Student Engagement and Motivation in STEM Education

Educator investigates factors of student motivation and teaching practices related to tasks and instructional design, teacher-student interaction, and feedback and formative assessment that have the potential to increase student engagement.

This micro-credential is currently available only to educators in the Milwaukee Public School pilot.

**Key Method**

The educator studies factors related to student motivation and increasing student engagement through the use of tasks and instructional design, teacher-student interaction, and feedback and formative assessment. The educator integrates teaching practices in an instructional episode designed to improve student engagement, measures student engagement, and analyzes student performance outcomes as a result of implementing the teaching practice.

**Method Components**

This micro-credential will be most effective if you can engage in some of the tasks with colleagues in your professional learning community or through online interactions with more distant colleagues.

**Part 1: What motivates you?**

Think about a time in which you have been highly motivated to complete a task. (This doesn't have to be a professional endeavor; it can be personal.) Describe the task. What aspects of doing this work helped you stay motivated? What challenged your motivation and your ability to take the task to completion?

Now think about a time that you have been particularly unmotivated to complete a task. Describe this task. What aspects of doing this work made it challenging to stay motivated? Why did you complete the task despite those motivational challenges?

Discuss these two stories with colleagues, and keep some notes about your story and the story of others. You will use them as a part of your final products for the badge.

**Part 2: Teaching practices that support student engagement**

Read the following articles related to motivation and engagement:

For mathematics:
- From Brahier (2011): Chapter 2, A Model for Mathematics Instruction to Enhance Student Motivation and Engagement; Chapter 6, Mathematical Dream Makers: How Two Different Math Departments Brought About Equity and High Achievement
- From Middleton & Jansen (2011): Chapter 9, Providing Challenge: Starting Where Students Are, Not Where They Are Not; Chapter 12, Building Relationships: Characteristics of Knowledge-Building Classroom Communities

For science:
- Kirk (2017) Chapter 7, Participation in Scientific Practices and Discourse; Chapter 12, Building Relationships: Characteristics of Knowledge-Building Classroom Communities
- Tanner (2013) Structure Matters: Twenty-One Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity
- Bennett (2017) Construction with Scaffolds

As you read these articles (or any of the other supporting articles listed in resources), consider the following. What strategies does research suggest are effective in supporting student engagement that promotes motivation in the following areas:

- **Task/instructional design**
  - How our choices about tasks to use with students and how they are implemented influence engagement
- **Teacher-student interaction**
  - How the classroom culture, our discourse practices, questioning, positioning students, and increasing student voice influence engagement
- **Feedback and formative assessment**
  - How supporting students in struggling productively, the nature and timing of feedback, and our philosophies and practices of assessment influence engagement

Keep notes on what you take away from the readings in each of these categories. You will make use of your notes as a part of the final products for the badge and as a part of the design for your action research. Watch the narrated slide show with a brief synthesis of instructional strategies that support engagement after you have completed this step.

**Part 3: Design and implement an action research project using high-engagement practices**

Based on your analysis of the teaching practices that support student engagement in Part 2, design a lesson or series of lessons that focus on improving engagement in your classroom.

Choose one of the three areas to focus on for data collection. Your lesson can and should attend to aspects of all three, but your data collection will focus on one.
Task/Instructional design
How our choices about tasks to use with students and how they are implemented influence engagement

Teacher-student interaction
How the classroom culture, our discourse practices, questioning, positioning students, and increasing student voice influence engagement

Feedback and formative assessment
How supporting students in struggling productively, the nature and timing of feedback, and our philosophies and practices of assessment influence engagement

Design a way to collect data about student engagement that connects directly to the instructional practices you intend to use. You might consider the following questions as you do so:

- How do I know whether or not students are engaged?
- For the strategies I am focusing on, what student actions would suggest to me that my strategy is working or not working?
- What data can I collect that provides both a teacher view of student engagement and a student view (such as a survey or questionnaire directly to students about their motivation)?
- To what extent did student engagement translate to motivation?

Part 4: Analyze the data and report results
Teach the lesson or lessons and collect your research data regarding engagement. Create a poster presentation and/or a written report. Your research report should include how the designed lesson was intended to increase student engagement related to the strategies you read about in Part 2, the data you collected, your methods used to analyze those data, and an analysis of the results. The research report should include both teacher and student reflections on engagement and motivation, including ideas for future changes to teaching practice.

Supporting Research


Resources

- Task Selection
- Teacher-Student Interaction
- Formative Assessment


- Motivation (General)


- Motivation and Engagement (Math)


- Productive Struggle


- Motivation to Learn Science


- Motivating Students to Learn Science: A Physicist's Perspective. http://digitalrepository.trincoll.edu/cgi/viewcontent.cgi?article=1153&context=facpub


- Student Engagement


- Structure Matters: Twenty-One Teaching Strategies to Promote Student engagement and Cultivate Classroom Equity. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3762997/


- Instructional Task Design

- Scaffold

Submission Guidelines & Evaluation Criteria

To earn the micro-credential, you must receive a “passing” for Parts 1 and 3 and a “Yes” evaluation for Part 2.

Part 1. Overview Questions
Synthesize the key ideas that you took away from the readings about the nature of motivation and how instructional practices can influence student engagement. In your narrative, use the examples of motivating and non-motivating tasks from Part 1 (or you may use a story told by a colleague if you don’t like your own example) to illustrate important features of engagement and motivation. Connect the motivating and non-motivating tasks you describe to at least one thing you do or will do in your classroom to change engagement. Your narrative should be three to five pages long and include citations of works read.

- **Passing:** Narrative draws on at least two key ideas from the research-based readings and makes meaningful connections to classroom practice.

Part 2. Work Examples / Artifacts
- Attach your lesson plan with specific indications of the instructional strategies you intend to use to support student engagement. Include which of the three areas will be your focus for the lesson. Include a table with your data collection and analysis strategies:
  - What data you will collect
  - How the data represents student engagement
  - How the data will be analyzed (descriptive statistics, inferential statistics, qualitative analysis, etc.).

- Create a research report (poster and/or written report) that describes the aspects of student engagement you focused on, the data you collected and the analysis of those data, and your reflections on the effectiveness of the work. This report should either be in large-format poster form or a written report of five to eight pages (APA format please).

<table>
<thead>
<tr>
<th>“Yes”</th>
<th>“Almost”</th>
<th>“Not Yet”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson plan includes specific instructional strategies from the readings designed to increase student engagement.</td>
<td>Lesson plan includes instructional strategies but it is not clear how those strategies support student engagement.</td>
<td>Lesson plan does not include instructional strategies that support student engagement, or the task is not a high-quality task that would support student engagement.</td>
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<tr>
<td>Assessment measures select one of the focus areas and include data from the teacher perspective and the student perspective.</td>
<td>Assessment measures select one of the focus areas and include data from the teacher perspective and the student perspective.</td>
<td>Assessment does not measure aspects of student engagement from both teacher and student perspectives.</td>
</tr>
<tr>
<td>Student learning data includes multiple artifacts, including at least one that represents students’ voices and reflections.</td>
<td>Student learning data includes multiple artifacts, including at least one that represents students’ voices and reflections.</td>
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<td>Analysis of student learning data and teacher reflection gives clear implications for future teaching and learning.</td>
<td>Analysis of student learning data and teacher reflection gives vague or unclear implications for future teaching and learning</td>
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Part 3. Reflection
Using both teacher and student voices, include a reflection on how your efforts to improve student engagement did (or did not) increase student motivation in the target lesson. Ensure that the section making use of student voice includes data collected from students about their engagement (which could be aggregated survey results, narrative written by students about their experience, or, ideally, both).

- **Passing:** Reflection includes teacher and student voices, with at least one data source and multiple student perspectives. Reflection connects meaningfully to elements of the lesson and the intended engagement strategies.

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