ECURE Assessment Design

Assessment mechanism

The assessment can be formative or summative. There are four major domains of assessments: (1) cognitive (2) psychomotor (3) affective (4) metacognitive

1. *Considering Learning Outcomes*
   - The assessments should be planned in accordance with learning outcomes.
     - For example, for the SLO: "carry out a literature search for the lab question", the assessment could be
     - Cognitive: a review of the literature. A rubric can be used to inform students the scope and standard of the review.
     - Metacognitive: "Describe how you conducted the literature search?"
     - Psychomotor: A demonstration of how vacuum filtration is done in the literature
   - ECURE Principles and Assessment Alignment
     - Each assessment type should reinforce ECURE activities such as research proposal, data analysis, or reflection

   Examples of Adaptation Matrix for ECURE Assessments

Activity Type	**pre ECURE (1-2 weeks)**	**Full ECURE**
Research Proposal	Brief outline with 2 sources	Detailed proposal with annotated bibliography
Data Analysis	Simple dataset interpretation	Comprehensive analysis with visualization
Reflection	One-page reflection	Weekly reflective journal

2. *Use Pre- and Post-tests for learning gains*
   - By asking students to take a test before (pre-test) and after (post-test) a learning period, the learning gain can be computed.
   - For example, Chemistry Concept Inventory tests were developed and validated before being used as pre- and post-tests.
   - Many STEM fields have similar concept inventory tests available in the literature. However, for a specific topic, task, or skills, developing an assessment for pre- and post-test might be the best way to customize your assessment for ECURE. Please refer to the following literature.

3. *Progress assessments during the semester*
   - To monitor the progress of students' learning, a progress check is handy for a quick evaluation. However, this check might not be necessary for a short ECURE activity.

- An example of the progress check is the "skill check" in the ECURE Chemistry lab. Students acquire various lab skills throughout a semester through ECURE activities. In the middle of a semester, students are asked to demonstrate a skill in front of the instructor. A grade is given based on the skill check rubric.

4. *Mastering assessments for different learning domains*

A. Conceptual Domain

Focuses on **knowledge and understanding:** students grasp theories, principles, and relationships.

Examples:

- **Sciences:**
  Physics: Explain Newton's laws and predict motion in a given scenario.
  Biology: Describe the process of photosynthesis and its role in ecosystems.
- **Engineering:**
  Civil Engineering: Understand load distribution in bridge design.
  Electrical Engineering: Explain Ohm's law and circuit behavior.
- **Arts:**
  Music Theory: Identify chord progressions and their emotional impact.
  Visual Arts: Analyze color theory and composition principles.
- **Social Sciences:**
  Psychology: Explain cognitive biases and their effects on decision-making.
  Political Science: Discuss theories of democratization and state stability.

B. Psychomotor Domain

Emphasizes **physical skills and execution**: students demonstrate techniques or perform tasks.

Examples:

1. **Sciences:**
   Chemistry: Perform titration accurately in a lab setting.
   Geology: Use field tools to collect and classify rock samples.
2. **Engineering:**
   Mechanical Engineering: Assemble a gear system following specifications.
   Computer Engineering: Solder components on a circuit board.
3. **Arts:**
   Dance: Execute a choreographed routine with precision.
   Painting: Apply brush techniques to create texture and depth.
4. **Social Sciences:**
   Anthropology: Conduct structured interviews in a field study.
   Geography: Operate GIS software to map spatial data.

C. Affective Domain

Targets **attitudes, values, and emotional engagement**: students reflect on beliefs and develop dispositions.

Examples:

- **Sciences:**
  Environmental Science: Reflect on personal responsibility in sustainability practices.
  Physics: Express confidence in problem-solving after completing experiments.
- **Engineering:**
  Software Engineering: Value collaborative coding and ethical considerations in AI.
  Civil Engineering: Appreciate the societal impact of infrastructure projects.
- **Arts:**
  Theatre: Discuss emotional connection to a character portrayed on stage.
  Music: Reflect on how performing a piece influenced personal expression.
- **Social Sciences:**
  Sociology: Evaluate personal biases when analyzing social inequality.
  Economics: Reflect on the ethical implications of policy recommendations.

D. Metacognitive Domain

Focuses on **thinking about thinking and learning:** students plan, monitor, and evaluate their learning strategies.

Examples:

- **Sciences:**
  Planning: Outline steps for a lab experiment before starting.
  Monitoring: Check if data collection aligns with hypothesis.
  Evaluating: Reflect on what worked and what didn't after an experiment.
- **Engineering:**
  Planning: Create a design workflow for a prototype.
  Monitoring: Assess progress during coding or assembly.
  Evaluating: Analyze why a design failed and propose improvements.
- **Arts:**
  Planning: Decide on composition techniques before painting.
  Monitoring: Adjust brush strokes based on visual feedback.
  Evaluating: Reflect on creative choices after completing artwork.
- **Social Sciences:**
  Planning: Develop interview questions for a field study.
  Monitoring: Review notes during data collection for completeness.
  Evaluating: Critique research approach after writing a report.

5. *Develop assessment tools*

a. define the purpose of the assessments
b. generate topic list
c. describe learning objectives or outcomes
d. determine the format of the assessment (written, practical, interview, etc)

e. write questions or content
f. examine validities (content, construct, etc)
g. pilot test
h. refine the assessment

Feedback Strategies

- Use rubrics for transparency and consistency of grading.
  - Choose the rubric type (analytic, Holistic, single-point, etc)

    Rubrics are scoring tools that outline criteria and performance levels for an assignment or task. They help ensure **consistency**, **transparency**, and **fairness** in assessment. There are several common types:

    - **Analytic Rubric**
      - Breaks down performance into multiple criteria, each scored separately.
      - **Best for:** Detailed feedback and identifying strengths/weaknesses.
      - *Example:* A lab report rubric with separate scores for hypothesis, data analysis, and conclusion.
    - **Holistic Rubric**
      - Provides a single overall score based on an impression of the entire work.
      - **Best for:** Quick grading when overall quality matters more than individual components.
      - *Example:* Evaluating an art portfolio for overall creativity and impact.
    - **Single-Point Rubric**
      - Lists criteria with one level of expected performance, leaving space for comments on strengths and areas for improvement.
      - **Best for:** Formative feedback and encouraging growth.
      - *Example:* Research proposal rubric stating "clear research question" as the standard, with space for notes.
    - **Checklist Rubric**
      - Uses yes/no or completed/not completed indicators for essential elements.
      - **Best for:** Tasks requiring compliance with specific steps or components.
      - *Example:* Engineering design checklist ensuring all safety standards are met.

  - define levels and criteria
  - write descriptions
  - pilot and revise
- Incorporate peer review sessions for formative feedback.
- Provide timely instructor comments to support metacognition.

Metacognitive tools

a. Three Types of Metacognitive Skills: Planning, Monitoring, and Evaluating

- **Planning:** Students set goals, identify resources, and outline steps before starting a task.
  Example: Before conducting a lab experiment, students write down the procedure and predict possible challenges.
- **Monitoring:** Students check their progress during the task, asking themselves if they are on track.
  Example: While writing a research paper, students pause to verify if their argument aligns with the thesis.
- **Evaluating:** Students reflect on the outcome and process after completing the task.
  Example: After a group project, students assess what strategies worked and what could be improved.

b. Using Questions to Prompt Students

- Ask reflective questions that encourage self-awareness:
  Examples:
  - "What is your plan for approaching this problem?"
  - "How do you know your solution is correct?"
  - "What would you do differently next time?"

c. Reflective Discussions with Peers

- Facilitate peer-to-peer dialogue about strategies and challenges.
  Example: In a seminar, students share how they approached data analysis and what adjustments they made when encountering difficulties.

d. Embed Metacognition in the Rubric

- Include criteria that assess reflection and strategy use.
  Example: A rubric for a research proposal might have a category: "Explains reasoning behind chosen methodology."

e. Give Metacognitive Feedback

- Provide comments that focus on thinking processes, not just the final product.
  Example: "Your approach to organizing sources was effective; how might you apply this strategy to future projects?"

Technology Integration

- Learning Management Systems (Canvas, Moodle) for quizzes and rubrics.
- Google Forms for quick surveys.
- Turnitin for originality checks.
- Padlet or Miro for collaborative activities.

Validation and Reliability Guidance

- Ensure inter-rater reliability by calibrating rubric scoring among instructors.
- Use pilot testing to confirm the clarity and fairness of assessments.

Examples of Assessment Tools:

Example A.

Grading Rubric for Progress Report 1

Each Progress Report 1 will be graded using the rubric below, with fraction-point grades allowed. I strongly encourage you to use explanatory phrases and words. The grade per each submitted progress report will be calculated as the average of the scores assigned per each category.

Example B.

Quiz Directions: Respond to each question with 150-200 words. For each answer, the goal is not to make the word count (although you should do so), but to show off what you have learned from readings and lecture. Be specific and reference sources from class material. Answers that do not, will receive mediocre grades even if all the material is accurate and relevant. Also, referencing lectures and readings but drawing inaccurate conclusions will also lead to mediocre grades. Here are some examples of how to reference lectures and readings:

Egerov and Sonin's (2011) writings on the dictatorial dilemma detail several dictator's tools for staying in power, such as….

Increases in income and the standard of living can help a dictatorship maintain positive public opinion, something the article by Qin and Hernandez (2018) illustrates with the case of China.

According to our discussion in the class (DATE), one reason dictators persist is...

We learned in class (DATE) that Chinese leaders maintain political alliances with elites by …

Quiz Prompt: You have been assigned a partner for a research project in class. Your goal is to develop a research proposal that:

Proposes a research question explaining variation in an outcome.

Informs the reader how this question builds on previous research.

Posits a plausible causal hypothesis (why/how one factor causes an outcome)

Describes the research methodology: including which cases you would choose and what evidence in your cases you will look for to confirm or disconfirm your hypothesis.

Uses a research approach that draws on strong causal logic and is a good test of your hypothesis.

Describes the possible importance of your findings if you find evidence to support your hypothesis.

Your partner has sent you a very preliminary draft of your proposal. Read through the proposal and then answer the questions in the quiz.

Research Proposal: We want to study why dictators fall. Our main hypothesis is that people revolt against dictators when living conditions get really bad. This is like Hobbes, who said that it's ok to revolt against Leviathan if you don't have enough to eat. We plan to use cases of Chile, China and the Philippines. We will look at how GDP per capita changes in the years before a revolt. If our hypothesis is correct, then we should see that GDP per capita is lowest before a large protest movement. The implications of this finding would be that political culture matters.

Help your partner build a literature review. From lectures AND readings in our class (no external research necessary), what we know about the theories of why dictatorships fail and why they persist.

It appears your partner randomly chose these three cases, but you happen to know a little about them. Drawing on readings and lectures, what can we learn (if anything) about why dictators fall in each case?

What do you think about the theory? Does it make sense given what we know?

In thinking of the causal logic (when "living conditions get really bad" then people revolt), is the research design (exploring the relationship between GDP per capita and large protest movements in the three cases) a good one? Why/why not?

It's now your turn. Show your partner how to clearly communicate and logically develop a proposal. Revise the proposal so that it is twice the length (~200 words) and includes your suggestions and ideas. You can change any of the material you partner suggested – don't feel pinned in.

Example C:

GEOG 1115: ECURE Research Literacy Assessment

Purpose

This assessment is designed to determine how the course material influences your research literacy. This assessment includes two important assessments covering aspects of research literacy:

1. Project design: Assesses students' comprehension of the practice of research in their discipline.

2. Analytical ability and communication skills – Assesses students' ability to extract and communicate the core of a research argument that they are presented with and critique such data.

Problem Description

Imagine you are working on a research project and you are writing instructions that your classmate will carry out. The purpose of the research is to map the distribution of trees in your Tree Study Area and determine the quantity and types of change that has occurred from 2000 to 2020. More specifically, the project investigates whether there has been a change in the number

and diversity of trees in your Tree Study Area associated with changes in commercial and residential development during this time period.

Discussion Prompt (300-350 words)

Explain how you would investigate this question. Be as specific as you can be about what types of geographic data and the sequence of steps you would take to answer the question above. Provide detail (how, when, where, what, and who) such that your classmate could follow your instructions.

Important considerations

1. What geographic data types would be important to include?

2. What geographic methods that you learned about in this class can be applied?

3. How would you analyze the results of your selected methods?

4. How would you visualize and display your results?

Peer Response (100-150 words)

Select a classmates' post to evaluate. Use the attached rubric to assess the strength of the proposed methodology. Provide supportive, constructive feedback (based on the rubric) to make suggestions/revisions to the post.

Example D:

Quick-Start Checklist for ECURE Assessments

1. Identify ECURE objectives (inquiry, research literacy, metacognition).
2. Align assessments with Student Learning Outcomes (SLOs).
3. Select assessment types (proposal, analysis, reflection).
4. Adapt for course length using the adaptation matrix.
5. Integrate feedback loops (peer review, instructor comments).
6. Use technology tools for scalability and engagement.
7. Validate reliability and validity of assessments.