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CEP 813

Formative Assessment Design Version 1.0

Link to Formative Assessment Design Version 2.0

Assessment can be used for a variety of purposes, including giving grades to students and even evaluating teachers and schools. Classroom assessment, on the other hand, is the kind that "can be used as a part of instruction to support and enhance learning" (Shepard, 2000, p. 4). It can be used to inform teaching and provide feedback to students.

Formative Assessment to Support Learning and Inform Instruction

By moving assessment from the end of the unit to the middle, it becomes formative and can be useful for helping students learn. Formative assessment is dynamic assessment, giving teachers the opportunity to find out what students are able to do on their own or with adult help and guidance (Shepard, 2000).

By making students' thinking visible and open to examination, it can reveal what a student understands and what misconceptions they hold (Trumbull & Lash, 2013). It also provides opportunities for scaffolding steps between one activity and the next, for each individual student (Shepard, 2000).

In Understanding by Design, Wiggins & McTighe (2005) identify three types of "uncoverage" (p. 46) to help teach for understanding so that students can learn more, avoid forgetfulness, and be able to transfer what they know to other situations. Through "focused questions, feedback, and diagnostic assessment" (p. 46), teachers can uncover misunderstandings, questions, assumptions, and core ideas of a subject to inform instruction.

Taking it a step further, teachers must use what they discover and uncover through formative assessment to inform their instruction. By doing that, they help to bridge the gap between what students know and what they are learning, allowing students to construct their knowledge.

Name and Purpose of the Assessment

5th Grade Robotics: Programming a Robot to Move 3 Plastic Blocks Autonomously

As part of this unit of study, students program a robot to drive autonomously (with minimal human intervention). After learning the basics of the coding environment and programming the robot to move autonomously in a straight line and a square, they program the robot to complete a task of physically moving three plastic blocks. The final task is anchored by a real-world problem and could have multiple solutions. The completion of this task requires students to understand how to modify their physical robot to most effectively move the plastic blocks, how to apply what they have learned about coding, and how to use computational thinking skills to determine a path for their robot to follow.

The transition from driving their robot in a square to solving the real-world problem is a challenging one. This authentic performance-based task shows “evidence that students are able to use their knowledge in context” (Wiggins & McTighe, 2005, p. 152). It requires that they “do” the subject, using innovation and judgment, and allows them to participate in the feedback loop of “rehearse, practice, consult resources, and get feedback on and refine performances” (Wiggins & McTighe, 2005, p. 153).

At this point in the unit, they will have already successfully driven in a square, demonstrating the ability to autonomously move the robot straight and to make turns. For the purposes of Formative Assessment Design Version 1.0, they are at the step of trying to solve the real-world problem with their robot. Students have multiple opportunities to go through the loop of programming, testing, and modifying their code until their robot completes the task.

In order to see what students have done so far and to provide feedback, I will require students to take a video of their robot attempting to move their three plastic blocks to the designated area. They will also provide screenshots of their code in process, and they will narrate why they used the code that they did.

Unit-specific goals are based on the formal goals found in the Next Generation Science Standards:

3-5-ETS1-3. 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.

• Science and Engineering Practices – Using Mathematics and Computational Thinking – Builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

Learning About Students' Learning Processes

At this point in the assessment, I would like to know the following about students' learning processes:

1. How students use the input and output devices on their robot.
2. How students understand the use of different event blocks in programming.
3. How students understand and interpret the final problem of moving three blocks off the competition field, and how they plan to move the blocks.
4. How students use computational thinking to apply what they have already learned about the distance their robot travels using certain blocks of code to the problem of moving the blocks off the competition field.

Assessing This Formative Assessment Using Rubric 3.0

The assessment rubric that I have been developing, Rubric 3.0, identifies eight criteria that I think are necessary for a well-designed assessment. As part of designing this formative assessment, it makes sense to see how well it is designed as compared with my criteria for an effective assessment.

Some of the criteria could be judged as met or not met, depending on the circumstances. I will clarify below what circumstances should be in place in order for each criterion to be met.

1: Timely feedback

My plan is to provide feedback to students early enough that they can improve their work before submission of a final project. Feedback will be given verbally, either in person or through voice recordings or videos.

2: Direct and specific feedback

Rubric 3.0 calls for summative feedback to be written, provided in a timely manner, and specific to the student (does not compare students with each other). This formative assessment may provide feedback in writing or verbally, in person or digitally. All feedback given will be specific to the individual student or the student group and will not compare students with other students.

3: Aligns with established goals

As noted earlier, established goals are from the Next Generation Science Standards (NGSS). Unit-specific goals have been identified based on NGSS. Criteria for meeting the unit-specific goals have been written in a rubric for the final summative assessment. The formative assessment described in this document takes place as students are working to meet the criteria of the summative assessment.

4: Transparent learning targets

Learning targets are provided to students at the beginning of the process. They are available to students within the learning management system we use for the course. They may refer to those learning targets at any time, and if they are ever unclear about what the learning targets are, they may ask me for clarification.

5: Self-assessment component

Self-assessment occurs naturally within this project as students work to build and modify their robot, code it to complete the task, and evaluate their design. Each time that they test their robot with the objective in mind, they are able to self-assess and revise.

6: Requires only target knowledge, skills, and abilities (KSAs) to complete

Target KSAs for this task are:

- knowledge of how to use an iPad, including several applications
- the ability to sign in on two applications
- fine motor skills to build their robots
- coding skills to program their robots
- computational thinking skills to calculate the path for their robot

One non-target KSA for this unit is that it requires a lot of reading. Instead of requiring students to read the introductions to each lesson, we typically read and discuss them as a whole group.

7: Requires transfer of knowledge to demonstrate understanding

This assessment requires students to complete an authentic performance-assessment that is based on a real-world problem. According to Wiggins & McTighe (2005), an authentic performance-assessment should include at least one facet of understanding. This one includes three facets of understanding: interpret the problem, apply what they know to solve an open-ended problem, and explain what they have learned.

8: Social component

This assessment includes a small group (2-4 students) in which students work collaboratively to build and program a robot across multiple class periods. This task does not have a pre-determined solution but is one in which students must solve an open-ended problem without one right answer. As part of the assessment, students must navigate social situations such as determining a course of action, assigning group roles, or helping an absent group member understand or catch up.

Digital Tools for Assessment

Digital tools, used thoughtfully, can support the work of providing feedback to students. I am considering the following tools for this formative assessment:

Seesaw

I am considering using Seesaw, a tool that is useful for collecting videos, photos, and screenshots from students, and also for easily providing feedback to the students. Students can capture videos and photos in the Seesaw app, or they can upload files they created in other applications. Seesaw is a learning management system, allowing teachers and students to share files back and forth. But it also allows for annotating by both teacher and the students, with the ability to add text, drawing, or voice-overs to files.

Thinglink

When students share screenshots of robot code with me, they usually need feedback about what the code does, how it works, and what can be improved. Thinglink allows me to add hyperlink tags on images, so I can annotate screenshots of code and draw students' attention to specific places on the image.

QuickTime

I often review and comment on video footage created by students. Occasionally, I also need to share new video content with my students. At times when I want to create a screencast to demonstrate and narrate a coding example that might be useful to my students, Quicktime is one option for me to use. It is free, already on my computer, and I already know how to use it.

References

Shepard, L. (2000). The role of assessment in a learning culture. Educational Researcher, 29(7), 4-14.

Trumbull, E. & Lash, A. (2013). Understanding formative assessment: Insights from learning theory and measurement theory. San Francisco: WestEd. Retrieved from www.wested.org/online_pubs/resource1307.pdf

Wiggins, G.P. & McTighe, J. (2005). Understanding by design. Alexandria, VA: Association for Supervision and Curriculum Development. Retrieved from http://p2047-ezproxy.msu.edu.proxy1.cl.msu.edu/login?url=https://search-ebscohost-com.proxy1.cl.msu.edu/login.aspx?direct=true&db=e000xna&AN=133964&scope=site