UMBC UGC New Course Request: **EDUC431**

Date Submitted: 6/24/2016  
Proposed Effective Date: 8/2017

<table>
<thead>
<tr>
<th>Dept Chair or UPD</th>
<th>Name</th>
<th>Email</th>
<th>Phone</th>
<th>Dept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eugene Schaffer</td>
<td><a href="mailto:geneschaffer@gmail.com">geneschaffer@gmail.com</a></td>
<td>410 455-2466</td>
<td>EDUC</td>
</tr>
<tr>
<td>Other Contact</td>
<td>Jonathan Singer</td>
<td><a href="mailto:jsinger@umbc.edu">jsinger@umbc.edu</a></td>
<td>410 455-3348</td>
<td>EDUC</td>
</tr>
</tbody>
</table>

**COURSE INFORMATION:**

<table>
<thead>
<tr>
<th>Course Number(s)</th>
<th>EDUC 431</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal Title</td>
<td>Methods for Teaching STEM in the Middle Grades</td>
</tr>
<tr>
<td>Transcript Title (≤30c)</td>
<td>Teaching STEM-Middle Grades</td>
</tr>
<tr>
<td>Recommended Course Preparation</td>
<td>N/A</td>
</tr>
<tr>
<td>Prerequisite</td>
<td>EDUC 410 and EDUC 430 with a “C” or better. Co-requisite courses: EDUC 411 and EDUC 454</td>
</tr>
<tr>
<td>Credits</td>
<td>3</td>
</tr>
<tr>
<td>Repeatable?</td>
<td>Yes ☑ No</td>
</tr>
<tr>
<td>Max. Total Credits</td>
<td>3 This should be equal to the number of credits for courses that cannot be repeated for credit. For courses that may be repeated for credit, enter the maximum total number of credits a student can receive from this course. E.g., enter 6 credits for a 3 credit course that may be taken a second time for credit, but not for a third time. Please note that this does NOT refer to how many times a class may be retaken for a higher grade.</td>
</tr>
<tr>
<td>Grading Method(s)</td>
<td>XReg (A-F) ☑ Audit ☐ Pass-Fail</td>
</tr>
</tbody>
</table>

**PROPOSED CATALOG DESCRIPTION** (no longer than 75 words):

This course introduces pedagogical practices associated with the teaching and learning of integrated STEM practices at the middle levels. The course addresses ideas that include (1) middle grades science, mathematics, engineering and technology (STEM) content, (2) understanding and developing middle grades students’ thinking; (3) designing, selecting, and sequencing instructional tasks, and (4) assessments for learners in the middle grades. Course must be taken concurrently with EDUC 411 and EDUC 454.

**RATIONALE FOR NEW COURSE:**

The Maryland State Department of Education (MSDE) has added middle school (grades 4-9) to its areas of teacher certification. In order to be competitive within the State and serve the UMBC students who want to specialize in STEM education at the middle school level, the education department is proposing a new Middle School STEM Education degree. EDUC 431 is needed for the new degree, and fits into the curriculum as a key pedagogical content course for students participating in Phase I of their internship (student teaching). This course is a 400 level course because it provides advanced knowledge required for program completion. Students who enroll must be accepted into Phase I of internship and have departmental permission. Students in the course will be graded using the regular grading scale and be required to earn a B or better in the course to advance to the second phase of the internship. The course is not offered with a repeatable option.

**ATTACH COURSE OUTLINE (mandatory):**
THE UMBC DEPARTMENT OF EDUCATION MISSION is to research teaching and learning, and to develop caring, thoughtful, knowledgeable, and skilled teachers who are responsive to children, families and the community. We expect our graduates to be leaders in their schools as well as advocates for democracy and social justice.

The middle school STEM methods course is built on the premise that teaching STEM is about more than “content” and addresses the complexity of social and cultural factors that operate in schools and their surrounding communities, as well as in science at-large. The course embraces the notion of teachers as life-long learners. This course is therefore just a beginning of a journey that will feature increasing competency as a teacher of science.

National Council of Teachers of Mathematics (NCTM) and National Science Teacher Association (NSTA) Standards for Preparation of Mathematics and Science Teachers are addressed in this course. Descriptions of these standards are found at the end of the syllabus. The course focuses on helping teachers address the Common Core State Standards for Mathematics (CCSSM) and Next Generation Science Standards (NGSS).

Course Objectives and Outcomes
Learning experiences in this course are framed around your current science, mathematics and pedagogical knowledge, skills, and dispositions.

During this course, you will:

- become familiar with current resource materials such as the Maryland Voluntary Curriculum Standards, district objectives, College and Career Readiness curriculum standards, NCTM standards and numerous science curriculum programs,
- enact inquiry-oriented activities by engaging in investigations involving exploration and discovery,
- develop a deep understanding of the nature of mathematics, the nature of science and their relationship with your teaching,
- gain experience in preparing, teaching, and analytically reflecting on middle school STEM lessons while working with students in local schools, and
- develop long-range teaching skills by preparing an in-depth science curriculum project.

EDUC 431 will be organized around the driving question:

How can I establish a learning community to support my teaching of middle school STEM?
This driving question is addressed by focusing upon a series of “sub questions”
- How do I know what to teach?
- How do I engage my students?
- How do I know what my students know?
- How do I connect class to the community?

Course Reading Material

Course readings (that can be found in Blackboard, course documents).

On-line resources we’ll use extensively:
   http://www.nap.edu/catalog.php?record_id=13165

3. Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. (2013).
   Next Generation Science Standards. They are available on-line at
   http://www.nextgenscience.org/

   http://www.nctm.org/ccssm/

5. Leadership in Mathematics Education Network, Communicate, Support Motivate
   http://www.mathedleadership.org/ccss/materials.html

6. Maryland Curriculum Standards
   http://mdk12.msde.maryland.gov/instruction/curriculum/

7. Sites Associated with Universal Design for Learning
   CAST: Center for Applied Special Technology http://www.cast.org/index.html
   National Center on Universal Design for Learning http://www.udlcenter.org/

8. Site associated with Standards for assessing Pre-service Science Teachers

9. Science Safety website
   http://mdk12.org/instruction/curriculum/science/safety/ or

Blackboard
In this era of technology, and with the goal of fostering a community of learners, we will use Blackboard in this course. Some readings will be posted there and you will be expected to access it frequently to post your own assignments and to read your classmates’ writings. Therefore you need to have good access to the Internet to participate on-line.

The class is based on the following ideas.
• The class is a community. To make it work, we ALL must be prepared and ready to participate every time we meet.
• Teachers need to learn to manage time both in and out of class. Therefore, you will be expected to hold to time constraints when presenting or contributing in class.
• Teachers are expected to be in school nearly every day and to be on time. Therefore, one excused absence is allowed under normal circumstances. After that, each absence will impact your grade, as will excessive lateness or leaving early.

**Academic Integrity**

By enrolling in this course, each student assumes the responsibility of an active participant in UMBC’s scholarly community in which everyone’s academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty and they are wrong. Academic misconduct could result in disciplinary action that may include suspension or dismissal.

**Classroom Accommodations for Students with Disabilities:**

If you are a student with a documented disability who requires an academic adjustment, auxiliary aids, or similar accommodations, please contact the Office of Student Support Services at 410-455-3250.

**Assignment Descriptions**

**Classroom Artifact:** An artifact is a physical representation constructed by the learner that represents their understanding of the key idea(s) presented during the last class meeting. Each artifact consists of two portions, the physical representation (e.g. picture, diagram, poem, etc.) and a short written paragraph that describes/connects how the physical representations reflect the key idea(s). Artifacts associated with the first 2 class meetings will be modeled by the professor.

**Content Expertise:** The candidates' Content Expertise statement is a self-assessment intended to allow the candidates to articulate what experiences have prepared them to teach the science discipline in which they are being certified. The statement needs to include a summary of academic preparation and performance and all other activities or experiences that have contributed to your knowledge in the content area. These experiences may include such things as college courses, lab experiences, internships, etc. Using the Content Analysis table recommended by NSTA for secondary science, the candidate must complete each table cell for “Unifying concepts” plus the “Core competencies”, “Advance Competencies” and “Supporting Competencies” associated with their area of certification.

**Philosophy Statement:** Construct a well-developed articulation of your beliefs about teaching and learning in science and your approach to optimizing student performance. Your philosophy should be interwoven with theory and research that extends and substantiates points. The philosophy statement should be cohesive and succinct (approximately 2 pages in length) and should include connections to:

- General beliefs about how students learn
- Aspects of the Nature of Science (NOS)
- Core Science and Engineering Practices
- Student Equity

**Course Requirements and Grading**

Note: Since this course is intended to help you become the best teacher you can be, it will be graded with a mastery perspective. The percentages listed here are approximate, but will give you a sense of the relative weight of each assignment.

# Assignments to be posted on TK-20 under course folder.

**Teaching portfolio elements on TK20**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Assignment Description</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>Class Artifact (An Artifact is physical representation constructed by the student that captures the key idea(s))</td>
<td></td>
</tr>
</tbody>
</table>
of the prior class meeting).

10% Philosophy Statement
10% Content Expertise

10% Safety and Legal Obligation Test
10% Local area resources
10% Interdisciplinary Instructional Activity:

30% # Focus Lessons PPT. presentations
  • Classroom management
  • Evidence of student learning
  • Differentiated instruction

20% # Final (Unit Plan)
  • Unit Idea/Standards
  • Pre/Post
  • Outline/Chart
  • Sample Lesson plan

Class Descriptions

<table>
<thead>
<tr>
<th>Due this week</th>
<th>In-class discussion and activities</th>
<th>Readings (To be discussed in class)</th>
</tr>
</thead>
</table>
| Week 1        | **Question**: How do I know what to teach?  
**Instructional activity**:  
What is science card exchange  
What is the nature of Mathematics  
**Artifact**: None | Class expectations and Syllabus |
|               | **Interdisciplinary Instructional Activity**: - Lesson design focusing cross-cutting themes | Next Generation Science Standards  
• Front Matter,  
• Structure  
• Assigned Appendices: A, C, F, G, H  
NCSM Toolkits (section X)  
Hattie Part 1 (pp. 1 – 34) |
| Week 2        | **Question**: How do I know what to teach?  
Student Presentations of Assigned NGSS Appendix.  
Intro to NCSM Toolkits  
Toolkit 1 (Content) Training | Next Generation Science Standards  
Select one DCI - look up the same idea (or as close as possible) on the current MD state standards. Be ready to discuss how they are presented.  
National Council of Teachers of Mathematics,  
Common Core State Standards for Mathematics |
|               | **Interdisciplinary Instructional Activity**: - Lesson design focusing disciplinary standards | |
| Week 4 | Enactment 1 presentation (Classroom Management) | Take a lesson from the mentor teacher and talk about what they taught and the adaptations they made.  
- Slide 1-Lesson Plan from mentor/or self  
- Slide 2—What went well with evidence  
- Slide 3--Missed Opportunities/what would they do differently next time with evidence  
- Slide 4—Reflection on Mentor feedback. |
<table>
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<tr>
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<tbody>
<tr>
<td></td>
<td>Philosophy statement due</td>
<td>Artifact:__</td>
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<td></td>
<td>Artifact:__</td>
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</tbody>
</table>

| Week 5 | Question: How do I engage my students? – Unit plan Idea due. | UDL: Focus on principles  
- Multiple means of Representation  
- Multiple means of action and expression.  
- Multiple means of Engagement.  
- Register for a CAST membership:  
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Interdisciplinary Instructional Activity: Lesson design to maximize engagement</td>
<td>Artifact:________</td>
</tr>
</tbody>
</table>

“Basic” Constructivism reading  
“Basic” Conceptual Change reading |
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Artifact: _______</td>
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</table>

| Week 7 | Question: How do I engage my students? – Collaborative learning Communities Interdisciplinary Instructional Activity (4): - Lesson design focusing on supporting group interactions – | Hattie Part 2 (Chapters 4 & 5)  
- Chpt. 4 – Preparing the lesson  
- Chpt. 5 – Starting the lesson |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Artifact: _______</td>
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</table>

| Week 8 | Enactment Presentation #2 Focus on Student Learning Unit plan Pre/Post test due | Discuss a lesson You led and talk about how it went and the adaptations you would make.  
- Slide 1-Lesson Plan and highlight the content standard.  
- Slide 2—Artifacts of student work: Talking points--What were your informal and formal assessments and what did they measure.  
- Slide 3—Critique of student work: Look at the data. In general, how did the entire class do? Then give one example of full understanding and explain why and one example of partial understanding and explain why and how you could have taught this differently.  
- Slide 4--Reflection on Mentor feedback. |
|---|---|---|
| Week 9 | **Question:** How do I maintain my student’s engagement? – **Scaffolding and making thinking visible**  
**Content Expertise Due**  
**Interdisciplinary Instructional Activity (5):** Lesson design focusing on scaffolding student learning and making thinking visible.  
**Artifact:** ________ | **Hattie, Part 2 (Chpt. 6)**  
- Chpt.6 – The flow of the lesson: Learning  
**MD Science safety Module**  
| Week 10 | **Question:** How do I manage and support classroom activities and discussions?  
**Science Safety test – graded in class.**  
**Interdisciplinary Instructional Activity (6):** Lesson design focusing on facilitating small and large group inter-actions  
**Artifact:** ________ | **Hattie, Part 2**  
- Chpt. 7 – The flow of the lesson: the place of feedback  
**MD Science safety Module**  
| Week 11 | **Question:** How do I know what my students know?  
**Unit Plan: Outline/Chart and Sample Lesson plan due**  
**Interdisciplinary Instructional Activity (7):** Lesson design focusing on formative feedback and assessment.  
**Artifact:** ________ | **Hattie, Part 2**  
- Chpt. 7 – The flow of the lesson: the place of feedback  
**MD Science safety Module**  
| Week 12 | **Enactment Presentation #3 Differentiated Instruction**  
**Artifact:** __ | Discuss a lesson **You** led and talk about how it went and the adaptations you would make.  
- Slide 1-Lesson Plan and point out a minimum of two populations that you need to differentiate for in your classroom  
- Slide 2—Adaptations: How did you differentiate instruction for each of the populations that you pointed out and why?  
- Slide 3—Evidence of the level of success of those |
| Week 13 | **Question:** How do I know what my students know?  
**Interdisciplinary Instructional Activity (7):** Lesson design focusing on summative assessment and using data to inform instruction  
Artifact: ________ | **Hattie, Part 2 chpt. 8**  
• Chpt. – 8 The end of the lesson |
|-------|-------------------------------------------------|--------------------------------------------------|
| Week 14 | **Question:** How do I connect the class to the community?  
**Class Project:** Local area resources  
Artifact: ________ | Students should be prepared to make a 10 minute presentation associated with their local community/context project.  
Please provide a 1 page handout to distribute to all class members that includes:  
 o Local area resource  
 o Contact information  
 o Services provided  
 o Appropriate grade level/content area  
 o Limitations and Benefits |
| Week 15 | **Curriculum Unit Plan Presentations**  
Artifact: ________ | **Hattie, Part 3 chpt. 9**  
• Chpt. – 9 Mind frames of teachers, schools leaders and systems |
### Artifact Rubric

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Not present or Not Acceptable (0 pts)</th>
<th>Acceptable (1 pt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A “physical object” that addresses a key idea/practice from the targeted lesson is provided.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A paragraph caption is included</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paragraph caption explains how the artifact represents the key idea from the lesson</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paragraph caption describes why the key idea is significant/important</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paragraph caption provides a connection between design challenge and the key idea represented by the artifact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artifact presentation is succinct and too the point (30 – 90 secs).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity bonus</td>
<td></td>
<td></td>
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</tbody>
</table>

Total points = ___________________
### Content Expertise Rubric

<table>
<thead>
<tr>
<th>Academic Preparation and Performance</th>
<th>Limited 1</th>
<th>Developing 2</th>
<th>Proficient 3</th>
<th>Exemplary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSTA 1A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The teacher understands the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.</td>
<td>Evidence of minimal content expertise gained from academic preparation. Table is incomplete or missing for Sections associated with</td>
<td>Evidence of comprehensive content expertise in specific science discipline gained from academic preparation. Includes completion of Table for Sections associated with</td>
<td>Same as level 2 plus: Any competencies not connected to academic experiences are addressed either by informal experiences or plan for future experiences. Includes reflection on specific competency for which they are most and least comfortable but explanation is weak or lacking</td>
<td>Same as level 3 plus: Includes reflection on specific competency for which they are most and least comfortable and why.</td>
</tr>
<tr>
<td></td>
<td>⚫ Unifying Competency,</td>
<td>⚫ Unifying Competency,</td>
<td>⚫ Unifying Competency,</td>
<td>⚫ Unifying Competency,</td>
</tr>
<tr>
<td></td>
<td>⚫ Core Competencies</td>
<td>⚫ Core Competencies</td>
<td>⚫ Core Competencies</td>
<td>⚫ Core Competencies</td>
</tr>
<tr>
<td></td>
<td>⚫ Advance Competencies</td>
<td>⚫ Advance Competencies</td>
<td>⚫ Advance Competencies</td>
<td>⚫ Advance Competencies</td>
</tr>
<tr>
<td></td>
<td>Limited 1</td>
<td>Developing 2</td>
<td>Proficient 3</td>
<td>Exemplary 4</td>
</tr>
<tr>
<td>----------------------</td>
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<td>--------------</td>
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</tr>
<tr>
<td>Academic Preparation and Performance</td>
<td>Evidence of minimal content expertise gained from academic preparation. Table is incomplete or missing for Sections associated with Supporting Competencies.</td>
<td>Evidence of comprehensive content expertise in specific science discipline gained from academic preparation. Includes completion of Table for Sections associated with Supporting Competencies.</td>
<td>Same as level 2 plus: Any competencies not connected to academic experiences are addressed. Either by informal experiences or plan for future experiences.</td>
<td>Same as level 3 plus: Includes reflection on specific competency for which they are most and least comfortable and why.</td>
</tr>
<tr>
<td>NSTA 1B</td>
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<td></td>
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<tr>
<td>The teacher understands the central concepts of the supporting disciplines and the supporting role of science-specific technology.</td>
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<td></td>
<td></td>
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<tr>
<td>Description of Research Experience(s) and appropriate evidence that demonstrate ability for designing, conducting, reporting, and analyzing research findings.</td>
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<tr>
<td>Description of experience(s) with technology to support their understanding of scientific concepts and practices.</td>
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</tbody>
</table>

Interns must obtain a score of at least Proficient (3) for all criteria in order to meet program completion requirements.
To be completed during Phase 2

<table>
<thead>
<tr>
<th>NSTA Standards 1A and 1B if NOT rated proficient prior to the start of phase 2 internship. (Use same rubric as original assignment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA 1A: Previously rated proficient or above</td>
</tr>
<tr>
<td>NA 1B: Previously rated proficient or above</td>
</tr>
</tbody>
</table>

**Standard 6: Professional Knowledge and Skills**

Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community.

<table>
<thead>
<tr>
<th>6a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.</th>
<th>Limited 1</th>
<th>Developing 2</th>
<th>Proficient 3</th>
<th>Exemplary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of PD is limited to Date, time and topic</td>
<td>Same as 1 but also includes a reflection of how the PD opportunity addresses a specific scientific concern for their disciplinary understanding</td>
<td>Same as 2 but the reflection also explicitly connects the PD opportunity between disciplinary understanding with classroom practices.</td>
<td>Same as 3 but multiple PD opportunities are described.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>6b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community.</th>
<th>Limited 1</th>
<th>Developing 2</th>
<th>Proficient 3</th>
<th>Exemplary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of PD is limited to Date, time and topic</td>
<td>Same as 1 but also includes a reflection of how the PD opportunity addresses a specific pedagogical concern</td>
<td>Same as 2 but also includes a description of how the practices learned at the PD have been applied (or will be applied) in their instruction.</td>
<td>Same as 3 but multiple PD opportunities are described.</td>
<td></td>
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</tbody>
</table>
### Teaching Philosophy Rubric

<table>
<thead>
<tr>
<th></th>
<th>Limited 1</th>
<th>Developing 2</th>
<th>Proficient 3</th>
<th>Exemplary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Statement of teaching and learning</strong></td>
<td>Minimal description of “how students” learn.</td>
<td>Describes the beliefs and assumptions that underlie learning and your approach to teaching.</td>
<td>A well-developed description of the beliefs and assumptions that underlie learning and your approach to teaching. Includes a general connection to psychological principles/theories.</td>
<td>A well-developed description of the beliefs and assumptions that underlie learning and your approach to teaching. Includes connection to specific key psychological principles/ theories.</td>
</tr>
<tr>
<td><strong>Nature of Science (NOS)</strong></td>
<td>Statement only includes a minimal connection to the <em>Nature of Science</em></td>
<td>Statement includes a general description of <em>Nature of Science</em> and why it’s important to include (or exclude). but does not provide a clear connection for instructional practices.</td>
<td>Statement includes a well-developed description of <em>Nature of Science</em>, why it’s important to include (or exclude). Connection to instructional practices is general.</td>
<td>Statement includes a well-developed description of <em>Nature of Science</em>, why it’s important to include (or exclude). Connection to instructional practices is explicit and well developed</td>
</tr>
<tr>
<td><strong>Science and Engineering Practices</strong></td>
<td>Statement only includes a minimal connection to the integration of <em>Science and Engineering Practices</em></td>
<td>Statement includes a general description of <em>Science and Engineering Practices</em> and why it’s important to include (or exclude). but does not provide a clear connection for instructional practices.</td>
<td>Statement includes a well-developed description of <em>Science and Engineering Practices</em> and why it’s important to include (or exclude). Connection to instructional practices is general.</td>
<td>Statement includes a well-developed description of <em>Science and Engineering Practices</em> and why it’s important to include (or exclude). Connection to instructional practices is explicit and well developed</td>
</tr>
<tr>
<td>Equity Pedagogy (UMBC 3.1.3; 3.1.4; 4.10)</td>
<td>Does not demonstrate an expectation that all children can learn.</td>
<td>Demonstrates minimal expectations that all children can learn science</td>
<td>Demonstrates expectations that all children can learn science and provides a general connection to “College and Career Readiness”</td>
<td>Demonstrates expectations that all children can learn science and provides a general connection to “College and Career Readiness”</td>
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</tr>
<tr>
<td>Organization and Presentation</td>
<td>Content is unorganized and not formatted or written in a professional manner.</td>
<td>Content is organized, but contains errors.</td>
<td>Content is organized and contains minimal errors.</td>
<td>Content is well organized and professionally presented.</td>
</tr>
</tbody>
</table>