Overview

The Next Generation Science Standards (NGSS Lead States, 2013) recast science proficiency as not only what students know, but also how they can use and apply what they know. Teachers will need high-quality curriculum materials to help them create instructional experiences that will engage students in this new form of learning. At this time, few curriculum materials have been designed expressly for meeting the NGSS, and thus there is limited evidence-based research on the efficacy of NGSS-designed curricula. This project is an effort to design and conduct a large scale study of the impact of the Amplify Middle School (ASMS) curriculum on teaching and learning. Designed by the Lawrence Hall of Science in collaboration with Amplify Education Inc., ASMS is the first comprehensive curriculum program that has been designed from the ground up specifically to meet the vision of the Framework and address the performance expectations of the NGSS. Findings from this study will inform the science education community about how curriculum materials can support NGSS instruction.

Design Features of ASMS

The ASMS curriculum materials aim to provide students in grades 6-8 with opportunities to engage with core ideas and crosscutting concepts in the context of science and engineering practices over time to strengthen their science proficiency. The curriculum package includes a digital platform for students and teachers along with physical materials for hands-on activities. Designed to enable students to:

- Tackle real-world problems
- Engage with anchor phenomena through multiple modalities
- Interact within a digital workspace with access to custom-written science articles, science simulations, and design tools

Provides teachers with:

- Coherent instructional sequence that builds proficiency with performance expectations over time
- Explicit support for literacy development
- Support for formative assessment and differentiation
- Online monitoring and reporting tools

Research Questions

Implementation: To what extent is the ASMS curriculum implemented with purpose? What is the impact of the ASMS curriculum materials vary by student background characteristics?

Student Outcomes: What is the impact of the ASMS curriculum on learning outcomes in culturally and linguistically diverse school settings? How does the implementation of ASMS curriculum support teachers in designing and implementing NGSS instruction? What is the impact on teachers’ enactment of instructional practices and classroom activities?

The Main Study: A Randomized Controlled Trial

Forty-eight schools will be randomly assigned to either implement ASMS materials (treatment condition) or their “business as usual” materials (control condition) in their 7th grade science classrooms.

- All seventh-grade science teachers in each school are expected to participate in the study
- Teachers in both conditions will follow their district science scope and sequence
- Treatment teachers receive the full year curriculum package + professional development that is commercially available to any district
- Control teachers receive the intervention following the school year (delayed treatment design)
- Mixed methods approach to capture instructional practices in treatment and control classrooms, examine implementation, and evaluate the impact of the ASMS curriculum

Benefits to Participating Districts and Teachers

Our approach is to frame benefits in terms of the practical support that we can provide to districts’ science programs through this participation. This support includes:

- Full year of 7th grade ASMS curriculum materials with accompanying professional development at no cost
- Teacher Performance Assessments aligned to performance expectations within MS-PS1, MS-LS1, MS-LS2
- Task scenarios for science and science life and science
- Task scenarios contain multiple assessment options for prompt for integrated responses
- Target science practices include: developing and using models, constructing explanations, analyzing and interpreting data
- Target crosscutting concepts include: matter and energy, cause and effect, and patterns
- Scoring rubrics based on evidence statements that integrate multiple dimensions

Online instructional logs are a reliable cost-effective way of gathering data on curriculum enactment and instruction across a large number of classrooms and at specific times during implementation (Rowan & Correnti, 2009).

- Teachers self-report on their use of curriculum materials in both conditions
- Enactment questions focus on lessons and activities enacted each week, modifications made and why, and successes and challenges encountered
- Instruction questions focus on frequency and depth of engaging students with the NGSS dimensions, instructional strategies employed, and instructional successes and challenges encountered
- Target of 16 weekly logs per teacher aggregated to describe implementation over time

4. Developing Measures that Align to the NGSS

We are focusing on middle school physical science and life science performance expectations that match our candidate states’ standards. ASMS units provide an opportunity to build NGSS proficiencies for 7th grade and that ASMS units provide an opportunity for students to achieve.

3-Dimensional Assessments

We are using a design process (Harris et al., 2016) that follows the principles of evidence-centered design (Mislevy & Haertel, 2006) to create summative assessment tasks and scoring rubrics. Our two assessments (physical science and life science) are intended to elicit three-dimensional performance.

- Assessments aligned to performance expectations within MS-PS1, MS-LS1, MS-LS2
- Task scenarios for each for physical science and life science
- Task scenarios contain multiple assessment options for prompt for integrated responses
- Target science practices include: developing and using models, constructing explanations, analyzing and interpreting data
- Target crosscutting concepts include: matter and energy, cause and effect, and patterns
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3-Phase Research Design

1. Overview of Multi-Year Project

We will design and conduct a randomized controlled trial of ASMS in a sample of 7th-grade classrooms comparing ASMS classrooms with those using existing curriculum materials. The study will employ measures of implementation, teaching practice, and student learning outcomes; schools will be randomly assigned to either a treatment or control condition.

2. Developing Measures that Align to the NGSS

We are developing a protocol, informed by recent NGSS-focused research and reports (e.g., Loper et al., 2017, NRC, 2015), which will enable us to characterize instructional practices as they relate to curricular uptake and supporting students in building NGSS proficiencies.

- Document teaching moves and the instructional and discourse patterns between teachers and students
- Describe curricular uptake including teachers’ use of resources and educational features and students’ use of digital platform and hands-on materials
- Characterize integrity to program principles, exposure, and participant responsiveness to lessons and activities
- Capture three-dimensional instructional events
- Identify patterns that indicate the “footprint” of ASMS and differentiate it from other curricula

3. Classroom Observations

We are developing a protocol, informed by recent NGSS-focused research and reports (e.g., Loper et al., 2017, NRC, 2015), which will enable us to characterize instructional practices as they relate to curricular uptake and supporting students in building NGSS proficiencies.

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Study Data Sources

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<th>Source</th>
<th>Purpose</th>
<th>Administration</th>
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<td>Teacher Surveys</td>
<td>Establish baseline for teachers’ education, certification, and experience, science teaching perspectives and practices, prior professional development support</td>
<td>All teachers prior to the study</td>
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<tr>
<td>Teaching Pre-Survey</td>
<td>Online self-report on overall successes/ challenges in enacting curriculum units</td>
<td>All teachers after completing physical and life science instruction</td>
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<tr>
<td>Post-Unit Implementation Survey</td>
<td>Document implementation integrity and characterize instructional practices as they relate to curricular uptake and supporting students in building NGSS proficiencies</td>
<td>Sample of treatment teachers during unit implementations</td>
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<td>Instructional Logs</td>
<td>Self-report of weekly progress through each target unit</td>
<td>All teachers each week during physical and life science instruction</td>
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<td>Observation Protocol</td>
<td>Document implementation integrity and characterize instructional practices as they relate to curricular uptake and supporting students in building NGSS proficiencies</td>
<td>Sample of treatment teachers during unit implementations</td>
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<td>Assessments</td>
<td>Document implementation integrity and characterize instructional practices as they relate to curricular uptake and supporting students in building NGSS proficiencies</td>
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<td>Physical Science Assessment</td>
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<td>Life Science Assessment</td>
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<td>Interviews</td>
<td>Identify system-level supports and/ or policies needed for effective implementation</td>
<td>Sample of teachers, school principals, and district administrators from each district</td>
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<td>System Log Files</td>
<td>Backend data capture of teacher and student online activity</td>
<td>All teachers and students in treatment classrooms</td>
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