STEM in World Language Education

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Outcomes of This Session

Participants will:

- Become familiar with the Maryland Race to the Top World Language Pipeline Project, especially the STEM-focused WL curricular modules for elementary students

- Learn the process necessary for the creation of STEM-focused curricular modules for elementary students

- Develop strategies for adapting the Maryland curriculum or creating their own STEM-focused curricular modules
In 2010, Maryland was the only state to receive federal *Race to the Top* funding to support world languages.
Maryland WL Pipeline Project
2010-2014

Elementary Programs for Arabic, Chinese, and Spanish:
- **Programs**: Funds for start-up costs and innovative technology
- **Curricular Modules**: STEM-focused WL curriculum modules
- **Teacher Development**: Online courses for WL teachers to teach elementary students
- **Student Assessment**: MD online LinguaFolio, Jr.
RTTT World Language Grants

- **2010-2011**: Planning
- **2011-2012**: 4 programs in 4 counties
- **2012-2013**: 4 programs in 3 counties
- **2013-2014**: 4 programs in 4 counties

A total of $420,000 was awarded to 19 schools.
STEM–focused WL Modules:  
_The Process_

- Contract national experts and Maryland WL teachers
- Conduct curriculum workshops
- Write → Review → Revise
- Develop an ESOL module in English; convert it into Arabic, Chinese, and Spanish
- Post online
- Review user feedback
Standards-based

- National Standards for Foreign Language Learning
- Maryland Common Core State Standards
- Next Generation Science Standards
STEM-focused WL Modules: *Essential Elements*

- Priorities: language development, cultural experiences, and hands-on content reinforcement
Guiding Principles

- Story Form
- Performance-based assessment and instruction
- Understanding by Design/backward mapping
- Each module as an inquiry project, integrating 5Cs with 5Es
The 5Es Inquiry Model

**ENGAGEMENT**
Object, event, or question is used to engage students & make connections between what students know and can do.

**EXPLORATION**
- Objects and phenomena are explored.
- Hands-on activities, with guidance

**EXPLANATION**
- Students explain their understanding of concepts and processes.
- New concepts and skills are formulated.

**EVALUATION**
- Students assess their knowledge, skills, and abilities.
- Activities permit evaluation of student development and lesson effectiveness.

Activities allow students to apply concepts in contexts and build on or extend understanding and skill.
Standards for Foreign Language Learning in the 21st Century ACTFL Performance Guidelines for K-12 Learners

5Cs –
Communication
Cultures
Connections
Communities
Comparisons
5 Cs-5Es in Global Competency Matrix

- **Communities**: as an anchor
- **Comparisons**: similarities and differences
- **Cultures**: products, perspectives and practices
- **Connections**: STEM

**Engagement**
- Investigate the world

**Exploration**
- Recognize perspectives

**Evaluation**
- Take action
- Communicate ideas

**Communication**: in the target language

## Teaching a World Language in the 5E Process

<table>
<thead>
<tr>
<th>STEM 5E</th>
<th>Second Language acquisition</th>
<th>Student WL learning</th>
<th>WL instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stages</td>
<td>Process</td>
<td>Process</td>
<td>Process</td>
</tr>
<tr>
<td>Engagement</td>
<td>Input</td>
<td>Teaser/ Activation</td>
<td>Beginning</td>
</tr>
<tr>
<td>Exploration</td>
<td>Input-intake</td>
<td>Learning via exploration &amp; practice</td>
<td>Beginning/ Middle</td>
</tr>
<tr>
<td>Explanation</td>
<td>Intake-output</td>
<td>Demo understanding</td>
<td>Middle</td>
</tr>
<tr>
<td>Elaboration</td>
<td>Output</td>
<td>Application/ transfer</td>
<td>Middle/ Synthesis/creation</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Output-assessment</td>
<td>Evaluation/Performance Assessment/reflection</td>
<td>Wow-Ending/ Teacher reflection</td>
</tr>
</tbody>
</table>
Time Needed for a Module and a Lesson

- **Time Needed:**
  Implementation varies widely depending on the program type and design.

- **Each Module:** 5 lessons; roughly 25-35 days (or 5 weeks) to teach a module, including performance assessment.

- **Each Lesson:** about 30 to 45 minutes per day; roughly 5 days (or a week) to teach a lesson, including assessment.
## Instructional Flow: Integrating 5Es and 5Cs + STEM

<table>
<thead>
<tr>
<th>5Es</th>
<th>Module/Lessons</th>
<th>5Cs + STEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td>Lesson 1/ Day 1</td>
<td></td>
</tr>
<tr>
<td>Exploration</td>
<td>Lesson 2/ Day 2</td>
<td></td>
</tr>
<tr>
<td>Explanation</td>
<td>Lesson 3/ Day 3</td>
<td></td>
</tr>
<tr>
<td>Elaboration</td>
<td>Lesson 4/ Day 4</td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td>Lesson 5/ Day 5</td>
<td></td>
</tr>
</tbody>
</table>
Components of Maryland Modules

- Module with teacher guide
- Worksheet
- PPT slides (in most modules)
- Additional stories and other resources
- In ESOL, Arabic, Chinese, and Spanish

A statewide online Linguafolio, Jr. was also built
Grades K-1 Modules

Rainforest Friends

Different Phases of the Moon

Let’s Go!

Change Can Be Good

Sound: Good Vibrations
From Seeds to Table

Your House and Mine

Grades 2-3 Modules

What’s the Matter with Ice Cream?

Water, Water Everywhere

Pyramids Around the World
Grades 4-5 Modules

Natural Hazards

Bridges Around the World

Healthy Living

The Chesapeake Bay – A Home for Many

A Small Island with Big Idea – Hold on to Your Hat
Module Template

World Language-STEM MODULE COVERSHEET
Module Name/Theme in English

Target Language: 
Grade Level: 4 and 5

Proficiency Level: Junior Novice Low – Junior Novice Mid

Context and Storyline:

Enduring Understanding:

Essential Questions:

Module Duration and Lessons:

Standards Targeted

SE – World Language Standards
Communication
Culture
Connections (sample below)
Comparison
Community

Skills and Process Technology Mathematics

Knowledge: Students will know...
Vocabulary (both linguistic and content areas)
Expressions and patterns

Skills: Students can...
(Can do statement)

Performance Assessment

Interpretive Task

Presentational Task

Interpersonal Task

Materials/Resources

STEM Background for teachers: (Identified and provided by a STEM teacher/resource person)

Lesson 1-Title in English
Title in the TL

Lesson 1 of 5 
Duration: 30 Minutes

Objectives

I Can:
Oral language:
Literacy:
STEM and Other Subject Areas:

Vocabulary and Expressions

Previously learned (Only in Lesson 1)
Content obligatory language
Content compatible language

Materials/Resources

Lesson Storyline and Core Text

Key Elements

Engagement

• Object, event or question used to engage students.
• Connections facilitated between what students know and can do.

Exploration

• Objects and phenomena are explored.
• Hands-on activities, with guidance.

Explanation

• Students explain their understanding of concepts and processes.
• New concepts and skills are introduced as conceptual clarity and cohesion are sought.

Elaboration

Activities allow students to apply concepts in contexts, and build on or extend understanding and skill.

Evaluation

Students assess their knowledge, skills and abilities. Activities permit evaluation of student development and lesson effectiveness.

Teacher Reflection Lesson 1: (Lesson 2 Title)

What worked well?

What did not work well?

What would I do differently?
**World Language - STEM MODULE COVERSHEET**

<table>
<thead>
<tr>
<th>Target Language: English as a Second Language</th>
<th>Grade Level: 4 and 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proficiency Level: Junior Novice Low – Junior Novice Mid</td>
<td></td>
</tr>
</tbody>
</table>

**Context and Storyline:** The Bridge Engineering Security Team has sent the class a package about a mission to design “A Bridge for the Future” for cities devastated by a major disaster. The team must explore bridges that are located around the world that have been classified as great structures of the world. As they travel around the world to explore these bridges, the class will learn about the engineering design, type, and history for each bridge. Students will become members of the Bridge Engineering Security Team by designing and constructing a “Bridge for the Future.”

**Enduring Understanding:** The design of bridges has greatly changed throughout history due to a variety of factors.

**Essential Questions:**
- 题的种类、造型、及题对人类的用处?
- 题的故事?

**Module Duration and Lessons:** The module is designed for three to five 30-minute class periods per week over three to five weeks. Instructional time will depend on students’ previous knowledge of content and vocabulary, as well as their language proficiency. Other factors include program type and whether the module is used as the main core of instruction or as a supplementary resource.

- Lesson 1: 题的种类
- Lesson 2: 题的造型
- Lesson 3: 题的故事
- Lesson 4: 题对人类的用处
- Lesson 5: 题的故事

**Standards Targeted**

<table>
<thead>
<tr>
<th>SCs – World Languages Standards</th>
<th>NGSS/STEM Standards</th>
</tr>
</thead>
</table>

**Communication**
- Students engage in brief exchanges about personal interests in the target language. (1.1.A)
- Students understand spoken and written language on very familiar topics in the target language that promote the learning of basic linguistic structures. (1.2.A)
- Students make short presentations and write simple communications on very familiar topics in the target language. (1.3.A)

**Cultures**
- Students identify and describe the products within the cultures studied. (2.1.A)

**Connections**
- Students access new information and reinforce

**NGSS**
- **E-5-ETS 3-1:** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **E-5-ETS 3-2:** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **E-5-ETS 3-3:** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Worksheet 1b

我们的梁桥

TEAM MEMBERS: ___________________ ___________________

1. 把书分成左右两堆，距离四英寸。 2. 将一个卡片（桥）放在两堆书的中间。假设：我们的桥可以载________分钱。

实验：
1. 每一次放一分钱，直到桥梁坍塌，算算共用了几分钱。
2. 记录结果。

分析结果：
1. 在你的图上，讨论为什么桥梁塌了。
2. 讨论如何使桥更强，使得它可以支持更多的负载（便士）。
3. 测试你重建桥梁。

<table>
<thead>
<tr>
<th>桥墩之间的距离</th>
<th>桥墩的高度</th>
<th>桥的厚度</th>
<th>负载量</th>
</tr>
</thead>
<tbody>
<tr>
<td>实验#1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>实验#2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>实验#3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>实验#4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>实验#5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>实验#6</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

CONCLUSION:

Source: http://www.exploratorium.edu/science_explorer/card_bridge.html
PowerPoint Slides Provide Visuals, Content, and Communication
小鸭子的故事

小鸭子饿了，小鸭子的故事

小种子找到了它的家

有一个小的种子，从一棵大树上掉下来。小种子说：“我能去哪里呢？哪里是我家？“

大风来了，小种子飞在空中。飞呀飞，小种子在空中飞呀飞。小种子说：“我能去哪里？哪里是我家？“
LinguaFolio, Jr. – An online assessment portfolio
Maryland LinguaFolio, Jr. – Can Do Statements

<table>
<thead>
<tr>
<th>Can Do Statement</th>
<th>Reset</th>
<th>I'm still learning</th>
<th>I can do it with help</th>
<th>I can do it</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can repeat words I hear.</td>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>I can say hello and goodbye to people.</td>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>I can name some people, places, or objects.</td>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>I can answer simple questions in a single word.</td>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
LinguaFolio, Jr. – Upload Evidence
MD LinguaFolio, Jr. – Student Passport

Languages I have learned in my family

Languages I have learned in school

Languages I learned outside of normal school instruction

Language experiences (travel with my family)

Language tests, competitions, certificates, diplomas

Language: Chinese (Mandarin)

- Speaking
- Listening
- Reading
- Writing

Language: Arabic

- Speaking
- Listening
- Reading
- Writing

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## Novice Low

<table>
<thead>
<tr>
<th>Activity</th>
<th>I'm still learning</th>
<th>I can do it with help</th>
<th>I can do it</th>
<th>Not checked</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can repeat words I hear.</td>
<td>5%</td>
<td>7%</td>
<td>71%</td>
<td>17%</td>
</tr>
</tbody>
</table>

## Novice Mid

<table>
<thead>
<tr>
<th>Activity</th>
<th>I'm still learning</th>
<th>I can do it with help</th>
<th>I can do it</th>
<th>Not checked</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can introduce myself.</td>
<td>10%</td>
<td>2%</td>
<td>1%</td>
<td>87%</td>
</tr>
<tr>
<td>I can ask and answer simple memorized questions.</td>
<td>5%</td>
<td>6%</td>
<td>1%</td>
<td>88%</td>
</tr>
<tr>
<td>I can recite simple rhymes or sing songs with others.</td>
<td>0%</td>
<td>14%</td>
<td>18%</td>
<td>68%</td>
</tr>
</tbody>
</table>

## Novice High

<table>
<thead>
<tr>
<th>Activity</th>
<th>I'm still learning</th>
<th>I can do it with help</th>
<th>I can do it</th>
<th>Not checked</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can express likes and dislikes.</td>
<td>10%</td>
<td>0%</td>
<td>1%</td>
<td>89%</td>
</tr>
<tr>
<td>I can describe myself, family, and things.</td>
<td>10%</td>
<td>0%</td>
<td>1%</td>
<td>89%</td>
</tr>
<tr>
<td>I can ask and answer questions in simple sentences.</td>
<td>10%</td>
<td>0%</td>
<td>1%</td>
<td>89%</td>
</tr>
<tr>
<td>I can ask for help when I need it.</td>
<td>10%</td>
<td>0%</td>
<td>1%</td>
<td>89%</td>
</tr>
<tr>
<td>I can recite simple rhymes or sing songs by myself.</td>
<td>10%</td>
<td>0%</td>
<td>3%</td>
<td>87%</td>
</tr>
</tbody>
</table>
Find these Modules Here
Questions or Comments?

• How are these modules different from traditional curricular units?
• How can you adapt a module for your program or classroom?
• Other thoughts and suggestions?
Thank you! 谢谢!

Visit MSDE WL/STEM Modules at
http://bit.ly/1guiNcv

Contact us:

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- Dr. Shuhan Wang, shuhancw@gmail.com