Standards for Mathematical Practice Instruction Design

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IST 526 Interactive Multimedia for Instruction

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Problem Analysis

The Common Core Standards for Mathematics (CCSM) have 8 overarching best practices for students in k-12 grade called the Standards for Mathematical Practice (SMP). According to National Governors Association Center for Best Practices & Council of Chief State School Officer these practices are essential to the new CCSM; "Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction" ([NGAC & CCSSO], 2010a, p. 8). This means teachers will need to understand the SMP to help design their lessons and assessments.

The combined need of including the SMP in all K-12 math instruction and all professional development, a solution is to have a stand-alone lesson focused on the SMP. The goal of the lesson is to have an understanding of the SMP that is applicable to the learner's own classroom instruction. This lesson could be used as a first module for many different eLearning course that focus on CCSM. Also, the lesson can be used as a pre-teaching module for any face-to-face professional development; an example of flipping the classroom.

Target Audience

In particular, this lesson will be created for all mathematics educators (K-12) mathematics educators; referred to as the learners. Learners will be working towards self-improvement in their profession with a desire of reaching a greater understanding of the CCSM. The learners can range from first year teacher to teachers nearing retirement. Importantly, all learners will be considered highly qualified under No Child Left Behind (NCLB) by the California Commission for Teacher Credentialing (2012). Because the learners are all highly qualified they will possess a great deal of knowledge of mathematics skills and practices appropriate to their instructional assignment; specifically, the learners will have a great deal of prior knowledge that they can apply to the SMP. However, explicit understanding of the SMP will not be structured for the learners at this time. Also, these learner likely have not completed a self-paced eLearning course and may be unfamiliar with the navigation and tools available.

Learning Objectives

1. Identify the 8 SMP.
2. Report the key characteristics of a SMP.
    1. Identify the key characteristics of SMP 1: Make sense of problems and persevere in solving them.
    2. Identify the key characteristics of SMP 2: Reason abstractly and quantitatively.
    3. Identify the key characteristics of SMP 3: Construct viable arguments and critique the reasoning of others.

4. Identify the key characteristics of SMP 4: Model with mathematics.
5. Identify the key characteristics of SMP 5: use appropriate tools strategically.
6. Identify the key characteristics of SMP 6: Attend to precision.
7. Identify the key characteristics of SMP 7: Look for and make use of structure.
8. Identify the key characteristics of SMP 8: look for and express regularity in repeated reasoning.

Assessment Instruments

Practice Items:

1. Multiple choice, true/false, or matching questions will be used to assess the learner's progress in identifying the SMP. Learners will also be asked to order the list of SMPs sequentially.
2. Multiple choice, true/false, or matching questions will be used to assess the learner's progress in reporting the key characteristics of the SMP.
    1. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 1 with multiple choice, true/false, matching, or drag & drop questions.
    2. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 2 with multiple choice, true/false, matching, or drag & drop questions.
    3. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 3 with multiple choice, true/false, matching, or drag & drop questions.

4. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 4 with multiple choice, true/false, matching, or drag & drop questions.
5. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 5 with multiple choice, true/false, matching, or drag & drop questions.
6. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 6 with multiple choice, true/false, matching, or drag & drop questions.
7. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 7 with multiple choice, true/false, matching, or drag & drop questions.
8. The learner's progress will be measured by comparing their list to a complete list of characteristics for SMP 8 with multiple choice, true/false, matching, or drag & drop questions.

Summative Assessment:

Learners will be notified that the first 4 test items must be completed before they can continue through the end of the summative assessment.

1. Given a list of possible SMP, learners will categorize the possible SMP as a real or not real SMP using a drag and drop interaction. 1 test item.

2. Given an incomplete name of a SMP, the learner will fill in the blank with the appropriate term. 3 random test items of 8 possible.

At this point in the assessment learners will be reminded that they will not be able to change the answers to the first 4 test items after the move onwards. This will prevent future questions from providing answers to the first group of questions.

3. Given a list of characteristics, learners will match the characteristic to a SMP. 2 matching test items.
4. Given an SMP, learners will identify if a given characteristic belongs to the identified SMP. 4 true/false test items.
5. Given an SMP, learners will identify a non-characteristic of the SMP from a list of possible characteristics. 2 multiple choice test items.
6. Given a list of possible characteristics for an identified SMP, learners will categorize the characteristics as included or not included using a drag and drop interaction. 8 test items.

Instructional Strategies

Using Gangé's nine events, the instruction will:

1. Gain attention by describing the overarching purpose of the SMP in the CCSM.
2. Inform the learners of the objectives; they will be able to identify all 8 SMP by the end of the lesson and report the key characteristics of each SMP.

3. Stimulating recall will be accomplished by showing an example problem that learners will be familiar with and describing some of the best practices demonstrated in the problem.
4. Present the stimulus material by having the learner read one of the SMP, and then demonstrate how to look for and identify the key characteristics of the SMP.
5. Providing guidance for the rest of the SMPs will be accomplished by having a hint button, or slide, that reminds the learner of the strategies demonstrated in identifying the characteristics of the first SMP.
6. Eliciting performance will take place after the learner has read and identified characteristics of each SMP through multiple choice, true/false, matching, and drag & drop exercises.
7. Providing feedback from the practice problems for each SMP will be immediate and will notify the learner when they were not able to identify key characteristics of a SMP, they will be redirected to review the responses and read through the SMP again.
8. Assessing the performance will be completed by a summative test that includes multiple choice, true/false, matching, and drag & drop exercises that demonstrate a complete understanding of the SMP.
9. The unit will enhance retention and transfer for the knowledge by combining their notes with a quick reference graphic organizer they will be able to print out.

Instructional Materials

This lesson will require the complete text of all 8 of the SMP as listed in the CCSM. There will also be images used from the CCSM, and mathematics problems or symbols. There is potential for the use of an avatar to provide guidance and hint to the learner while they are reading the SMP.

There will be a video designed to catch the learner's attention by describing the purpose of the SMP. A video that demonstrates the navigation and some of the tools available, will be included in the lesson as a resource for the learner. Also, video will be used to shown to demonstrate some skills in decoding the SMP. Audio recording for narration and direction will be included, with closed captioning.

A quick reference guide will also need to be created for the user at the end of the lesson. It should include all the identified key characteristics used in the lesson in an organized manner; also, if it's possible the content of the graphic organizer should be populated by the responses the user generates in the assessment items. This will generate the most buy in for the learner. There might even be a way to allow the learner to populate this graphic organizer as they read through the material and allow them to use it as a reference on the assessment.

The content of the slides will be generated by the author (this includes the identification of the key characteristics of the SMP) except for the actual text of the SMP, which will be pulled directly from the CCSM. The text may be used as long as its use is in line with its public license and given proper attribution (NGAC & CCSSO, 2010b).

Appendix A - Release Form

Permission to Show and Use by CSUMB

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Evan Ryan Willig April 1, 2014

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References:

California Commission on Teacher Credentialing. (2012) *Subject matter authorization guideline book*. Sacramento, CA: Author.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010a). *Common Core State Standards for Mathematics.* Washington, DC: Authors.

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