

NGSS Disciplinary Core Ideas: What Are Our Needs?

Nicole Ray, Assistant Professor
Agricultural Education and Communication
California Polytechnic State University, San Luis Obispo
nray04@calpoly.edu

Valerie Lorenzo Jimenez, Undergraduate Student
Agricultural Education and Communication
California Polytechnic State University, San Luis Obispo

Mayra Juarez, Undergraduate Student
Agricultural Education and Communication
California Polytechnic State University, San Luis Obispo

Erin Gorter, Assistant Professor
Agricultural Education and Communication
California Polytechnic State University, San Luis Obispo

Hannah Parker, Lecturer
Agricultural Education and Communication
California Polytechnic State University, San Luis Obispo

Department of Agricultural Education & Communication
College of Agriculture, Food and Environmental Sciences
California Polytechnic State University
1 Grand Avenue
San Luis Obispo, CA 93407
(805) 756 - 0661

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Introduction/need for research

Literature has indicated movement toward school-based agricultural education (SBAE) teachers addressing Next Generation Science Standards (NGSS) standards in their courses (Barrick et al., 2018). Chumbley et al. (2019) and McKim et al. (2016) suggested teachers will need professional learning with content and pedagogy of science. Within NGSS, the *Disciplinary Core Ideas* (DCI) represent the scientific content within each standard (National Research Council, 2012). This study is part of a larger study that examines SBAE teachers' implementation of NGSS. The purpose of this research was to describe and rank SBAE teachers' professional learning needs relating to the NGSS DCIs. These findings can provide SBAE stakeholders with prioritized science concepts for workshops, teaching resources, classroom experiences, and program updates to support greater science knowledge.

Conceptual Framework

Realizing SBAE teachers are at varying levels of implementation of NGSS (Chumbley et al., 2019), with consideration of Knowles' (2020) adult learner assumptions, it is important to meet adult learners where they have a felt need. The Ranked Discrepancy Model is an approach that considers respondents' perception of the importance of the item, as well as their personal knowledge of the item (Narine & Harder, 2021). Within this study, respondents rated their perceived importance, knowledge and skill for selected NGSS DCIs in an effort to rank professional learning needs based on teachers expressed needs.

Methodology

A descriptive survey research methodology was used in this study (Creswell & Creswell, 2017). The Ranked Discrepancy Model was utilized with a census of California SBAE teachers. With an accessible population of 1077 teachers, researchers sent a Qualtrics survey with several constructs, the items represented in this study were selected high school NGSS DCIs (National Research Council, 2012) for all but PS2.C, PS2A-D, and the Engineering and Technology standards. Using skip logic, respondents were only asked to respond to DCIs for a domain if they were currently teaching or had taught courses including those DCIs. A total of 190 responses were received for the survey. Sample sizes for each domain are noted in Table 1. Researchers followed Nardine & Harder (2021) steps for analyzing Ranked Discrepancy Model with SPSS and Excel. Ranks with a negative score were interpreted as indicating professional learning need (Harder & Narine, 2024). Only the negative ranking DCIs are included within this abstract, but the full ranking by DCI domain will be provided on the poster. As suggested by Lindner et al. (2001), early and late responders were compared on other areas of the survey, finding no significant difference between early and late responses.

Results/Findings

Within the 34 high school DCIs examined, 35% were negatively ranked (Table 1). Negative rankings accounted for 8% of Earth and Space ($f=1$ of 12), 38% of Life Science ($f=5$ of 13), and 67% of Physical Science ($f=6$ of 9). The research poster will include the full list of Ranked Discrepancy Scores.

Table 1
Negatively Ranked Discrepancy Scores for NGSS Disciplinary Core Ideas

Disciplinary Core Idea by Domain	%
Earth and Space (<i>n</i> = 22)	
ESS3.C Management of natural resources, biodiversity, sustainability, reduction of pollution, waste and degradation.	-4.5
Life Science (<i>n</i> = 66)	
LS3.B Role of meiosis, mutations, and environmental factors in genetic variation and inherited traits. As well as the role of genetic and environmental factors in the probability of a trait in an ecosystem.	-16.7
LS2.B Cycles of Matter and Energy Transfer in Ecosystems: Photosynthesis and respiration, food webs, energy transfer, transfer of matter, carbon cycle	-10.6
LS4.D Negative human impacts on biodiversity and solutions to support sustaining biodiversity.	-9.1
LS3.A Role of DNA and chromosomes in coding for proteins and gene expression.	-6.1
LS1.C Organization for Matter and Energy Flow in Organisms: photosynthesis, sugar molecules, flow of matter and energy between systems, cellular respiration	-1.5
Physical Science (<i>n</i> = 47)	
PS3.A Energy transfer, energy types - motion, sound, light, thermal.	-21.3
PS1.B Reaction rates, energy and collisions, concentration, equilibrium.	-19.1
PS3.B Conservation of Energy: transfer between systems conservation, mathematical models of prediction, energy movement toward stable state.	-17.0
PS3.D Energy in Chemical Process: conservation of energy, and useful forms.	-6.4
PS1.C Nuclear Process: fusion, fission, radioactive decay.	-4.3
PS3.C Interaction of objects and their changes in energy.	-4.3

Conclusions

In general, SBAE teachers expressed a skill gap in science content, supportive of Chumbley et al. (2019) as indicated by negative rankings across all of the NGSS domains. Their greatest skill gaps are in the Life Science and Physical Science Domains based on the respective frequencies of DCIs with a negative ranking.

Implications/Recommendations/Impact

Negative rankings are interpreted as a need (Harder & Narine, 2024) in the Ranked Discrepancy Model. Data is supportive of previous literature that SBAE teachers need support with content and pedagogy within NGSS (Chumbley et al., 2019), and also more broadly when applying common core concepts (McKim et al., 2016). Realizing this, curriculum developers and organizations seeking to build agriculture literacy should consider developing resources and professional learning that synergistically promote NGSS pedagogy and build confidence around NGSS DCIs which are in the greatest need areas. In alignment with Knowles et al. (2020), practitioners and preservice teachers should be conscious of targeting professional learning that aligns with their personal needs. Researchers should explore different populations of SBAE teachers and expand the list of DCIs to also include all the physical science domain DCIs and the engineering and design standards. Researchers should also explore these areas of negative ranking to learn more about what patterns may exist for SBAE teachers.

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