIFFERENTIATED INSTRUCTION DETAILS

Knowledge of Students

Differentiation based on student:

- Readiness Interests Preferences: Styles Intelligences Other (e.g., environment, gender, culture)



Need to Know

- Student interests in diseases and abnormalities, learning preferences and prior experience with presentation formats to design RAFT options

How to Find Out

- Observation prior to this lesson and during the Minds On Centres activity; discussions regarding interests and learning preferences

Differentiated Instruction Response

- Topic, Entry Point (content) Ways of learning (process) Ways of demonstrating learning (product) Learning environment

CURRICULUM CONNECTIONS

Big Idea: Plants and animals, including humans, are made of specialized cells, tissues, organs that are organized into systems.

Fundamental Concepts: Systems and Interactions, Structure and Function, Change and Continuity

Overall Expectation: A. Scientific Investigation Skills and Career Exploration

A1. Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning (IP), performing and recording (PR), analysing and interpreting (AI), and communicating (C))

Overall Expectations: B. Biology: Tissues, Organs, and Systems of Living Things

B2. Investigate cell division, cell specialization, organs, and systems in animals and plants, using research and inquiry skills, including various laboratory techniques

B3. Demonstrate an understanding of the hierarchical organization of cells, from tissues to organs to systems in plants and animals

Specific Expectations: (A1) Scientific Investigation Skills; (B2) Developing Skills of Investigation and Communication; (B3) Understanding the Basic Concepts

A1.7 Select, organize, and record relevant information on research topics from various sources, including electronic, print, and/or human sources, using recommended formats and an accepted form of academic documentation

A1.9 Analyse the information gathered from research sources for reliability and bias (AI)

A1.11 Communicate ideas, plans, procedures, results, and conclusions orally, in writing and/or electronic presentations, using appropriate language and a variety of formats (C)

B2.1 Use appropriate terminology related to cells, tissues, organs, and systems of living things, including, but not limited to: *absorption, anaphase, capillaries, concentration, differentiation, diffusion, meristematic, mesophyll, phloem, prophase, red blood cells, regeneration, stomate, and xylem* (C)

B2.7 Use a research process to investigate a disease or abnormality related to tissues, organs, or systems of humans or plants (IP, PR, C)

B3.3 Explain the links between specialized cells, tissues, organs and systems in plants and animals

Learning Goals:

- Use the research process to investigate a disease or abnormality
- Explain how a disease or abnormality connects to cells, tissues, organs, and systems
- Communicate their research findings using appropriate language in a selected format

ASSESSMENT AND EVALUATION

Assessment/Success Criteria

Knowledge and Understanding

- Explains how the disease/abnormality connects to cells, tissues, organs, and systems
- Uses scientific terminology

Thinking and Inquiry

- Analyzes sources for reliability and bias
- Selects information that is relevant to the research questions
- Documents sources in an acceptable form of academic documentation

Communication

- Communicates research findings

Assessment Tools:

- Checklist
- Rubric
- Anecdotal Comments
- Rating Scale

PRIOR LEARNING

Prior to this lesson, students will have:

- An understanding of the links between specialized cells, tissues, organs, and systems in plants and animals
- An understanding of the primary functions of a variety of systems in plants and animals
- An understanding of the interaction of different systems within an organism and why such interactions are necessary for the organism's survival
- Knowledge of how to locate resources (basic Internet research skills)

MATERIALS AND RESOURCES

Materials:

Six to eight centres with high-interest materials to motivate further investigation (e.g., photos of diseases/abnormalities, newspaper headlines, slide images of affected cells, quotes)

Chart paper

Access to a computer lab

Appendix A: Internet Resources (Teacher Reference)

Appendix B: Suggestions for Grade 10 Science, Applied (SNC2P) Biology (Teacher Reference)

Appendix C: Place Mat: Steps to Finding Out Information—one per centre (photocopy on ledger-size paper)

Appendix D: Research Process Checklist—one per student

Appendix E: Criteria for Evaluating Sources for Reliability and Bias—one per student

Appendix F: Diseases and Abnormalities RAFT Research Assignment Rubric—one per student

Appendix G: Diseases and Abnormalities RAFT Research Assignment—one per student

Appendix H: Research Note-taking Organizer—one per student

Appendix I: Diseases and Abnormalities RAFT Research Assignment: Self and Peer Assessment Rating Scale—one per student

Internet Resources:

See Internet Resources (Teacher Reference) (Appendix A)

Resources:

Marzano, Robert J., Pickering, Debra, and Pollock, Jane E. (2001). *Classroom Instruction that Works: Research-Based Strategies for Increasing Student Achievement*. Alexandria, VA: ASCD.

Ministry of Education (2008). *The Ontario Curriculum, Grades 9–10, Science*. (Scientific Investigation Skills, pp. 19–21)

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Teaching/Learning Sequence: Grade 10 Science, Academic (SNC2D) Biology: Researching Diseases/Abnormalities—Science

<p>MINDS ON</p> <ul style="list-style-type: none"> Establishing a positive learning environment Connecting to prior learning and/or experiences Setting the context for learning <p>Note: This Teaching/Learning Example may be adapted for use in Grade 10 Applied Science. See Suggestions for Grade 10 Science, Applied (SNC2P) Biology (Teacher Reference) (Appendix B).</p> <p>Groups of Four → Centres/Place Mat—Steps to Finding Out Information Set up six to eight (depending on the size of the class) centres around the room, each with a Place Mat—Steps to Finding Out Information (Appendix C) and one or more items related to a particular disease/abnormality of humans or plants (e.g., photo, newspaper headline, slide image of an affected cell, a quote from an expert or someone who has had the disease)—see Internet Resources (Teacher Reference) (Appendix A). Include items that are high interest and will motivate further investigation.</p> <p>Students:</p> <ul style="list-style-type: none"> Select a centre of interest and go to that area; form groups of no more than four students per centre Examine the item(s), clarify their understanding of the item(s) as a small group and prepare a short statement of explanation for a speaker from their group to share with the class Individually, respond to the question: “If you had to provide some basic information on this disease/abnormality for a local radio or TV station, what steps would you take to find accurate information about this disease/abnormality so that you could present it clearly and concisely to the listening/viewing public?” Write their steps in point form in their individual section of the Place Mat: Steps to Finding Out Information (Appendix C) Share their response with their small group As a group, agree upon and list at least three steps they could take and note these steps in the centre of the Place Mat <p>Whole Class/Centre Groups → Facilitated Discussion/Classification (Scientific Research Skills) Indicate that taking steps to find out more information on a topic is research and that the steps in the research process are skill-based. Students will apply Scientific Investigation Skills in four broad areas: initiating and planning [IP], performing and recording [PR], analyzing and interpreting [AI], and communicating [C]. Use these four broad areas of skills as headings for four pieces of chart paper/columns drawn on the board.</p> <p>Have a few centre groups share some of their agreed-upon steps (from the Place Mat, Appendix C) and indicate the skill areas into which the steps fit. Record these steps on the chart paper/board in the appropriate columns. Provide feedback and clarify as needed. Distribute the Research Process Checklist (Appendix D) and have centre groups classify their steps in the appropriate skill areas.</p> <p>Facilitate a class discussion as groups share; note and explain the skill areas that received the most and least attention, ensuring that students understand the importance of all steps.</p> <p>Whole Class/Pairs → Discussion/Think-Pair-Share Initiate a discussion on the importance of accurate information related to health and the possible consequences of inaccurate or incomplete information (e.g., health-related websites developed by companies that profit from selling products to poorly informed customers).</p> <p>Students:</p> <ul style="list-style-type: none"> Individually, list factors to consider when assessing the reliability of resources and information sources Share with a partner and refine their list Share, as a pair, with the class to create a list of criteria for evaluating the reliability of an information source (e.g., the author, the sponsor, the date) <p>Refine Criteria for Evaluating Sources for Reliability and Bias (Appendix E), based on student input and distribute to students. Work with the class to apply the criteria to a pre-selected, health-related website or brochure to determine the reliability of its information. Review and provide an example of how to document sources. (See information in the <i>Think Literacy Subject-Specific</i> documents in Appendix A.)</p>	<p>CONNECTIONS</p> <p>L: Literacy ML: Mathematical Literacy AfL, AoL: Assessment for/of Learning SIS: Scientific Investigation Skills</p> <p>SIS: Initiating and Planning</p> <p>AfL: Observation/Anecdotal Comments AfL: Scientific Research Skills/Checklist</p> <p>SIS: Analyzing and Interpreting</p> <p>L: Critical literacy/evaluating information sources</p>
<p>ACTION</p> <ul style="list-style-type: none"> Introducing new learning or extending/reinforcing prior learning Providing opportunities for practice and application of learning (guided → independent) <p>Pairs/Whole Class → Guided Viewing/Co-constructing Criteria for the Product Set the context for learning by explaining that the students will be responsible for selecting a disease/abnormality to research and for presenting the results of their research in the format of their choice. Review the learning goals for the lesson. Indicate that students will view a video that serves as an example of a product resulting from someone else’s research (see diabetes video listed in Appendix A) so that they can determine the criteria for:</p> <ul style="list-style-type: none"> Product content <ul style="list-style-type: none"> The types/categories of information required for a concise, informative and accurate product on a disease/abnormality The relating of information to cells, tissues, organs, and/or systems AND Effective presentation of content <p>To determine and clarify criteria for product content, students:</p> <ul style="list-style-type: none"> Before viewing, in pairs, generate questions that they predict will be answered during the video During viewing, individually, note questions that were answered/unanswered and any additional information After viewing, in pairs, share observations and questions that were answered/unanswered and any additional information <p>Pairs share their observations with the class. Facilitate a discussion on how the information in the video connects the disease to specialized cells, tissues, and organs that are organized into systems. Indicate that these connections are important for them to make in their product (e.g., symptoms described in terms of their connections to cells and tissues versus only a list of symptoms). As a class, consolidate a list of questions that must be addressed in the RAFT assignment, Diseases and Abnormalities RAFT Research Assignment (Appendix G) such as:</p> <ul style="list-style-type: none"> What is the disease or abnormality and how does it affect cells, tissues, organs, and/or systems? What are its causes and symptoms? <p>Indicate that students will be able to ask a third research question of their choice.</p> <p>Groups of Four/Pairs Compare → Co-constructing Criteria for the Presentation To determine and clarify criteria for effective presentation/communication of content, students:</p> <ul style="list-style-type: none"> Form pairs to respond to the following questions: <ul style="list-style-type: none"> Is the information in the video clear? How was this achieved? Or, how could this have been achieved? What made (or could make) the information organized and easy to follow? Who is the target audience? How does the video appeal to the target audience? Join with another pair to compare their answers, then share with the class <p>As a class, clarify the criteria for effective presentation/communication of content. Refine the criteria in the Diseases and Abnormalities RAFT Research Assignment Rubric (Appendix F) to reflect student input and distribute.</p> <p>Whole Class/Individuals → Diseases and Abnormalities RAFT Research Assignment Distribute and review the Diseases and Abnormalities RAFT Research Assignment (Appendix G). Modify, if necessary, the RAFT Format options based on the prior experiences of the class. Support students as required as they make their RAFT choices and throughout the research process. Some suggestions for students to consider in drafting their own questions are: How does the disease affect/attack the cells, tissues and organs of the sick person or plant? Or, how does the medical treatment affect the cells, tissues and organs of the sick person or plant?</p> <p>Provide students with an organizer for their note-taking—see Research Note-taking Organizer (Appendix H). Encourage student self-assessment throughout the process using the Diseases and Abnormalities RAFT Research Assignment: Self and Peer Assessment Rating Scale (Appendix I).</p>	<p>L: Viewing for content/ Guided Viewing</p> <p>L: Analyzing effective communication/Co-constructing criteria</p> <p>SIS: Initiating and Planning, Performing and Recording, Analyzing and Interpreting and Communicating</p> <p>AfL: RAFT Research/Anecdotal Comments</p> <p>L: Selecting information/Note-taking AfL: Self-Assessment/RAFT Research/Rating Scale</p>
<p>CONSOLIDATION AND CONNECTION</p> <ul style="list-style-type: none"> Helping students demonstrate what they have learned Providing opportunities for consolidation and reflection <p>Pairs → Peer Assessment Students:</p> <ul style="list-style-type: none"> In pairs, examine each other’s RAFT product using the RAFT Research Assignment: Self and Peer Assessment (Appendix I); discuss and refine their RAFT product as appropriate Hand in final RAFT product for teacher evaluation. See RAFT Research Assignment Rubric (Appendix F) Consider how the products could be shared with the class or another audience 	<p>AfL: Peer-Assessment/Rating Scale</p> <p>AoL: RAFT Research/Rubric</p>