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How do I balance teacher lead instruction versus student lead instruction in my science classroom? This has been a question I have had throughout my early teaching career and throughout this course. At the end of many of my science lessons, I have questioned whether I explained enough or allow students enough time to explore? I want to ensure that the needs of my students are being met and that they also find themselves having fun and inquiring about science as they learn. There are times where I find myself lecturing at my students because I feel as if they need the background knowledge in order to understand the concepts. There are other times where the majority of the lesson is being student lead in investigations and exploration. After reflecting, I have found that there are instances where neither delivery method worked to fulfill my science goals and vision. Teaching is both an art and a science and I understand that there is never going to be a completely correct way to deliver content. Teacher led instruction and student led instruction can vary based on student interest and needs. Some students need more direct instruction while others lean more towards self-learning. It can also differ based on the specific science concepts that the classroom is working on. There are times where more background information is needed for students to succeed. If there is no correct way to teach every lesson, how can teachers find a balance to ensure student success in the science classroom? I found guidance on this issue in the practices and methods highlighted by the Next Generation Science Standards and Ambitious Science Teaching. By keeping a focus on the standards and the approaches to teaching high quality science set out by both NGSS and AST, I believe that finding a balance between teacher and student led instruction will come naturally.

It is important to be familiar with what students should be doing inside the science classroom as defined by the Next Generation Science Standards (citation). “From its inception, one of the principal goals of science education has been to cultivate students’ scientific habits of mind, develop their capability to engage in scientific inquiry, and teach them how to reason in a scientific context” (NGSS, 2012, p. 41). Focusing on a set of standards is not enough. It is important to implement the set of practices that accompany the standards so that science isn’t taught as a series of unrelated facts. No matter if the teacher or student is leading the instruction, the implementation of these practices should be considered. Are there opportunities for students to ask questions and define problems? Will students build models or plan and carry out investigations? Will students engage in arguments from evidence? These are some of the practices that whether or being orchestrated by the students or explained by the teacher, should make it into the science instruction. “The actual doing of science or engineering can pique students’ curiosity, capture their interest, and motivate their continued study.” (NGSS 2012 p. 43). Students have fun “doing” science as opposed to reading and hearing about science. Whether the instruction is teacher led or student led, an exploration of science through the scientific practices should be driving the lessons.

When I first started thinking about what a teacher does in the classroom before becoming a teacher I immediately thought about lecturing. I pictured a teacher standing in front of a classroom and students writing notes in a notebook. Even when I was being observed my first year of teaching, I always wanted the principal to pop in while I was giving direct instruction. In reality, direct instruction should take up a small amount of the instruction in class. There is also specific ideas within direct instruction that should and should not be covered. Through direct instruction, “[t]he ideas that you will share are usually at the conceptual level and they cannot be “discovered” by students through any form of work with data or observation” (AST, 2015). This means that the teacher should not be doing the heavy lifting part of the lesson. You do not want to be done giving instruction to your students and not have given them anything to explain themselves. Students should be given instruction that peaks their interest of the scientific phenomena being introduced and should give them the tools they need to develop their own questions and claims. A good rule of thumb is to give yourself about 10 minutes of direct instruction before sending students on to their own explorations and investigations. Holding oneself to a time limit can help in delivering only the necessary information needed. I was running into the problem of lecturing on and on about a subject only to leave my students with an insufficient amount of time to work on their own. I would also find myself answering too many questions that would have been better addressed when the students explored and inquired on their own. The AST primer titled “How to use direct (or “just-in-time”) instruction in your science classroom” offers tips in how to express ideas clearly. It is important to think about how you are delivering instruction and not just what you are delivering. Making sure to use your “teacher voice” as well as active voice. Avoid long wind-ups, an overuse of pronouns, and writing unorganized thoughts on the board. In keeping this practice in mind, I can ensure that I am delivering science instruction effectively while also not taking away student’s opportunities to explore and investigate phenomena on their own.

With a limited amount of time to lead a discussion to a class it is important to ask quality questions to elicit student engagement and interest in science. The NGSS emphasizes that asking questions is vital to developing expertise in science. “A major goal of the NGSS is for students to learn how to generate questions “about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations (NRC, 2012, p. 56). A good way for students to develop the skill of asking good questions is for the teacher to model the idea of asking good questions. In a study done by E.C. Wragg and George Brown, 53% of the questions teachers asked are standalone questions, while 47% were part of a sequence of two or more questions. This was because a lot of questions asked only required students to recall facts. A dilemma I was running onto in my own science classroom was not allowing enough time for students to think about the questions being asked. My teacher wait time was too quick and it deterred students from wanting to ask questions. Students are curious and allowing students the time to ask the questions they are curious about will in return ensure students are inquiring about science. When “teacher questions were classified as reflective, that is, questions that stimulate student thinking and encourage students to modify, confirm or contemplate their thinking more thoughtful, and meaningful conversations about science happens in the classroom (Citation Ernst-Slavit, Gisela). The more reflective questions asked in class, the more student questions and discussions will develop in the classroom.

In thinking about student led instruction I immediately turn to group work. I have had many successes and failures when it came to students working in groups within my science classroom. Some of my problems come from difficulty in assigning students to a group, ensuring each student in a group finds success, and how to assess group work. AST offers many resources in how to effectively implement group work. A goal of having students work in groups is for students to discuss science ideas and practices in a meaningful way. I never realized how important the selecting of students within group was until now. “When the groups are of mixed ability, regardless of the primary language spoken, the more accomplished students can benefit by explaining their thinking to others and the kids who usually struggle can hear how other students organize themselves, how they approach complex problems, and how they seek out relevant resources" (AST, 2015). There will never be a perfect way to group students of various abilities, interests, and backgrounds, but keeping in mind how different students can find success within a group is beneficial in placing students in a group. I also struggled with the roles of students within a group. There are always going to be students who take on the heaviest load of the activity while others try and skate by doing minimal work. Roles like "clarifier" and "questioner" ensure that all members of the group hear the important concepts and questions addressed during discussions help keep all students focused. Having a "progress monitor" and "peacekeeper" help make sure all students are participating in the group as well. These roles help keep participation amongst members high while also not calling on certain students to carry the load of the activity. Finally, AST offers an idea on assessing students in a group. A rubric that gives students a group grade as well as an individual grade can ensure a bit more equality to grading students. "There is no such thing as total, objective fairness in group assessment. The benefits to well-designed group work however, clearly outweigh the challenges to assessing student progress" (AST 2015 p. 7). It is important to note that there is not a perfect way to group students and assess students. I often found myself not being able to create perfect groups and then wanted to scrap group work all together. Students understanding how to work together and share ideas with one another is not an easy task. With practice, students will develop the skills needed to effectively talk and inquire about science.

One useful tool for students to be able to lead in their own learning comes from their ability to use and manipulate models. Students deepen their understanding of science by being able to create and explain models. "The more rigorous work that scientists and students can do is to construct, test, evaluate, and revise models. It is during these kinds of work that students see the need to learn new science ideas, to reason about how ideas and events are related, to argue about evidence, and to monitor their own thinking along the way." (AST 2015 p. 4). When modeling works for students, their thinking and connections about science are clear and allow for them to have productive discussions amongst their peers. Modeling is about being able to generate science ideas, explain, and evaluate what information is important.

The ultimate goal of science education should begin with a focus on standards and practices. If the teacher is creating an environment where students are able to fully engage with the material in a meaningful way, the balance between teacher and student led instruction will find its spot. There may not be a perfect answer to where the control of the classroom is taking place. If students are able to use the scientific practices set forth by the NGSS then they are being exposed to an effective science education. A teacher that critically thinks about direct instruction, as stated by AST, will ensure that the lesson is not spoon fed to students. Also, if students are able to engage in meaningful group work, their student led activities will prove successful. In thinking about the question of how to balance teacher and student led instruction, I have found that the more important goal of science instruction in the classroom is to ensure that each component is planned out with a purpose. Teacher led instruction, however long it takes, should be effectively providing the necessary tools to produce students who can make sense of the world around them. Student led instruction in the form of group work or creating models should allow students to use scientific practices. Continuous practice and self reflection will help improve the balance in control within the classroom to create a science classroom that will improve the educational and professional lives of the students.