Embracing Phenomena: Investigating SBAE Teacher Adoption and Efficacy

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Introduction/need for Research

Integrating Next Generation Science Standards (NGSS) into agriscience courses can be challenging (Chumbley et al., 2019). In 2012, the National Science Framework (National Research Council, 2012) rolled out a three-dimensional approach to science instruction which includes Disciplinary Core Ideas (what students will know), Science and Engineering Practices (what students will do), and the Crosscutting Concepts (how students will think). Within the Science and Engineering Practices (SEPs), learners are expected to engage with phenomenon. Phenomena are contextualized natural or manmade occurrences intended to create curiosity for learners, provide context for their learning, and create opportunity to develop language, critical thinking, and problem solving (Adipat, 2024; National Research Council, 2013). An example might be a timelapse video of listening and watching corn grow (https://youtu.be/76xEkEXI2a4) to explore the environmental factors impacting the rate of photosynthesis. When situating phenomenon driven instruction within science and school-based agricultural education (SBAE), Dewey (1938) does not use the word phenomenon but does note the importance of learners being either stuck or struck. This may take the form of an authentic problem to be solved or can refer to something surprising or incongruent with their current understanding. This research, as part of a larger study exploring SBAE teacher's implementation of NGSS, describes SBAE teachers' efficacy and adoption of phenomenon driven instruction.

Conceptual Framework

Bandura's (1997) theory of self-efficacy, McKim & Valez's (2016) SBAE connection to efficacy, and diffusion of innovations (Rogers, 2003) coalesces in the Phenomenon Adoption Scale (PEAS) explored in this research. Self-efficacy is described as an individuals' belief in their ability to perform specific tasks (Bandura, 1997). Within the PEAS, SBAE teachers responded to *I can* statements. Statements within the scale connect to the Rogers' (2003) stages of knowledge, implementation, and confirmation helping to provide researchers greater insight into SBAE teachers' confidence related to phenomenon driven instruction.

Methodology

This study used a descriptive survey to conduct a census of California SBAE teachers, where an accessible population of 1077 was invited to respond via Qualtrics. Ninety-five respondents completed the Phenomenon Efficacy and Adoption Scale (PEAS), resulting in a 9% response rate. Following guidance from Lindner et al. (2001), early and late respondent groups were compared using independent samples *t*-tests with no significant differences ($p > .05$) for early and late respondents. Results should be generalized with caution, but even studies with low response rates can add to the body of literature (Johnson & Shoulders, 2017). The PEAS items are listed below in Table 1, participants responded on using a Likert (1932) five-point scale. Reliability of the scale was deemed acceptable using Cronbach's $\alpha = .93$ (Cronbach, 1951, Field, 2013).

Results/Findings

This research was aimed at describing teachers' confidence and adoption of phenomenon driven instruction. Explaining ($M = 4.28$, $SD = .82$) and giving examples of phenomenon ($M = 4.25$, $SD = .90$) showed the most agreement with the lowest standard deviations. Teachers showed slightly lower agreement with planning lessons ($M = 3.99$, $SD = .93$), and teaching

lessons with phenomenon (*M* = 3.80, *SD* =1.00). The lowest rated statements were giving examples of how phenomenon is used in their daily teaching, where to find phenomenon (*M* = 3.72, *SD* = 1.24), and coaching others to use phenomenon (*M* = 3.57, *SD* = 1.18).

Table 1
Phenomenon Efficacy and Adoption Teacher Scale (N = 95)

Item	Mean	SD
I can explain what phenomenon is in the context of a classroom.	4.28	.82
I can give examples of agricultural phenomena in the classroom.	4.25	.90
I can plan lessons that are started with and driven by phenomena.	3.99	.93
I teach lessons that are driven by phenomenon.	3.80	1.00
I can give examples of how I use phenomenon in my daily teaching in the classroom.	3.74	1.13
I can list examples of sources of where to find phenomenon for my classroom.	3.72	1.24
I can coach another teacher/student teacher to use phenomenon in the classroom.	3.57	1.18

Note. Responses were coded as 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree or disagree*, 4 = *agree*, 5 = *strongly agree*. Cronbach's α = .93. Overall *M* = 3.90, *SD* = .88

Conclusions

Considering phenomenon driven instruction as an innovation in the context of Rogers' (2003) diffusion of innovations, the first stage of diffusion shows high adoption, with teachers' agreeing they are confident in their ability to define phenomenon and give examples of how it can be used. Interestingly, confidence in knowing where to find phenomena was low compared to the other statements relating to knowledge. Statements relating to their implementation showed less agreement, indicating that while teachers have knowledge of phenomena, that knowledge does not translate into frequent use. Teachers expressed the least confidence in the confirmation phase, particularly when it came to coaching another teacher/student teacher.

Implications/Recommendations/Impact on Profession

Findings in this study should be generalized with caution, given the low response rate. In this study, while teachers have a general awareness of phenomenon, they appear less confident in implementing it in their classrooms. Practitioners should consider collaborating to develop curated lists of phenomenon sources such as Next Generation Agricultural Science's (NGSS) phenomena bank. Teacher educators and professional learning programmers should consider their role in diffusing this innovation given the importance. This might include developing and sharing teaching resources with peers. The PEAS can also be used as a reflection exercise for participants during professional learning. The final recommendation for practitioners is those who are in the confirmation stages (implementation), to consider serving as a coach for others who have a positive attitude toward innovation. Given the high levels of knowledge, researchers should explore barriers to implementation, including attitudes. Additionally, explore the methods and resources that could be used to increase visibility, and coaching support for those that have shown interest in adoption. While the PEAS had high reliability, to continue to improve the scale, researchers should consider adding items related to teachers' attitudes toward phenomenon, and that also look to develop items that not only represent the ability but also the action of implementing coaching.

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