Standards and Assessment Development

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ED5023 – Fundamentals of Integrated Thinking

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June 6th, 2021

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It is widely discussed that there are three key elements to education. The first element is planning. Every lesson must be planned, from the overarching goals and standards, to the practical things like notes sheets and warmups. Teachers must understand the big idea of a unit and then plan the structure and sequence of the unit to guide students towards the big idea (Olson, 2008). The second element is likely the most widely discussed element of teaching: instruction. Instruction is the vehicle through which information is passed on to students. More simply put, instruction is passing of knowledge. This is the part that typically comes to mind when you hear the word "teaching". The third element is assessment. Assessment is used for two purposes, collecting evidence of learning and providing feedback to encourage students to reach their full potential (Stiggins, 2008). While each of these elements are important in their own right, they must also be combined in order for teaching to have its optimal outcomes. Each of these elements has strong relationships with each other, but perhaps the most intriguing relationship is the one that exists between planning and assessment.

Part One: Table of Test Specifications

When planning a unit of study, it is important to have the summative assessment in mind. As mentioned above, assessment is often used as a way to collect evidence of learning. For this reason, teachers must know what evidence they will be collecting before they begin the learning. Before any of this process can begin, teachers must begin by identifying the standard of education that they will be teaching. Once this has been identified, teachers should unpack the standard to determine essential questions brought up by the standard. Essential questions should guide students toward personal experiences and content knowledge (Miller, 2021). Using the essential questions, teachers should create learning objectives, otherwise known as learning

outcomes, that they wish the students to learn. Once all of these have been identified, the outline of a summative assessment should be created. When creating an outline for a summative assessment, it is often helpful to use Bloom's Taxonomy to determine the levels of thinking required by each learning target. Once these levels of learning have been determined, teachers should ensure that these are reflected in their assessment questions. The process of linking assessment and planning is a complex one, and organization is key. One organizational tool that many teachers and school districts use is a table of test specifications. A table of test specifications has been created below for a unit on trigonometry.

Table of Test Specifications

Standard: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems				
Unit of Study: Right Triangles				
Grade Level: 10		Content Area: Geometry		
Total Points: 10		Type of Items: Multiple Choice		
	Bloom's Taxonomy Cognitive Levels Number and Percent of Items Per Level			
Objectives	Level: Remembering	Level: Applying	Level: Analyzing	Total/Percent
Students will memorize the Pythagorean theorem and the six trigonometric ratios.	3 (30%)			3 (30%)
Students will be able to explain the correct right triangle solution path.			3 (30%)	3 (30%)
Students will be able to apply the Pythagorean theorem and trigonometric ratios to indirect measurement and 2-dimensional distance problems.		3 (30%)	1 (10%)	4 (40%)

Total:	3 (30%)	3 (30%)	4 (40%)	10 (100%)

Part Two: Curriculum Map

The link between assessment and planning is not yet complete. As discussed above, there are two major uses for assessment. The summative assessment planned above only covers one use for assessments; collecting evidence of student learning. The other major use of assessment has not yet been covered. The second use is to provide feedback that will encourage students to reach their full potential. This type of assessment is commonly referred to as formative assessment. Formative assessments should also be planned ahead of actual instruction. On top of planning out the type and format of formative assessment, timing is also crucial. In order to help organize all of this, a concept map is often used to map out when a formative assessment is necessary. Another perk of concept mapping is that it allows a teacher to quickly scan their assessment types to ensure that assessments are meeting the needs of diverse learners. A concept map has been created below for a unit on trigonometry.

Concept Map

Standard: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems	
Learning Objectives: 1. Students will <u>memorize</u> the Pythagorean theorem and the six trigonometric ratios. 2. Students will be able to <u>explain</u> the correct right triangle solution path. 3. Students will be able to <u>apply</u> the Pythagorean theorem and trigonometric ratios to indirect measurement and 2-dimensional distance problems.	
Grade Level: 10	Content Area: Geometry

Unit Title: Right Triangles	Length of Unit: One week
Description: Students will learn about the Pythagorean Theorem and right triangle trigonometry. They will memorize the formulas and learn how to distinguish between the usage of the two solution methods. They will then apply this knowledge to real world situations such as indirect measurement and 2-dimensional distance.	

Essential Questions	Knowledge and Skills	Assessments	Activities	Resources
How do you use the Pythagorean theorem and trigonometry? How do these concepts differ in their usage? How do you use these concepts to find indirect measurements and 2-dimensional distance? How are these concepts integrated and used in the real world? How do these concepts allow me to live an easier life? How do I use these concepts in the future?	The Pythagorean Theorem Formula The six trigonometric ratios (SOH CAH TOA) Plugging expressions into a calculator Which solution path to use based on information provided in the problem Using the two solution paths to solve real-world problems Usage in everyday technology	Pretest - Day 1 Exit Tickets - Days 2, 3, and 4 Summative Assessment - Day 5 Reflection of learning - Day 5	History of the Pythagorean Theorem (it was NOT discovered by a great guy named Pythagorus) Measure the height of the school	Equipment to measure angle of elevation to the school and the distance from the school Guided notes

Calendar				
Day 1: Pretest	Day 2: Discuss brief history of the Pythagorean Theorem Guided notes on formulas for Pythagorean theorem and right triangle trigonometry Exit Ticket #1	Day 3: When to use each solution path. Discuss the difference in given information and how this informs solution path Exit Ticket #2	Day 4: Guided notes on application problems Measuring the height of the school activity (Exit Ticket #3)	Day 5: Summative Assessment Reflection on Learning

Rationale for Assessment Choices

It is important to have a balanced assessment approach. A pretest is administered on day one for two reasons. First, it is helpful for the teacher to have a diagnosis of what students know and what they do not. This allows for the teacher to adjust their teaching to spend more time on what the students do not know, and less time on what they do. Second, for reflection purposes it is important for students to have an understanding of the prior knowledge that they are bringing with them into the new unit. The exit tickets given throughout the unit serve as formative assessments. The exit tickets are less formal than a quiz or a typical formative assessment, but allow the teacher to see the learning of each student. The teacher ends each class by going over the exit ticket, so students are provided with instant feedback. Instant feedback allows the students to be aware of their own mastery level and adjust. The exit tickets are graded in a “trade and grade” fashion. Day four contains a performance exit ticket where students will get hands on and measure the height of the school via indirect measurement. The end of unit summative will provide evidence of student learning. This evidence will be analyzed by the Geometry

professional learning community to determine mastery level and ensure that students are ready for the next unit. Immediately after the summative assessment students will take a learning reflection where they will assess themselves on their mastery levels, as well as other various behavioral topics such as: time spent studying, homework completion, and focus in class. The reflection is done for metacognitive purposes.

Conclusion

Of the three main elements of education, the most intriguing link lies between planning and assessment. The two are closely tied together, and much work is required to properly plan a unit. To help with this, organization is key. Two great methods for organization include the table of test specifications and concept mapping. In this paper an example of each is provided for a unit on right triangles in a high school geometry class.

References

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