Your Own Anatomical STEM Laboratory

Utilize characteristics of the human body to explore, define, and expand principles of bioengineering and related STEM concepts with the goal of applying lessons learned to non-anatomy subject areas.

**Key Method**

Demonstration of rules governing muscle behavior through the use of physical modeling and the essential method Present, Express, Reflect.

**Method Components**

Instructor designs an investigation governed by the essential method Present, Express, Reflect. Then, the instructor elicits students’ lessons learned through discussion and applies these conclusions to future investigations and lesson differentiation outside of STEM disciplines.

**Investigation elements:**

1. Presenter describes the specific rules of muscle behavior (e.g., muscles can only contract) as participants build individual muscles with clay and apply them to a plastic model of an anatomical structure (e.g., the hand). Examples of student tasks and concepts include:
   a. Determine how muscles control functions of the hand (i.e., how flexion and extension are accomplished).
   b. Construct individual muscles and tendons of the hand with clay and attach them at appropriate points on a scale-model skeleton, where each can perform one basic task: contraction. Explore how muscle fibers act individually or in groups to enable different degrees of movement, direction, and strength.
   c. For bones to move, each muscle must cross at least one joint so that when the muscle contracts, one bone is pulled toward or away from another.
   d. Since muscles can only contract, each muscle must have a corresponding muscle to reverse—or antagonize—this movement by contracting in the opposite direction.
2. Lessons are applied with discussion encouraged, which requires students to share their solutions, including lessons from non-anatomy subject areas.
3. Concepts presented are from the key STEM elements—science, technology, engineering, and math—with the broadest being problem-based learning and the essential method Present, Express, Reflect.

**Supporting Research**


- Waters, J. R., Van Meter, P., Perrotti, W., Drogo, S., & Cyr, R. J. (2011). Human clay models versus cat...
dissection: How the similarity between the classroom and the exam affects student performance. Advances in Physiology Education 35(2), 227–236.


Resources


Submission Guidelines & Evaluation Criteria

Following are the items you must submit to earn the micro-credential and the criteria by which they will be evaluated. To earn the micro-credential, you must receive a passing evaluation for Parts 1, 3, and 4 and a “Yes” for Part 2.

Part 1. Overview questions
(200-word limit for each response)

- Please describe the project/activity that you designed, including the following elements:
  - How did you identify simple rules that govern muscle activity?
    - Passing: Activity description includes a description of what anatomical rules were applied during the lesson.
  - How did you demonstrate these rules using the selected anatomical structure?
    - Passing: Activity description includes a description of how these rules were applied to the anatomical structure selected by the instructor.
  - How did you extend the concept of your established simple rules through the use of the

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essential method?
- **Passing**: Extension of the established rule set and implementation of the essential method (present, express, reflect) are apparent and unambiguous.

**Part 2. Student work**

Present two pieces of evidence (video, photos, or other products) that illustrate how student work contributed to the development of your STEM anatomical laboratory, including discussion and implementation of the essential method. Please accompany each piece of evidence with a short description or video annotation if appropriate.

<table>
<thead>
<tr>
<th><strong>Addressed lesson objective</strong></th>
<th><strong>“Yes”</strong></th>
<th><strong>Almost”</strong></th>
<th><strong>“Not Yet”</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student work demonstrates one or more specific applications, including an application outside of anatomy</td>
<td>Student work shows a loose connection with the lesson objective and/or all applications identified by students are only related to STEM domains</td>
<td>Student work did not clearly show how the activity was tied to the lesson objective</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Evidence of student discussion</strong></th>
<th><strong>“Yes”</strong></th>
<th><strong>Almost”</strong></th>
<th><strong>“Not Yet”</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student discussion is made evident by the submitted artifacts, and students make clear connections to application or concepts outside of STEM disciplines</td>
<td>There is some evidence that student discussion took place, but the details are not organized in a discernable way</td>
<td>There is little or no evidence that students engaged in open discussion</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Incorporation of the STEM essential method</strong></th>
<th><strong>“Yes”</strong></th>
<th><strong>Almost”</strong></th>
<th><strong>“Not Yet”</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Artifacts clearly show implementation of the essential method (presentation, expression, and reflection)</td>
<td>There is some evidence that the activity was tied to the essential method, but one or more of the method components is missing or ambiguous</td>
<td>There is no apparent link between the activity and the components of the essential method</td>
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**Part 3. Teacher reflection**

Please provide a reflection on your activity, using the following questions as guidance (200-word limit for each response):

- **What other applications of muscle behavior may apply to your instructional subject area?**
  - **Passing**: Teacher clearly and unambiguously identifies how additional anatomical investigations may be applied to his or her subject in future instruction.

- **How might you modify or differentiate an activity like this for future instruction?**
  - **Passing**: Reflections clearly state how the activity will affect the teacher’s future practice, and the reflections are specific and convincing.

- **What challenges did you face while incorporating the elements of the essential STEM method (present, express, reflect) into your lesson?**
  - **Passing**: Teacher clearly and unambiguously identifies challenges he or she faced in implementing the essential STEM method. Teacher also describes how the activity was modified or might be modified in future instruction.