Science Teaching Brief Podcast

Host:
Welcome to this podcast hosted by the U.S. Department of Education's Office of English Language Acquisition (OELA). We are here with Elizabeth Judd, an Education Program Specialist from OELA and Martha Castellón Palacios, Senior Program Associate at WestEd, to discuss the *Integrated Language and Science Content Teaching Brief* produced by OELA. This teaching practice brief draws upon recommendations from the National Academies of Science, Engineering, and Medicine's 2018 report titled *English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives.*

Today, we're going to explore five key practices presented in the brief–practices that can support science teachers as they design quality classroom instruction for English learners. These practices include: (1) Embracing asset beliefs that position and support English learners as full participants in disciplinary learning, (2) Engaging English learners in disciplinary practices, (3) Providing scaffolding as a way of supporting students' engagement and comprehension of challenging content, (4) Engaging English learners in meaningful interactions with other students and teachers, and (5) Providing an explicit focus on how language functions in the discipline.

With growing numbers of English learners in U.S. schools, content educators are in need of practical and effective instructional approaches that can help them create access to their content areas for this population of students. It is our hope that this podcast and the teaching brief can provide teachers with food for thought as they design quality classroom instruction for English learners.

Let's get the conversation started….

Liz:
Thanks for being with us today, Martha. We're hoping to provide our listeners with some key understandings about how teachers can address the needs of English learners in Science.

Martha:
Of course. I'm happy to be here. As a teacher, I was always really excited to hear about the latest research and findings for teachers of English learners. So, I hope that both the brief and this podcast are helpful to our colleagues who are teaching Science.

Liz:
What do you want listeners to know about this brief?

Martha:
First of all, I'd really like them to know that despite the diversity of English learners with their differing levels of English language proficiency and familiarity with science concepts, there are some evidence-based practices that teachers can use to teach academic language and science in a coherent, integrated way.

Liz:
Great! Get us started, please. What are some of these practices?

Martha:
Today I'm going to focus on five practices that can inform instructional decisions teachers make no matter what grade they teach. I don't want to overwhelm anyone, so I'm going to tackle them one at a time—first discussing the larger, more general findings and gradually focusing on those that are more particular to the instructional setting.

Liz:
So, the first practice is embracing asset beliefs that position and support English learners as full participants in disciplinary learning. Can you elaborate on this?

Martha:
This practice is about the attitudes that teachers can demonstrate toward their English learners. I want to unpack this. As teachers, our goal is to fully involve or engage our students in the content—whether it be the molecular structure of carbon dioxide or the water cycle. We want our students to experience science by relating it to their daily lives, not simply listen to what we have to say about—oh, say—building a closed circuit. So, in order to do this, teachers have to embrace asset beliefs. That is, they have to project positive beliefs about students' ability to do and understand science. They give them credit, if you will, for the assets—background information, prior learning, and cultural and linguistic resources—they bring to the classroom.

Liz:
So, in other words, teachers should expect that students have something in their previous life experiences and educational experiences that they can build upon.

Martha:
Exactly. A teacher cannot go into a classroom thinking that his/her students have been educationally deprived of science learning and that they will be unable to engage with the content. They need to tap into what researchers call students' Funds of Knowledge—the cultural, linguistic, and content resources that students bring to the classroom.

Liz:
Okay. What does this look like in practice?

Martha:
Well, one way to do this is by making positive statements that communicate to students that their teachers have great confidence that they can learn. For example, teachers should avoid saying things like, "I know this is really hard. You might not get it because you've never heard of this before." Okay, a teacher might not actually say this. But a teacher could think this and that is precisely what they should avoid. Students may be able to pick up on a teacher's low expectations, and may be less likely to participate, take risks, and ask questions. Instead, a teacher should find ways of authentically expressing his/her belief in students' abilities and value students' experiences. For example, a teacher could say, "I know many of you have lived by the ocean. I'm sure you have some great predictions about what could happen to the earth if sea levels rise."

Liz:
Great. So that's fairly straightforward. A teacher should believe in students' abilities, value their knowledge and experiences, and act accordingly!
Martha:
Right!

Liz:
What's another practice?

Martha:
The second practice described in the brief is that of engaging English learners in disciplinary practices. Let me first explain what I mean by disciplinary practices. Disciplinary practices are the practices in which students must engage over and over again within a particular discipline or subject. In science and engineering there are certain disciplinary practices. The Framework for K-12 Science Education describes them in depth.

Disciplinary practices in science include: asking questions and defining problems, developing and using models, planning and carrying out investigations, and analyzing and interpreting data. There are others too. But to get to the point, teachers need to provide students with opportunities to actively participate in these disciplinary practices.

Liz:
Again, can you give an example?

Martha:
Sure. Take the scientific and engineering practice known as planning and carrying out investigations. Students need to be able to understand that carrying out systematic investigations or experiments is one way in which knowledge is constructed in science. Now, some teachers would say their English learners are not able to participate in the planning or execution of scientific experiments due to their limited English proficiency. While it's true that students are developing their English proficiency and knowledge of science, they must still have opportunities to plan and carry out various kinds of investigations during their K-12 education. In the beginning, investigations can be structured and supported by the teacher. Students can be involved in measuring, collecting, organizing, and analyzing data. Later, as students' language proficiency increases, students can formulate their own questions and design their own experiments. It's important to realize that doing science not only develops students' science-related concepts but builds in them a positive identity as someone who engages in scientific study.

Liz:
I see. So, we shouldn't prevent students from doing science just because they're still learning English.

Martha:
Correct. It's so important that students see themselves as capable of doing science. And we should provide them with adequate support. We'll get to that next.

Liz:
Okay. Don't stop. That sounds like a good segue.

Martha:
Yes, definitely! The next practice that's highlighted in the brief is that of providing scaffolding as a way of supporting students' engagement and comprehension of challenging content.

Liz:
Scaffolding as a way of supporting students' engagement and comprehension of challenging content. Hmm… Break that down for us, if you don't mind.

Martha:
Scaffolding is a term that many teachers are familiar with, especially when used in the context of teaching English learners. But it's often misunderstood as a strategy for making things easier for English Learners. We do not want to make instruction "easier" for English learners. We want to keep it challenging. What scaffolding does, and here I'm going to quote Walqui and van Lier, is provide "temporary support to English learners with the goal of developing students' autonomy."

Liz:
Let's stop there for a moment. The support is meant to be temporary, right?

Martha:
Yes. Otherwise, it becomes a crutch and actually prevents students from advancing. Scaffolding is absolutely meant to be temporary. Let me give you an example. Let's imagine we're in a fifth-grade class and students are reading an informational text about food chains and food webs. Before a teacher has students read an informational text, the teacher allows students the opportunity to talk about what they know about the topic. The teacher might seat them in groups of four and give them a picture card that illustrates a food chain. She then gives them a question that they must each answer in a round robin format. The first question is: What is the relationship between the objects in this picture? The round robin format is a familiar routine for students because they've used it before on previous occasions. Each student in the group of four takes a turn articulating what they understand about the picture. Students can say things like: "it shows what animals eat" or "The Mountain Lion eats the snake. The snake eats the mouse. The mouse eats the seeds." Another student might say. "Some animals eat meat. Other animals eat plants." Even if students are not accurate in their understanding of the relationship between various parts of the illustration, they know that the lesson is going to be about some aspect of the natural world…animals and plants, snakes and mice, what eats what, etc. So, what the teacher has done is used visuals to stimulate student interaction on the topic of interest in the lesson. This is a form of scaffolding.

Liz:
Okay, I'm familiar with the concept of introducing visuals and having students talk about them.

Martha:
Yes, but it's important to know that you can't simply say. Here's a picture. Now talk about it. Students might not know what to say. It's important that you give them a structure for how they

are going to engage with one another. In this case it's done by giving them a question to answer and by requiring them to respond in a round robin format. This way everyone gets a turn to say something and no-one can interrupt.

Liz:
How would you build on this short interactive activity?

Martha:
Well, depending on students' needs, the teacher might feel that they're ready to read a related text. But rather than asking them to read it individually, she can ask them to read it in pairs using what we call a clarifying bookmark—a strategy that allows them to read a small segment of text and summarize it, make a connection, or formulate a question. Their partner then responds to their statement, either by providing an example, providing a different answer, or simply validating the person's statement. This is another form of support or scaffolding. Of course, you're not always going to ask students to read this way. As they begin to increase their content knowledge and language proficiency, these kinds of activities can be used less frequently. Remember, scaffolds are meant to be temporary.

Liz:
We've covered three of the recommended practices in the brief. What's the fourth?

Martha:
The fourth practice has to do with giving students more opportunities to have meaningful, oral interactions with their teachers or peers about academic topics. Researchers have found that, in general, teachers do the vast majority of talking in their classrooms. There are good intentions behind this, of course. Teachers have an immense amount of curriculum to cover in the course of a semester, and an expeditious way of getting through it is by delivering it orally. Unfortunately, this strategy does not allow students to develop the science practices we mentioned previously. Take the science practice of asking questions and defining problems—this practice is inextricably tied to language production. How can students ask questions and define problems without opportunities to practice doing this? But if you give students opportunities to engage in hands-on science experimentation and observation, they are forced to use language. Here's another example of a science practice: analyzing and interpreting data. Students can engage in this practice by orally presenting their interpretations of the data to their peers, for example. And yet this is incredibly language intensive. In order to engage in analyzing and interpreting data, students must engage in the processing of information—whether it be words, tables, or graphs—all of which involve language at some level. Not only that, students also have to use language in order to express their understanding of the data. Pair work is a great way to give students the opportunity to practice presenting their interpretations orally.

Liz:
So how do you get English learners to use oral language if they don't feel confident with their English abilities?

Martha:
That is such a good question! One of the great things about having students work in groups is that it's low stakes. So long as they're not competing with each other and they have the same objective, they can help each other and participate at whatever level they feel comfortable. But the key is that they participate! And that's where providing students with appropriate tasks and scaffolds comes in.

Liz:
Got it. So, teachers have to provide appropriate tasks and activities to stimulate this kind of interaction.

Martha:
That's right!

Liz:
That brings us to practice number five.

Martha:
Yes, this one is a tricky one because it has to do with language. When teaching science to English learners, teachers can provide students with an explicit focus on how language functions within the discipline of science. What this means is that teachers can make students aware of what the language of science is, what genres exist within science, how the language is structured, and how to deal with various challenges that it presents.

Liz:
I hear a lot about the importance of teaching scientific vocabulary. Is that really all it is?

Martha:
That's a great point. No, teaching the language of science is so much more than just introducing them to the vocabulary that they will come across in scientific explanations and texts. It's part of it, but it's not everything.

Liz:
Let's talk about what you might do with a class of newcomer English learners.

Martha:
Sure. As you know there is wide variation in the prior knowledge and school experiences that newcomer English learners bring to the classroom. If students have prior school experiences in their home countries, then they may bring with them quite a bit of prior knowledge about science. For other students, this might be their first time learning science in a formal setting. Regardless, in the very beginning, give kids experiences with science. Allow them to manipulate artifacts, classify objects, conduct simple experiments, and at the same time provide them with rich opportunities to hear and use language. Over time, they'll begin to internalize the meanings of various words and phrases and will be able to produce more and more language on their own.

Liz:
Okay, what about kids who have relatively intermediate levels of English proficiency? They're not starting from zero, but they don't speak, read, or write with fluency yet.

Martha:
You still want to give students opportunities to do science, but now you expect them to read scientific explanations—a whole different genre from what they experience in math or social studies. This is where you begin to have students recognize various features of scientific texts, depending on their purpose. For example, there are often lots of photos or visuals in science texts and these visuals are accompanied by captions which may not be written in complete sentences. Also, science texts are divided by section headings and these section headings introduce the reader to the main idea or focus of the text that follows. Even at the intermediate level, teachers can provide students with opportunities to create science texts of their own in which they explain processes or interpret their findings. You do talk about vocabulary, of course. But you talk about the vocabulary in context—not as separate words with specific definitions that you introduce at the beginning of the lesson.

Liz:
I have to ask. You know what's coming. How do teachers address the needs of more advanced English Learners?

Martha:
Aha! So, this is where you can begin to work on the subtler aspects of language—this is when you can really go into depth on the linguistic features of language, talk about the use of nominalization in scientific texts and the density of concepts, this is where they can really build their stamina with respect to reading and writing and do work in the study of prefixes and roots. But let me clarify. You don't proceed through these phases of instruction in lock-step fashion. I don't want to give you the impression that you can't introduce these features before they reach the advanced stage. You can introduce them as long as you do so in context and in the spirit of building disciplinary concepts.

Liz:
This has been absolutely fascinating, Martha. Thanks so much for making time to talk to us about this important topic.

Martha:
My pleasure.

Host:
Thank you for discussing the Science Teaching Brief with us today. You've given us many useful teaching tips and things to think about as we continue to serve English learners in classrooms across the country. As this podcast comes to a close, I encourage all of you to visit the NCELA website at www.ncela.ed.gov to download a copy of the science teaching brief and check out the many other resources available to educators