HEOV
Hearing Each Other's Voices

A Survey Tool to Reveal Student Thinking

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Problem Statement

Supporting the communication skills of English learners and others from marginalized backgrounds is a unique discipline-specific challenge for teachers. Although listening, speaking, reading, and writing can be conceptualized as broad skills, each responds to subject-specific contexts in different ways. For example, speaking in mathematics may be different than in history, with different vocabulary and ways of knowing/communicating.

Ability in and confidence for communication in STEM topics, in particular, can be a contributor to success in these subjects and selection into STEM majors and careers (Suh et al., 2020). Pedagogical and curricular innovations can improve students' motivation, engagement, skills, and knowledge by using, for example, project-based learning to make concepts concrete (Krajcik, & Blumenfeld, 2006; Wijnia et al., 2024). However, students themselves have thoughts and feelings about their learning that, when made visible, can provide valuable information for teachers to use in improving their teaching. And, the act of providing these thoughts and feelings can also further support valuable communication skills as students reflect upon their current knowledge, understandings, skills, and motivation, and how they can reach the next level of their learning.

By encouraging student reflection, teachers can provide an avenue for practicing STEM communication in a way that values and supports student agency. With frequent opportunities to reflect, students should refine their thinking as they develop STEM understanding. These reflections provide teachers with information they can use to identify class-level and individual differences and target their lessons to support specific areas of need.

Implementing a Survey

Surveys can provide information both on student understandings and on their motivational or affective responses to a topic or material. Questions should be chosen to provide the information teachers need to judge the effectiveness of a lesson in light of their school and district goals and standards.

Our example focuses on content taught within an International Baccalaureate (IB) World School with a Primary Years Program (PYP) and a Middle Years Program (MYP). Within the PYP, teams plan, teach, assess, and reflect upon transdisciplinary units of inquiry. The inquiry units are guided by a central idea, which is supported by three lines of inquiry. The lines of inquiry are content and conceptually-focused. The school emphasizes student reflection and questioning as essential components of the learning

process and as key elements of the IB Approaches to Learning (ATL), particularly the skills of reflection, communication, and self-management.

Implementing brief pre- and post-instruction student surveys provides educators with valuable formative data by capturing both individual students' prior knowledge and understanding, as well as overall class trends related to a unit, line of inquiry, or targeted skill. In addition, we use graphics-based motivation surveys validated with students as young as second grade (Rutherford et al., 2021).

A pre-survey provides a baseline measure of students' understanding and motivation for the topic. In our example, we first introduce a line of inquiry with a provocation related to the overall unit topic before asking the students to type the line of inquiry in their survey. This ensures that all students are on the same page regarding what they are reflecting on and gets them in the practice of referencing specific topics—something that can aid their question asking and future communication. Students then answer two rating questions anchored with tomato emojis ("tomojis"):

What is your level of understanding for this line of inquiry?

I'm just getting started.	I understand some parts.	I can explain it to someone else and can connect it to other topics.
		

How interested are you in this line of inquiry?

Not at All	A Little	A Lot
		

After providing their rating, students answer two open ended questions: *What is something you know about this line of inquiry? What is one question you have about this line of inquiry?*

The post-survey asks these same questions and adds an additional question directing the students to upload a picture of an artifact demonstrating their learning: *Select and attach one piece of evidence you*

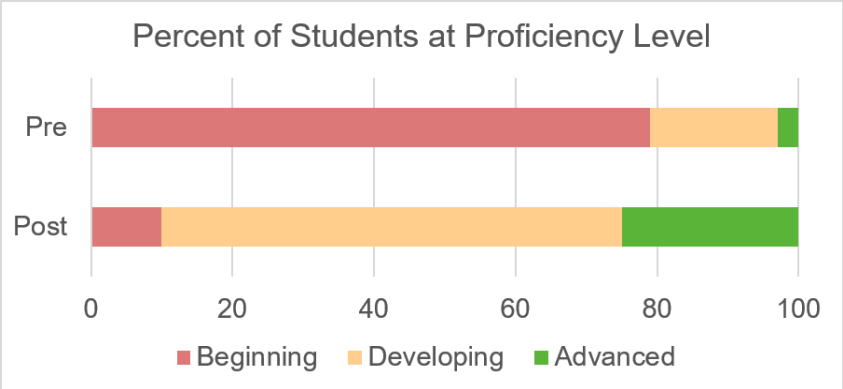
created for this line of inquiry that shows your learning and what you are most proud of (writing, diagram, foldable, drawing photo of group work, etc.).

Both surveys end by providing students an opportunity to offer additional feedback or questions with, *Is there anything else you want to tell or ask your teacher?*

Resulting Data

In creating these example surveys, our aim was to present a tool that could efficiently gather useful information. Both McGuinness and Rutherford have had experience administering similar tools in classes from first through fifth grade. Students generally find the example surveys easy to answer, and they require minimal classroom time.

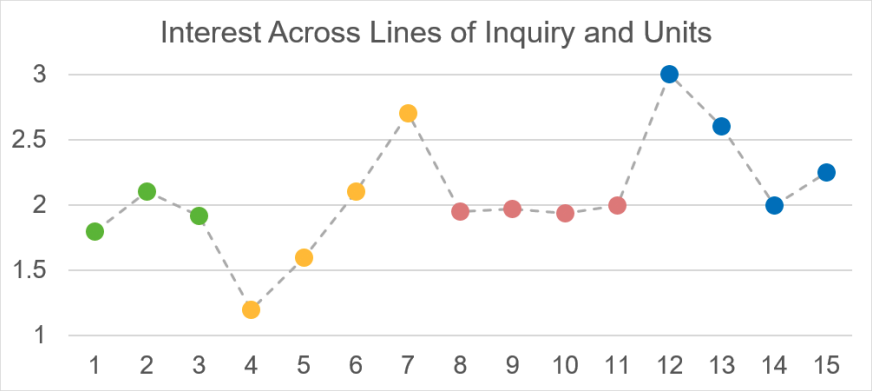
Data resulting from these surveys can provide an average for the class across pre- and post-instruction, as is seen in the example graph below. For a given line of inquiry, teachers can get a quick look at where students rate their level of understanding. Here, the change from before (pre) to after (post) instruction shows a beneficial pattern. Students generally reported improved understanding after the lessons. However, there were still a small group who reported that they were "just getting started," even after completing the lessons. The teacher would be able to investigate these students' individual responses.



An example of individual responses for proficiency are below. Whereas most of the students show growth from pre to post in their estimates of understanding, two students do not. One student, Joseph, starts the line of inquiry saying he can already explain the topic and back it up with evidence, but after learning, he adjusts his estimate of understanding down. Given the tendency of individuals to be overconfident, especially those new to a topic, (Kruger & Dunning, 1999), it is not surprising that some students will start a line of inquiry reporting advanced proficiency and calibrate as they learn more. More concerning might be the lack of growth in another student, Xavier, who started and ended the unit reporting that he is still beginning his understanding. The teacher can investigate further to see if there is other evidence in Xavier's work to explain this result. With evidence, the teacher can form a course of action.

	Pre	Post	Growth
Adrian	2	3	1
Carly	1	2	1
Joseph	3	2	-1
Maribel	1	3	2
Xavier	1	1	0

By administering the survey across lines of inquiry, teachers can also examine trends in content. Below, student mean post-survey interest is graphed across 15 lines of inquiry, divided in four units. With these data, a teacher can assess how student interest waxes and wanes with changes in content. For units one (green) and three (pink), interest is relatively stable. Unit two (yellow) starts with interest near the floor (1 = “Not at all interested”) but gains quickly and nears the ceiling as the lines of inquiry progress. The teacher may want to examine the provocation for that unit to make sure it is one that is relevant to the student population so that students are engaged in the unit from the start. Conversely, unit four (blue) starts strong, at or near the ceiling, but declines across lines of inquiry before recovering to slightly above average interest of units one and three. The teacher can investigate further to see if there are any drawbacks from this decline.



Using the Data

Pre- and post-instruction survey data are intended to serve as a collaborative tool for grade-level teams and professional learning communities (PLCs) to strengthen instructional decision-making and improve student outcomes. Rather than examining individual student performance alone, teams can analyze aggregated survey responses to identify patterns in student understanding, misconceptions, confidence levels, and the quality of student-generated questions and reflections.

Within PLC meetings, we can use this data to identify common strengths, misconceptions, and instructional needs; examine the progression of students' reflective thinking and questioning skills, particularly their ability to generate increasingly rigorous and meaningful questions; and to identify opportunities for differentiation and intervention, especially for English learners and students with

limited background knowledge or academic language. Students will also be invited to upload, share, or describe an artifact that demonstrates their learning, providing an additional source of evidence beyond self-reflection and allowing educators to examine how students apply and communicate their understanding through authentic products and performances.

The collaborative analysis of survey data and artifacts also supports continuous improvement by encouraging teachers to share successful instructional practices and make evidence-based adjustments to curriculum and instruction.

Ultimately, the surveys are intended to function as both a formative assessment tool for student learning and a collaborative inquiry tool for educators. By engaging in ongoing analysis of student reflections and questions, grade-level teams and PLCs can foster a culture of reflective practice that mirrors the inquiry process expected of students.

Pilot Study

To test the usefulness of this survey tool, we will launch a pilot study focused on upper elementary students in grades four and five within the PYP noted above. Teachers and students in five classrooms will be included. Before using the surveys, cognitive interviews will be conducted with third-grade students, representing the lower bound of the target students. Interviews will focus on readability and student ability to understand and respond to questions.

Participating students will engage with the pre-survey before each line of inquiry is introduced. While the problem of practice focuses on STEM-related content, the survey has been designed to be adaptable and applicable to multiple disciplines. Using the survey across multiple disciplines will provide data that will help determine the overall usefulness of the survey tool.

Prior to administering the survey, participating teachers will collaboratively review the survey tool and determine a protocol for introducing and facilitating the completion of the survey. After administering the first pre-survey, they will analyze resulting student data to identify trends. This information can be used to adjust the unit planning for learning experiences that address student needs and interests. Teachers may use the survey results to inform specific instructional strategies, vocabulary, and resources for learning and teaching.

Upon completion of the line of inquiry learning experiences, students will complete a post-survey. Participating teachers will collaboratively plan and consistently administer the post-line-of-inquiry survey. As a PLC, teachers will analyze the survey results, including the self-ratings, shared artifacts, and newly developed student questions shared via the survey.

This process will be completed for each line of inquiry in each transdisciplinary unit. The PLC will continue to analyze the results of surveys to inform their practices over the course of the year.

Ultimately, participating teachers will determine if the survey tool provides actionable information to enhance the learning experiences and outcomes for students.

Data collected will include student surveys and information on teacher implementation as indicators of usefulness (e.g., number of surveys given, time spent in PLC on survey data). In addition, we will develop a survey to gather end-of-year teacher feedback on the usefulness of the tool. Survey questions may include these:

- How did you feel about the usefulness of the pre- and post- survey?
- How did student responses change over the course of the year?
- How did student motivation change over the course of the year?
- What role did this tool play in your PLC time?
- What influence did the surveys have on your instructional practices (e.g., planning, implementing specific strategies, developing or making time for learning experiences that addressed students' questions from the pre- and/or post-surveys)?
- How would you adjust this survey tool or process to make it more effective?

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