Science Teachers' Vision for Promoting Productive Classroom Talk

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PURPOSE

Students' engagement in productive talk is essential for promoting the development of scientific proficiency and skills such as critical thinking, reasoning, collaboration, and communication (e.g., Driver et al., 2000; NRC, 2012; Resnick et al., 2015). Productive classroom talk is achieved when students attempt to comprehend science phenomena or solve problems with the utilization of strategies such as argumentation, questioning in their learning community. (e.g., NRC, 2012; Resnick et al., 2018).
However, facilitating productive talk remains to be complex and challenging for many teachers even with reform-based teaching efforts (e.g., O'Connor & Michaels, 2019; Sandoval et al., 2018). Prior research predominantly has framed teachers as practitioners and focused on teachers' practices in the moment of teacher, however science teachers' thinking regarding productive science talk and how to promote this talk remains an area that requires further investigations (e.g., Pimemtel & McNeill, 2013). Teachers' instructional vision refers to how teachers characterize high-quality instruction and what aspects of instruction teachers highlight for enacting high-quality instruction (Munter, 2014). To address this need, we aim to explore science teachers' vision of high-quality science instruction with a particular focus on classroom talk in order to understand how to generate science lessons that promote opportunities for engagement in science talk.

ABSTRACT

In this study, we explored the instructional vision of two biology teachers who attended an NSF-funded professional program focused on fostering productive epistemic discourse in science classrooms. The vision interviews focused on understanding how teachers envision high quality science instruction. We explored how the teachers' instructional vision maps translated into the vision of high-quality science learning and teaching discussed in the literature. We explored the level of sophistication in teachers' vision based on vision rubrics. The results of data analysis supported to reveal for a holistic view of the teacher's vision. Our analysis reveals variations in teachers' instructional vision. Exploring teachers' instructional vision and its development can allow us to promote development of a shared vision between teachers and stakeholders, allowing for the goals of reaching a high-quality science environment to be mutually understood.

STUDY CONTEXT

The PD program included a summer workshop and cycles of meetings throughout the subsequent school year. Each PD cycle consisted of three parts: (a) co-designing a science lesson with another teacher or a research team member, (b) teaching the co-designed lessons, (c) reflecting on the lessons.

PARTICIPANTS

Participants' teaching experiences varied, ranging from 1.5 years (Ms. Shelly) to 14 years of teaching experience (Ms. Renee). They taught at different middle schools.
Ms. Tina was certificated to teach biology across grades 6 through 12 and elementary K-6 Mathematics, and Elementary K-9 Science

DATA SOURCE

The teachers were interviewed after taking the PD program. The interviews began by asking the teacher the following question: If you were asked to observe a teacher's science classroom for one or more lessons, what would you look for to decide whether the science instruction is high quality? Depending on the teachers' response, teachers were asked the following questions: *Why do you think it is important to use/do _____ in a science classroom? Is there anything else you would look for? If so, what? Why? Then, more specific questions were asked for assessing participants' instructional visions. The interviews whereas recorded then transcribed for further analysis to take place.*

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METHODS

We began by exploring teachers and their transcripts by using instructional vision rubrics (Munter, 2014; Tekkumru-Kisa et al., 2021). We aim to explore how teachers' instructional vision maps translated into the vision of high-quality science learning and teaching discussed in the literature. We explored the level of sophistication in teachers' vision based on vision the rubrics.
We began data analysis by dividing the transcript of each interview into several different groupings which are defined in a rubric regarding the quality of instruction (Munter, 2014) . The groupings are organized by topic, which includes:
Teacher Role: This pertains to how the teacher relates to the content being taught and how the teacher interacts with the student on a day-to-day basis (see Table 1) Nature of the Classroom Task: Simply examines the characteristics of a classroom task in terms of demand on students' thinking.
Classroom Engagement: Describes how the teachers view how students interact and participate in the task at hand.
Classroom Discourse: Focuses on different sub-elements consisting of nature and structure of classroom talk, questions posed by student and teacher, as well as student explanation.
Following the grouping and coding of the transcripts based on the descriptions above, we started to identify the level of sophistication in teachers' ability to envision productive classroom talk by using the rubrics.

ANALYSIS CATEGORY	LOWEST LEVEL OF SOPHISTICATION	HIGHEST LEVEL OF SOPHISTICATION
TEACHER ROLE	(1) Teacher seen as "deliverer of knowledge"	(4) Teacher seen as "more knowledgeable other"
NATURE OF CLASSROOM TALK	(2) Talk among students about the investigation	(4) Talk should encourage spawning new investigations
STUDENT ENGAGEMENT IN CLASSROOM ACTIVITY	(1) Stresses importance of passive engagement	(2) Stresses importance of active engagement
PATTERNS/ STRUCTURE OF CLASSROOM TAL	(1) Traditional lecturing without debate or inquiry	(4) Whole class conversation independent of the teacher
STUDENT QUESTIONS	(3) Promotes straightforward student questions	(4) Promotes student questions that drive instruction
TEACHER QUESTIONS	(1) Aid in keeping students on task	(4) Aid student explanation and develop student's thinking

FINDINGS

ANALYSIS CATEGORY	LEVEL OF SOPHISTICATION	
	SHELLY	TINA
TEACHER ROLE	Level 4	Level 4
NATURE OF CLASSROOM TALK	Level 3	Level 4
STUDENT ENGAGEMENT IN THE CLASSROOM	Level 2	Level 2
PATTERNS/STRUCTURE OF CLASSROOM TALK	Level 4	Level 4
STUDENT QUESTIONS	Level 4	Level 2
TEACHER QUESTIONS	Level 4	Level 4

RESULTS

Shelly and Tina both received fours on their ideals regarding **Teacher Role**. They both supported problematizing as well as co-participation.

Shelly received a three and Tina received a four when it comes to **the Nature of Classroom Tasks**. This is because Shelly did not emphasize connections between several tasks and did not have a focus on applicability of learned skills.

Shelly and Tina received twos in the category of **Student Engagement in the Classroom**. Allowing students to engage in investigations and present their findings, while keeping them accountable for their actions and behavior within the classroom.

Shelly and Tina received fours in **Patterns and Structure of Talk** as they emphasized whole classroom discussions led by the students. Allowing more room for student independence.

Shelly and Tina both received fours in **the Nature of Classroom Talk** as they allowed for mistakes and constructive criticism. They also made sure to use scientific terminology to help reinforce their learning abilities.

Shelly and Tina received fours in **Teacher Questions** because they expect not only an answer, but an explanation to the questions being posed.

Shelly received a four and Tina received a two in **Student Explanation** because Tina simply did not justify her ideas of student engagement and its importance. While Shelly fully explained how students should be able to justify their answers.

CONCLUSION

The objective of exploring science teachers' instructional vision is to better understand how to enact science lessons that promote students' engagement in science talk as suggested by current reforms. The findings of this study can help us to gain a better understanding of discrepancies and areas of strength in a particular teachers' instructional vision. With this information, we hope to inform and shape the professional development programs, in order to further promote the shift in science classrooms to foster students' engagement in science talk.The research was based on teacher vision interview

REFERENCES

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