EQuIP Review Feedback

Lesson/Unit Name: Knowing Nets
Content Area: Mathematics
Grade Level: 6

Overall Rating:

E/I

Exemplar if Improved

Dimension I – Alignment to the Depth of the CCSS

The lesson/unit aligns with the letter and spirit of the CCSS: ✓ Targets a set of grade-level CCSS mathematics standard(s) to the full depth of the standards for teaching and learning. ❒ Standards for Mathematical Practice that are central to the lesson are identified, handled in a grade-appropriate way, and well connected to the content being addressed. ✓ Presents a balance of mathematical procedures and deeper conceptual understanding inherent in the CCSS.	Knowing Nets is an introductory lesson to capture student interest in the topics of nets for prisms, area, surface area, and volume, which are standards 6.G.A.1-4. Being a lesson (and not a unit) there are parts of these standards that are not fully developed. For example 6.G.A.2 (the lesson does not require fractions) and 6.G.A.4 (Students are not specifically asked to find surface area of a prism from the net). Because it is an introductory two-day lesson, its apparent intent is not to address the standards to their full depth, but instead to motivate and diagnose students' current level of knowledge regarding these topics and for students to explore and discover facts and relationships about nets and their surface area and volume. Follow up lessons that focus on certain topics in more detail, such as finding the area of any triangle or quadrilateral, will need to follow and the author may consider bringing attention to that fact. Besides the content standards, this lesson engages students in developing conceptual understandings and application of nets as well as making connections to various mathematical constructs such as solids, Cartesian coordinate systems, and measurement. There are several ways that students are engaged with the math content that are not identified in the lesson. For example, students are expected to make sense of nets and persevere in their creating solids from nets. The lesson encourages students to build preliminary generalizations about nets that are the result of decomposing a shape and justify their reasoning. In this way students are reasoning from concrete to abstract using mathematical models. The Standards for Mathematical Practice are central to the lesson, but they are not specifically identified. There is evidence in the plan that students need to persevere with problems (SMP.1) and reason abstractly and quantitatively (SMP.2) in the workshop section, construct viable reasoning and critique the reasoning of others (SMP.3) in the Post, Share, Comment Section, and look for repeated reasoning (SMP.8) in the Focus Problem: Same Content in a New Context section. A strong suggestion for this dimension is to document which Standards for Mathematical Practice are expected to surface during the lesson and how those are related to the specific content of the lesson. This is especially important for experienced teachers who are still refining their implementation of the Common Core Standards for Mathematics and for new teachers who may need to realize that there are two sets of standards - content standards and standards for practice. The authors might want to consider the connections to the following practices during this lesson: - #1 Make sense of problems and persevere in solving them. - #3 Construct viable arguments and critique the reasoning of others. - #5 Use appropriate tools strategically. - #6 Attend to precision. - #7 Look for and make use of structure.

	There is a balance of mathematical procedures and deeper conceptual understanding as evidenced in the inclusion of the launch to build conceptual understanding of nets and the application of a variety of procedures in solving the various levels of problems.
Rating: **2 – Meets many of the criteria in the dimension**	

Dimension II – Key Shifts the CCSS

The lesson/unit reflects evidence of key shifts that are reflected in the CCSS: ✓ **Focus:** Lessons and units targeting the major work of the grade provide an especially in-depth treatment, with especially high expectations. Lessons and units targeting supporting work of the grade have visible connection to the major work of the grade and are sufficiently brief. Lessons and units do not hold students responsible for material from later grades. ✓ **Coherence:** The content develops through reasoning about the new concepts on the basis of previous understandings. Where appropriate, provides opportunities for students to connect knowledge and skills within or across clusters, domains and learning progressions. ✓ **Rigor:** Requires students to engage with and demonstrate challenging mathematics with appropriate balance among the following: – **Application:** Provides opportunities for students to independently apply mathematical concepts in real-world situations and solve challenging problems with persistence, choosing and applying an appropriate model or strategy to new situations. – **Conceptual Understanding:** Develops students' conceptual understanding through tasks, brief problems, questions, multiple representations and opportunities for students to write and speak about their understanding. – **Procedural Skill and Fluency:** Expects, supports and provides guidelines for procedural skill and fluency with core calculations and mathematical procedures (when called for in the standards for the grade) to be performed quickly and accurately.	FOCUS Cluster 6.G.A.1-4 are supporting standards for the work of the grade and this lesson. However, there are no visible connections to the major work of the grade in the lesson. The author might consider some of the following opportunities to connect to the major work of the grade, including perhaps a summary of possibilities for future lessons on these topics: - 6.NS.A.1 Apply and extend previous understandings of multiplication and division to divide fractions by fractions. (Given the area of one of the faces and a fractional edge length, can you find the missing edge length?) - 6.EE.A.3.c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. (Given the patterns and relationships that students discover as they draw and calculate the surface area of nets on the coordinate plane, can they see the structure in those relationships and derive or verify the formulas to find surface area of prisms and volume of triangular and rectangular prisms?) COHERENCE Students in grade 6 build on their work with area in elementary school and focus on reasoning about relationships among shapes to determine area, surface area, and volume. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. The unit develops their understanding in a coherent manner as they find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging and/or removing pieces, and relating the shapes to rectangles. In addition, coherence is evident vertically as the lesson prepares students for work on scale drawings and constructions in grade 7 by drawing polygons in the coordinate plane. The author might consider that in identifying prior content that the concept of volume is introduced in Grade 5 with 5.MD.C.3-5. This would provide an opportunity to activate and assess prior knowledge during the Launch with the Kleenex box by asking how many cubic centimeters or cubic inches of Kleenex the box might hold. There is good coherence from the work on the coordinate plane from Grade 5 and to previous concepts of area and perimeter measurement for rectangles with whole number side lengths from Grades 3 and 4 and those with fractional side lengths in Grade 5. There is also within the lesson introduction a brief foreshadowing of future work with right triangles. RIGOR Application - The use of a real-life Kleenex box in the Launch video provides a context for "doing the math" of the lesson. Perhaps the author might consider foreshadowing some more questions about real-life applications of surface area and volume? What do we cover? What do we fill? How can we predict those measures and why would we want to predict them?

	Conceptual Understanding - The lesson uses the coordinate plane to visualize nets and develop conceptual understanding for surface area of triangular prisms and rectangular prisms. Procedural skill and fluency - Students utilize a variety of procedures as they work through the workshop tasks solving for area, surface area, and volume. There is a balance of application, conceptual understanding and skill in the lesson. However, the lesson does not give students the opportunity to reason about right rectangular prisms with fractional side lengths nor extends formulas for the volume of a right rectangular prism to fractional side lengths. The expectation for students in this lesson is that they will be able to draw a net from a given rectangular prism and analyze the net's shape.
Rating: **3 – Meets most to all of the criteria in the dimension**	

Dimension III – Instructional Supports

The lesson/unit is responsive to varied student learning needs: ❒ Includes clear and sufficient guidance to support teaching and learning of the targeted standards, including, when appropriate, the use of technology and media. ✓ Uses and encourages precise and accurate mathematics, academic language, terminology and concrete or abstract representations (e.g., pictures, symbols, expressions, equations, graphics, models) in the discipline. ✓ Engages students in productive struggle through relevant, thought-provoking questions, problems and tasks that stimulate interest and elicit mathematical thinking. ✓ Addresses instructional expectations and is easy to understand and use. ❒ Provides appropriate level and type of scaffolding, differentiation, intervention and support for a broad range of learners. – Supports diverse cultural and linguistic backgrounds, interests and styles. – Provides extra supports for students working below grade level. – Provides extensions for students with high interest or working above grade level. <u>*A unit or longer lesson should:*</u> ❒ Recommend and facilitate a mix of instructional approaches for a variety of learners such as using multiple representations (e.g., including models, using a range of questions, checking for understanding, flexible grouping, pair-share). ❒ Gradually remove supports, requiring students to demonstrate their mathematical understanding independently.	The lesson has six phases in which student understanding of the content is developed. Each phase moves students toward developing an understanding of surface area of right rectangular prisms. The introduction/overview provides background information and a general direction and purpose of the lesson. The learning objectives are clearly identified and correlated with specific standards. 1. Launch - The launch includes concrete examples of creating a net of a shape without any math context. A problem is then posed to elicit mathematical thinking about what net figures are the result of decomposing a cube. The directions for the teacher seem to be clear enough for most educators to follow. It is important, though, to maintain the precise vocabulary, moving students to refer to "vertex" instead of "corner." 2. Pose A Problem - This small group work is used and students have an opportunity to share ideas and determine attributes about a net diagram. The direction to build upon previous activities to lead to the workshop can be effective. The general directions are clear and provide opportunities for differentiation for students, including the possible use of cutting out the figures to check for "net-worthiness." There is a typing error - the last paragraph should read "The purpose of this phase is TO help students (not THE). 3. Workshop - Students embark on a somewhat inquiry-based look at a more complex figure. This can very well serve to elicit a variety of student understanding. If students are not yielding the desired results, it might be nice to provide some questions for teachers to pose to help move student thinking forward without telling them explicitly what to do. - From a bias-review perspective, it might be better to say "designed differently" instead of "more interesting." - Some students might be challenged to take the leap directly from figures with only 1 unit to a more complex shape with multiple units. It might be more beneficial to give some students opportunities to see how the area, surface area and volume changes with greater dimensions.

❒ Demonstrate an effective sequence and a progression of learning where the concepts or skills advance and deepen over time. ❒ Expect, support and provide guidelines for procedural skill and fluency with core calculations and mathematical procedures (when called for in the standards for the grade) to be performed quickly and accurately.	
Rating: **2 – Meets many of the criteria in the dimension**	

Dimension IV – Assessment

The lesson/unit regularly assesses whether students are mastering standards-based content and skills: ❒ Is designed to elicit direct, observable evidence of the degree to which a student can independently demonstrate the targeted CCSS. ✓ Assesses student proficiency using methods that are accessible and unbiased, including the use of grade-level language in student prompts. ✓ Includes aligned rubrics, answer keys and scoring guidelines that provide sufficient guidance for interpreting student performance. *A unit or longer lesson should:* ❒ Use varied modes of curriculum-embedded assessments that may include pre-, formative, summative and self-assessment measures.	Most of the assessment in this two day lesson is formative, through teacher observations and the use of prompts to help students move toward an understanding of nets. This lesson is posted on the www.math.SERPmedia.org website as "diagnostic", however the downloaded PDF version does not make that clear to teachers. The formative methods and activities presented provide many opportunities for the teacher to informally assess student understanding. Answer keys are provided for handouts that provide sufficient guidance for expected student performance. The author might consider showing all the possible nets for the Focus Problem on the Answer Key. At the end of the lesson, the Focus Problem does provide students with an individual opportunity to design a net for a rectangular prism with given dimensions. This is an opportunity for teachers to gauge just how well each student understands the concept of a net and also provides the opportunity for students to demonstrate understanding of surface area and volume. However, teachers are not directed to use the Focus problem in that way. The author might also consider that the Focus Problem is not truly an individual summative assessment of the learning from the lesson as the problem is not a triangular prism and also expects students to extend from a drawing of a rectangular prism to actually drawing the net of the rectangular prism, which they also did not do in the lesson.
Rating: **2 – Meets many the criteria in the dimension**	

Summary Comments

Overall this lesson meets the needs of educators and students to reach the targeted standards. However, students and teachers would greatly benefit from more detail and support to help drive their work appropriately. It would help if it was clear from the very beginning that educators need to access the website for the additional resources.

It provides teachers with a quality introductory lesson to stimulate student interest in and exploration of nets for rectangular and triangular prisms, area of faces, surface area, and eventually volume of those same prisms. There are opportunities in the lesson to support students who need more help and also for students who already grasp the concepts to move ahead to more complex topics through self-motivation and exploration. The hands-on activities on the coordinate plane to analyze the components of nets also provide a bridge for students to connect conceptual understanding to procedures and formulas for surface area and volume and good direction for teachers with regards to "how" these concepts should be taught.

Following is a summary of suggestions for improvement. Details are included in the previous separate dimension sections of this review.
- Include connections between the student expectations for engaging in the content and related Standards for Mathematical Practice.

- Remind teachers of the connected standards for volume of a rectangular prism and the work in the 1st quadrant of the coordinate plane from the Grade 5 standards.
- Provide more directions and probing questions for teachers to use during the Workshop portion of the lesson. As written, this Poster Problem is fine for teachers experienced with the workshop model of teaching, but new teachers and direct-instruction teachers may really struggle. Directions should also include suggestions for how to develop a student mindset that mistakes are a natural part of learning and that products can be made better through editing and revision.
- Supply teachers with more direction as to what might come next after this two-day introductory lesson and where students will need more experiences to master 6.G.A.1-4, especially in dealing with fractional edge lengths, finding the area of any triangle, parallelograms, and trapezoids, drawing polygons in the coordinate plane given the coordinates for the vertices, and applying their understanding in the context of solving real-world and mathematical problems.
- Add instructional supports for addressing ELLs and other diverse learners.

Rating Scales

Rating Scale for Dimensions I, II, III, IV:

3: Meets most to all of the criteria in the dimension
2: Meets many of the criteria in the dimension
1: Meets some of the criteria in the dimension
0: Does not meet the criteria in the dimension

Overall Rating for the Lesson/Unit:

E: Exemplar – Aligned and meets most to all of the criteria in dimensions II, III, IV **(total 11 – 12)**
E/I: Exemplar *if* Improved – Aligned and needs some improvement in one or more dimensions **(total 8 – 10)**
R: Revision Needed – Aligned partially and needs significant revision in one or more dimensions **(total 3 – 7)**
N: Not Ready to Review – Not aligned and does not meet criteria **(total 0 – 2)**

Rating Descriptors

Descriptors for Dimensions I, II, III, IV:

3: **Exemplifies CCSS Quality -** meets the standard described by criteria in the dimension, as explained in criterion-based observations.
2: **Approaching CCSS Quality -** meets many criteria but will benefit from revision in others, as suggested in criterion-based observations.
1: **Developing toward CCSS Quality -** needs significant revision, as suggested in criterion-based observations.
0: **Not representing CCSS Quality -** does not address the criteria in the dimension.

Descriptor for Overall Ratings:

E: **Exemplifies CCSS Quality –** Aligned and exemplifies the quality standard and exemplifies most of the criteria across Dimensions II, III, IV of the rubric.
E/I: **Approaching CCSS Quality –** Aligned and exemplifies the quality standard in some dimensions but will benefit from some revision in others.
R: **Developing toward CCSS Quality –** Aligned partially and approaches the quality standard in some dimensions and needs significant revision in others.
N: **Not representing CCSS Quality** – Not aligned and does not address criteria.