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Arguing about Science: Empowering Students and Developing Issue-Based Pedagogies through Debate

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TITLE:
Arguing about Science: Empowering Students and Developing Issue-Based Pedagogies through Debate

RELEVANCE:
This presentation addresses the NYAR HEART and HEAD strands by showcasing examples of empowering student voice and ownership of knowledge through policy debate. Debates afford opportunities for students to use the academic language of content area learning to create resolutions to community-based issues of importance to them. These resolutions can then be defended or refuted through oral arguments that afford students opportunities to apply knowledge in relevant and authentic ways.

BRIEF DESCRIPTION:
This presentation will guide 4th-12th grade educators to engage students in using content area knowledge to solve real-world problems. Using an adaptation of policy debate, learners use facts and evidence gathered through their participation in Science and Engineering Practices to create resolutions to place-based issues that are occurring in their own communities.

SUMMARY:
Through an initial overview of the literature on authentic, integrated, and place-based learning, participants will be engaged in thinking through the motivating and empowering aspects of creating real reasons for for understanding science concepts. With a goal or providing a framework of instruction that uses inquiry to engage in content knowledge and oral arguments to apply that knowledge, a model of instruction that applies a knowledge of physics and weather to address environmental issues in home construction is provided. The instructional framework includes the essential elements of (1) using inquiry to understand targeted scientific principles and practices; (2) using dialogic discussions to consider community-based issues that are related to the content learning; (3) developing a promising solution to the selected issue; (4) developing arguments for and against the resolution; (5) developing oral speaking skills that are compelling, and; (6) using civil discourse practices to respectfully cross-examine arguments.

This session focuses on the engaging and empowering aspects of providing opportunities for students to apply and practices to community-based issues. Specifically, we encourage the use of authentic and agentive reasoning for applying scientific knowledge to situations that are meaningful for students. In this presentation, we will discuss an instructional model that builds on inquiry approaches for learning science to include discussions of community- or place-based issues where the

knowledge is relevant. Students select an issue of importance to them (e.g. relevant socioscientific issue) and are guided to develop a resolution to the issue. Students then prepare arguments for and against the resolution as they engage in a policy debate. The oral debates are opportunities for students to hone their communicative skills as they defend, refute, and question the resolution and evidence provided. These debates are also an engagement in the democratic processes that will serve them well as adult citizens.

EVIDENCE:

Current literature on learning motivation converges to support the integration of choice, challenge, collaboration, and authentic or relevant tasks when designing instruction that is engaging and motivating for students (Guthrie, Wigfield, & Perencevich, 2004; Purcell-Gates, Duke, & Martineau, 2007; Turner, 1995). Such instruction would engage students in interesting, challenging tasks, provide opportunities to work together toward goals they help to determine, and serve some real-world purpose (Gambrell, et al., 2011; Taboada, Guthrie, & McRae, 2008). The alternative -- instruction that is highly teacher directed and focuses on 'receiving' knowledge-- can result in an eventual alienation from academic tasks (Wilhelm, 2007). Instead, students should find a purpose for learning (Bartholomaeus, 2013; Brophy, 2008; Purcell-Gates, 2002) and use this purpose as a reason for engagement in meaningful learning tasks.

We suggest that teachers have opportunities to increase student engagement in scientific learning when students are presented with opportunities to use that knowledge to solve problems that are important to them through oral arguments such as debates. While focusing on issue-based science curriculum is not new and has been the focus of many school-wide initiatives (e.g., Science, Technology, and Society, Project-based Learning, and STEAM), the effective use of debates and argumentation is not always presented to teachers in an easy to use format. These activities support them in building their science literacy and skills for exploring and responding to socioscientific issues impacting their community (Zeidler & Kahn, 2014).

Washburn and Cavagnetto (2013) share an instructional planning tool for teaching argument in science with a focus on explicit instruction and scaffolding to deepen students' understandings of logical arguments through inquiry-based learning (Washburn & Cavagnetto, 2013). Tools such as this allow students to explore socioscientific issues that are relevant to their communities. Teachers' can enhance students' development of argumentation skills if the provide scaffolding and support in the implementation of argument in their classrooms. These scaffolds and provide opportunities for cross-curricular connections with lessons and enhancing students'

scientific literacy (Zeidler & Kahn, 2014). Illustratively, Lee and colleagues (2014) used concrete science learning experiences to help fourth and fifth students better understand argumentation. Through scaffolded instruction and discussion, students demonstrated a better understanding of how components of argument differed, such as distinguishing claims from evidence. Scaffolds included materials used during science activities, such as task cards with questions to prompt students' thinking and time for discussion as a class and in small groups. With these supports, students developed in reasoning, adding evidence to support their claims, and adding details to provide clarity to their arguments. Lee and colleagues (2014) state:

> The additional emphasis on claims, evidence, and reasoning helped our hands-on activity to be a minds-on activity as well. While our students grew in their ability to argue from evidence, we grew as well in our ability to teach scientific argumentation as we better understood the specific challenges and difficulties they encountered. (p. 52)

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FORMAT:
Individual presentation

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Debate, Science & Engineering Practices, Socioscientific Issues, Place-based Learning

BIOGRAPHICAL SKETCH:
Dr. Cynthia C. M. Deaton is an Associate Professor of Science Education and Chair of the Department of Teaching and Learning in the College of Education at Clemson University. Her research focuses on reflective practice, mobile learning integration in science, preservice science teacher education, and professional development for science teachers. She has worked with a variety of PreK-12th grade teachers on science teaching and integrated instruction through numerous externally professional development projects.

Dr. Jacquelynn A. Malloy is an Associate Professor of Teaching and Learning in the College of Education at Clemson University. Jackie's research focuses on motivation, engagement, and integrating the language arts across the content areas. Jackie teaches English Language Arts methods and Social Justice in Education and has collaborated on professional development projects to develop math and science inquiry instruction that integrates speaking/listening, reading/writing, and viewing/representing.

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