How do Animal Science Standards Align: A Comparison of South Carolina Standards to AFNR Standards

Kayla N. Marsh
Oklahoma State University
Kayla.marsh@okstate.edu

Christopher J. Eck
Oklahoma State University
Chris.eck@okstate.edu

K. Dale Layfield
Clemson University
dlayfie@clemson.edu

Research Type: Quantitative
Research Priority Area: Teacher Education and School-Based Agricultural Education

How do Animal Science Standards Align: A Comparison of South Carolina Standards to AFNR Standards

Abstract

Content and performance standards were the basis on which school-based agricultural education (SBAE) teachers develop effective and relevant instruction. These standards prepare students for future agricultural careers and support the needs of the community. The purpose of this study was to determine the extent to which South Carolina SBAE standards align with the national AFNR standards for the animal science career pathway. This study implemented an existing data design, comparing the South Carolina animal science standards and the national AFNR animal science pathway standards through content analysis. Thirty-one percent of standards were written at or above the Applying level, as compared to 95% of the AFNR standards. The analysis of standards demonstrated the lack of rigor in current standards. Although this study highlights concerns with SBAE standards in South Carolina, additional research is needed to see how other states' standards align with AFNR standards. It is further recommended that teacher educators develop preservice and in-service activities that will prepare SBAE teachers to plan activities and assignments at higher-order levels of thinking.

Introduction

"A standard is both a goal (what should be done) and a measure of progress toward that goal (how well it was done)" (Ravitch,1995, p.7). Standards help teachers design courses and develop objectives to deliver content and evaluate student learning (Nilson, 1998). Specifically, content and performance standards were the basis on which school-based agricultural education (SBAE) teachers, school districts, and state education departments rely. These standards develop effective and relevant instruction to prepare students for future agricultural careers and support the needs of the community (Molina, 2009; Swafford, 2018). To be effective, content standards need to be current to support effective SBAE teachers, build capacity for abstract learning, and prepare students for science, technology, engineering, and math (STEM) based agricultural careers (Swafford, 2018). Judson et al. (2020) defined the process of teachers adapting standards to meet the community's needs, beliefs, culture, and values as the sensemaking of educational standards. This evidence suggested that strong state standards provide a needed structure to empower teachers while still giving the sensemaking freedom to implement and support student learning (Judson et al., 2020).

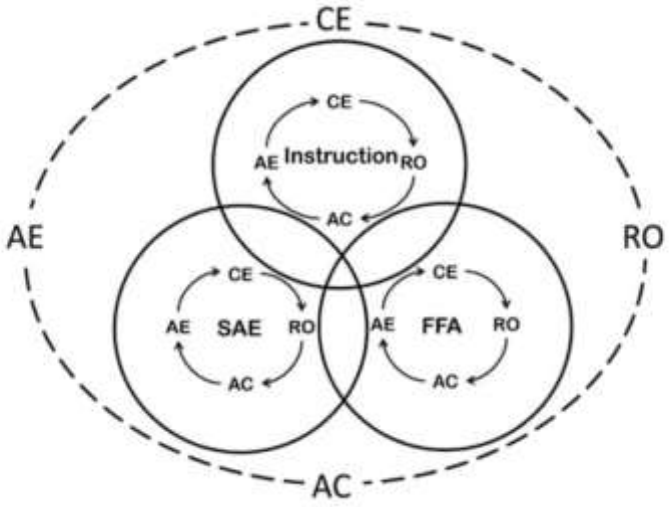
The push for national standards started in 1989 with policy goals focused on academic achievement and an increase of rigorous coursework for all students. They prompted the reform of learning expectations and assessment, which led to state and national debate over content, assessment, and evaluation in educational systems (Clune, 1993; Darling-Hammond, 1994; Ravitch, 1995). Many oppose the adoption of national standards for a multitude of reasons, including federal control of educational standards, weak or narrow standards due to political influence, controversial values imposed by the government, and diminishing of teachers' creativity and ability to connect with students in the classroom because they were forced to teach to an assessment or examination (Ravitch, 1995). These concerns still exist, as well as evidence that strong educational standards indicate learning gains, equity for all students, and increased

collaboration and communication of needs (Bloom, 1956; Judson et al., 2020; Ravitch, 1995). Sharing ideas between teachers and educational content developers (i.e., textbook writers, curriculum and software developers, and assessment companies) requires well-defined standards as a guide (Anderson, 2001; Darling-Hammond, 1994; Ravitch, 1995). The debate was further complicated by diverse types of standards that have been ill-defined and vaguely used, but each were essential when creating coherent educational expectations for students (Ravitch, 1995). Specifically, content standards are appropriate when discussing what students should learn, while performance standards relate to measuring the level at which it was learned (Ravitch, 1995). Interrelated but irrelevant without the other is the consistent relationship between content and performance standards, making the process of adopting and revising standards messy (Ravitch, 1995). Therefore, it has become best practice to address the complexity and develop content and performance standards that serve as a strong framework to support SBAE teachers, students, administrators, faculty, and content developers because vague non-measurable standards are an ineffective tool in supporting rigorous and relevant instruction and learning (Anderson, 2001; Judson et al., 2020; Ravitch, 1995; Swafford, 2017).

To support these efforts, the Agriculture, Food, and Natural Resources (AFNR) content and performance standards were developed and supported by the National Council for Agriculture Education (2015). AFNR standards provide a baseline to support SBAE career clusters that incorporate STEM integration for multiple agricultural career pathways (The Council, 2015; Swafford, 2018). The eight different SBAE career pathways align AFNR standards with the components of a comprehensive SBAE program for instruction, career and leadership development (FFA), and Supervised Agricultural Experiences (SAE) with the following national standards to ensure a robust framework of rigor and relevance for SBAE programs: Common Career and Technical Core (CCTC), Next Generation Science Standards (NGSS), Common Core Mathematics (CCSS), Common Core English Language Arts (ELA), National Standards for Financial Literacy and Green/Sustainability Knowledge and Skill Statements (The Council, 2015; see figure 1). Not only were the AFNR standards a thoroughly crafted framework for SBAE teachers, students, and support professionals for classroom instruction, but they were purposely constructed to support the comprehensive model for secondary agricultural education developed by Baker et al. (2012), which includes supervised agricultural experiences (SAE) and leadership and career development through the national FFA organization.

Figure 1

Comprehensive Model for SBAE (Baker et al., 2012)



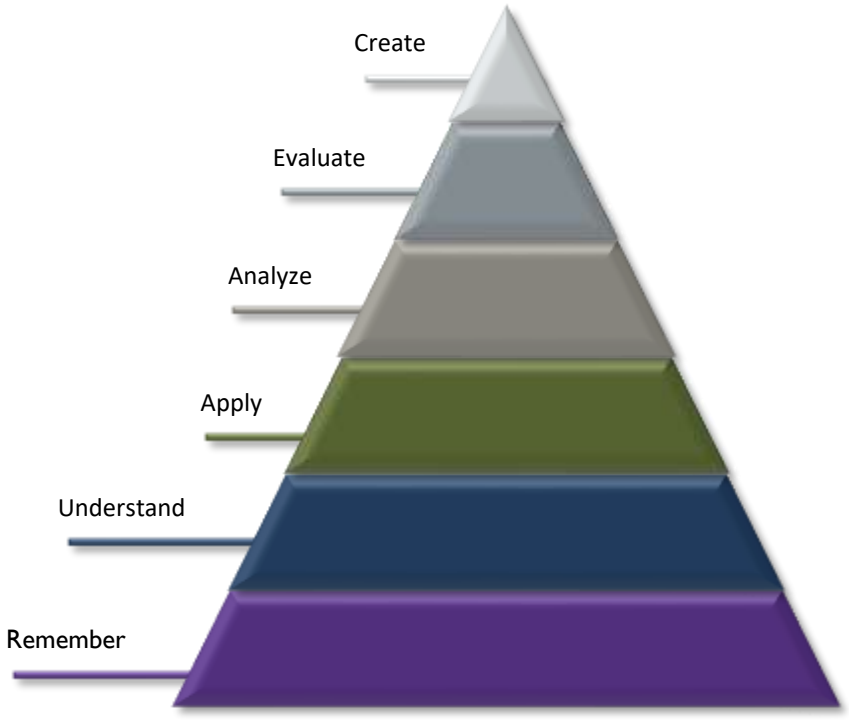
"Adoption and use of these standards is voluntary; states and local entities are encouraged to adapt the standards to meet local needs" (The Council, 2015, p. 2), ultimately allowing SBAE teachers to prepare students for future STEM careers by providing rigorous and relevant instruction while also meeting the needs of the community and program (Baker et al., 2012; Judson et al., 2020; Ravitch, 1995; Swafford, 2018). According to Swafford (2018), at least one STEM component (i.e., science, technology, engineering, or math) was directly aligned with AFNR standards within each pathway, with science the most prevalent as it was found in six of the eight pathways. Therefore, comprehensive SBAE programs were supported by strong content and performance standards with increased levels of rigor and career preparation through the relationship between AFNR and STEM standards (Baker et al., 2012; Judson et al., 2020; Swafford, 2018).

Theoretical and Conceptual Framework

This study was undergirded by Bloom's (1956) taxonomy, which established distinct levels of learning and engagement as a hierarchical structure representing six categories, ranging from basic learning objectives (i.e., knowledge of content) to higher-order learning (i.e., synthesis and evaluation; Bloom, 1956; Clemons & Smith, 2017). Bloom formed the basis for early work on the development of instructional objectives, standards, and learning goals for classes and curricula, providing a framework and shared vocabulary for teachers, school districts, and educational content developers (Anderson et al., 2001; Bloom, 1956; Krathwohl, 2002). Each of the six categories of Bloom's Taxonomy has been defined and represented by an action verb that distinguishes the level of learning and retention taking place, as represented in Figure 2.

Figure 2

Bloom's (1956) Cognitive Taxonomy



The rigor, relevance, and retention of the content and skills learned increase as we move to the pinnacle of the pyramid represented by the action verb *create* from the base represented by the action verb *remember* (Anderson et al., 2001; Bloom, 1956; Krathwohl, 2002). *Remember* represents cognitive tasks that are more concrete and less abstract, including memorization, recall, and labeling as learning activities. *Understanding* demonstrates concrete learning through cognitive activities of comparing, contrasting, and explaining. *Applying* is achieved by organizing, developing, or utilizing concrete concepts learned in a new and abstract situation. *Analysis* reflects when learning activities ask students to *analyze* content to make assumptions, conclusions, and simplifications. *Evaluation* is an abstract process of detailed parts or critical elements to criticize, defend or justify within the learning activity. *Create* is the abstract use of many dissimilar sources to build, invent, solve, or test within the learning activity (Anderson et al., 2001; Bloom, 1956; Krathwohl, 2002). According to Anderson et al. (2001), we should approach this taxonomy as a guide to communicating the cognitive rigor expected from content and performance standards to construct relevant and effective learning activities and content materials. While the action verb is our first indicator as to the level of rigor associated with a learned activity, the context in which the action verb was used in the standard will impact the level of rigor of the task (Anderson et al., 2001; Bloom, 1956; Krathwohl, 2002). For this study, the hierarchical structure was used to determine the cognitive level of animal science standards in South Carolina compared to that of the national AFNR standards.

Purpose of the Study

The purpose of this study was to determine the extent to which South Carolina SBAE standards align with the national AFNR standards for the animal science career pathway. Three research objectives guided this study: (1) What percentage of South Carolina SBAE standards align with the AFNR standards for animal science; (2) At what level of Bloom's Cognitive Taxonomy are the South Carolina SBAE standards written; and (3) How does the level of rigor compare between the South Carolina SBAE standards and AFNR standards?

Methods and Procedures

This study implemented a non-experimental existing data design (Privitera, 2020), comparing the South Carolina animal science standards and the national AFNR animal science pathway standards through content analysis. A content analysis allows researchers to analyze written records that outline detailed content (Privitera, 2020), in this case, educational standards. The publicly available electronic documents served as the existing data (Privitera, 2020) being analyzed, which included South Carolina SBAE standards for the Animal Science Career Pathway (South Carolina Cooperative Extension, 2021) and the national AFNR Standards for Animal Science (The Council, 2015).

The research team evaluated the state and national standards to determine the alignment between South Carolina standards and national AFNR standards. The research team consisted of a graduate student with nine years of SBAE teaching experience and two faculty members in agricultural education with over 40 years of combined experience in teaching and preparing students to be effective SBAE teachers. The team aimed to answer the three proposed research objectives through collaborative content analysis. Bloom’s Taxonomy (1956) was the lens used to evaluate the state and national standards by the research team. Using the complete research team to analyze the existing data helps the researchers overcome the potential experimenter bias (Privitera, 2020).

Microsoft Excel was implemented to categorize, compare, and analyze animal science standards through the lens of Bloom’s taxonomy (1956). As the research team analyzed each South Carolina standard, the standard was categorized into one of the 20 performance indicators associated with the eight AFNR content standards for the animal systems career pathway (see Table 1).

Table 1

Agriculture, Food, and Natural Resources (AFNR) Animal Systems Pathway Content Standards

AFNR Standard	AFNR Performance Indicator
AS.01. Analyze historic and current trends impacting the animal systems industry	AS.01.01. Evaluate the development and implications of animal origin, domestication and distribution on production practices and the environment. AS.01.02. Assess and select animal production methods for use in animal systems based upon their effectiveness and impacts.

AFNR Standard	AFNR Performance Indicator
	AS.01.03. Analyze and apply laws and sustainable practices to animal agriculture from a global perspective.
AS.02. **Utilize** best-practice protocols based upon animal behaviors for animal husbandry and welfare.	AS.02.01. Demonstrate management techniques that ensure animal welfare.
	AS.02.02. Analyze procedures to ensure that animal products are safe for consumption (e.g., use in food system, etc.).
AS.03. Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction and/or economic production.	AS.03.01. Analyze the nutritional needs of animals.
	AS.03.02. Analyze feed rations and assess if they meet the nutritional needs of animals.
	AS.03.03. Utilize industry tools to make animal nutrition decisions.
AS.04. Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.	AS.04.01. Evaluate animals for breeding readiness and soundness.
	AS.04.02. Apply scientific principles to select and care for breeding animals
	AS.04.03. Apply scientific principles to breed animals

AFNR Standard	AFNR Performance Indicator
AS.05. Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.	AS.05.01. Design animal housing, equipment and handling facilities for the major systems of animal production.
	AS.05.02. Comply with government regulations and safety standards for facilities used in animal production
AS.06. Classify, **evaluate,** and select animals based on anatomical and physiological characteristics.	AS.06.01. Classify animals according to taxonomic classification systems and use (e.g. agricultural, companion, etc.).
	AS.06.02. Apply principles of comparative anatomy and physiology to uses within various animal systems.
	AS.06.03. Select and train animals for specific purposes and maximum performance based on anatomy and physiology.
AS.07. **Apply** principles of effective animal health care.	AS.07.01. Design programs to prevent animal diseases, parasites and other disorders and ensure animal welfare.
	AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals on a local, state, national, and global level.
AS.08. **Analyze** environmental factors associated with animal production.	AS.08.01. Design and implement methods to reduce the effects of animal production on the environment.
	AS.08.02. Evaluate the effects of environmental conditions on animals and create plans to ensure favorable environments for animals.

To address the second research objective, the research team evaluated each South Carolina standard and categorized the taxonomical level (i.e., remember, understand, apply, analyze, evaluate, or create) at which the standard aimed to represent. The percentage of standards at each

taxonomical level was then compared to address the final research objective using Microsoft Excel.

Results

Research Objective 1: What Percentage of South Carolina SBAE Standards Align with the AFNR Standards for Animal Science

The first objective sought to identify the percentage of South Carolina SBAE standards aligning with the AFNR standards for animal science. The South Carolina animal science pathway included 19 courses and 150 standards that were analyzed in comparison to the AFNR animal science pathway, which consists of eight standards and 20 performance standards. Ninety-five percent of the AFNR standards were written at or above Bloom's *applying* level of taxonomy; in comparison, only 39% of South Carolina standards were written at a comparable level. The majority (57%) of South Carolina standards fell in the lowest taxonomy levels, including 12% at *remembering* and 45% at the *understanding* level. Additionally, 14% of the South Carolina standards were written at the *applying* level, 5% at the *analyzing* level, 3% at the *evaluating* level, and 20% at the *creating* level. Although 20% of South Carolina standards were representative of *creating* based on the action verbs used, 17 of the 31 (11%) used "Discuss" as the verb, when really it was being used to represent *explain*, which suggests that the South Carolina SBAE standards belonged to the *t* (Anderson et al., 2001; Bloom, 1956; Krathwohl, 2002). Sixty-eight percent of South Carolina SBAE standards were at or below the *understand* level compared to five percent of the AFNR Standards for the animal science pathways after the verb meaning adjustment (see Table 2).

Table 2

Comparison of State SBAE Standards and AFNR Standards at Each Level of Bloom's Taxonomy

Standard	I	II	III	IV	V	VI
AFNR Standard	0%	5%	35%	30%	20%	10%
South Carolina SBAE Standard with Adjusted Verb Meaning	12%	56%	14%	5%	3%	9%

Research Objective 2: At what Level of Bloom's Cognitive Taxonomy are the South Carolina SBAE Standards Written

The second objective explored South Carolina SBAE standards for animal science to be analyzed using Bloom's taxonomy shown in Figure 1 (i.e., remember, understand, apply, analyze, evaluate, and create). The South Carolina standards align to *remember* (12%) and *understand* (56%) levels of rigor, which were limited to basic cognition tasks representing knowledge

(Anderson et al., 2001). In addition, the wording of South Carolina SBAE standards and action verbs indicated the intended level of rigor at basic knowledge levels of *remember* and *understand*. Eleven percent of standards used the action verb *discuss* to represent lower cognitive tasks.

Furthermore, South Carolina SBAE content and program standard's strength and value were hard to measure due to the limited number of standards per each of the 19 courses in the animal science pathway. Courses within the South Carolina SBAE animal science pathway ranged from 46 to zero standards, with an average of eight and a median of six. Additionally, five of the 19 South Carolina SBAE animal science pathway courses had no animal science standards. Table 3 compares the number of standards at each of the six levels of Bloom's (1956) taxonomy with each of the 19 courses in the animal science career pathway in South Carolina.

Table 3

Comparison of South Carolina SBAE Course Specific Standards at Each Level of Bloom's Taxonomy

South Carolina SBAE course	I	II	III	IV	V	VI	Total Standards per course
5624 - Agricultural Science and Technology	2	4	0	0	0	0	6
5691 - Agricultural and Biosystems Science	0	7	2	0	0	0	9
5620 - Agricultural Science and Technology for the Workplace	0	0	0	0	0	1	1
5600 - AgriBusiness and Marketing	0	0	0	0	0	0	0
5614 - Agricultural Crop Production and Management	0	3	0	1	1	0	5
5660 - Agricultural Mechanics and Technology	0	0	0	0	0	0	0
5663 - Aquaculture	3	1	4	0	0	0	8
5692 - Biosystems Mechanics and Engineering	0	0	0	0	0	0	0
5679 - Equine Science	2	12	2	1	0	2	19
5657 - Food Processing	0	1	0	0	0	0	1
5646 - Cattle Production	0	6	1	2	1	1	11
5647 - Farm Animal Production	0	3	2	0	0	2	7
5612 - Small Animal Care	6	30	2	2	0	6	46

South Carolina SBAE course	I	II	III	IV	V	VI	Total Standards per course
5613 - Introduction to Veterinary Science	5	5	1	0	0	2	13
5627 - Soil and Water Conservation	1	0	3	0	0	0	4
5630 - Soil and Soilless Research	0	0	0	0	0	0	0
5603 - Animal Science	0	4	2	1	3	0	10
5621 - Equipment Operations and Maintenance	0	0	0	0	0	0	0
5608/5609[a] - Animal Science for the Workplace I and II	0	8	2	0	0	0	10

Note. [a]Course codes 5608 and 5609 represent the same course that is to be taken concurrently within an academic year. For the purpose of our standard analysis, they have been counted as a single and complete course.

Research Objective 3: How does the Level of Rigor Compare Between the South Carolina SBAE Standards and AFNR Standards

The final objective compared the level of rigor between the South Carolina SBAE standards and AFNR standards for the animal science pathway. Ninety-five percent of AFNR standards for the Animal Systems Career Pathway have expected student learning outcomes at or above the *applying* level, whereas 31% of South Carolina SBAE Animal Science standards were found in corresponding levels of Bloom's Taxonomy.

Conclusions, Recommendations, and Discussion

Thirty-one percent of South Carolina animal science standards were written at or above the *applying* level of Bloom's Taxonomy compared to 95% of the AFNR standards. The analysis of standards demonstrated the lack of rigor in current South Carolina standards, as they were primarily written at or below the *understanding* level. Comparatively, the AFNR standards were written at or above the *applying* level of Bloom's Taxonomy, allowing students to integrate the new knowledge in the future, draw conclusions, and produce their own products. Unfortunately, the South Carolina standards asked students to memorize or recall basic information or describe the material, with students very rarely (less than 31%) getting to the *application* level. Furthermore, the South Carolina SBAE standard's strength and value are hard to determine due to the apparent lack of consistent standards or expected quality of written standards in the animal science pathway. The number of standards spanned from zero to 46, with an average of eight standards per course. Additionally, five of the 19 animal science courses had no animal science standards, which represented a vague attempt at a rigorous and relevant framework for supporting SBAE students, teachers, school districts, content developers, and community needs (Molina, 2009; Ravitch, 1995; Swafford, 2018). The concept of vague standards was further exacerbated by unclear and misaligned action verbs with the expected student learning activity, where *discuss* was used at the level of *create* to represent higher-order learning activities that

were truly explaining basic knowledge at the *understanding* level (Bloom, 1956; Clemons and Smith, 2017; Judson et al., 2020).

The movement from teacher-led learning activities to student-led learning creates higher-order learning activities that allow students to use and process information abstractly (Baker et al., 2012; Judson et al., 2020; Swafford, 2018). Upon further evaluation of South Carolina SBAE standards, they should be considered incomplete, according to Ravitch (1995), since complete standards must include content and performance standards. Content standards describe what was taught, and performance standards describe the depth and use of that learning (Ravitch, 1995). The two types of standards were connected, and South Carolina standards currently lacked both. Despite the current South Carolina SBAE standards weak level of rigor and clarity in both content and performance standards, standards remain essential for effective teaching (Nilson, 1998), furthering the need to evaluate and revise these standards to provide relevant and purposeful standards for SBAE teachers across the state (Kraftwohl, 2002; Ravitch, 1995).

Perhaps this misguided attempt was purposeful to allow teachers creative freedom in their SBAE program content and teaching, but the current South Carolina standards burden SBAE teachers with the search for relevant frameworks to align content due to its incomplete, weak, and confusing nature. Ravitch (1995) found that teachers and administrators who argue against national content and performance standards actively seek curriculum, textbooks, industry certification, or mandated exams to align their course content. SBAE teachers need and deserve the support provided by clear, consistent, and measurable content and performance standards (Judson et al., 2020; Ravitch, 1995). Further demonstrating that a strong and clear framework of standards can support all involved, but vague, unclear, and unmeasurable standards have little value for teachers and students when it comes to designing lessons that promote abstract learning for STEM integration. This lack of alignment limits the ability to meet the rigor and relevance needed to support SBAE teachers in preparing students for future STEM-based agricultural careers (Baker et al., 2012; Judson et al., 2020; Swafford, 2018).

Developing strong, clear, and realistic content and performance standards can be a messy and complex process, but it is essential to support the success of our SBAE students, teachers, programs, and communities (Judson et al., 2020; Molina, 2009; Ravitch, 1995). Perhaps South Carolina should consider adopting or cross-walking the AFNR standards to support their SBAE programs, as reevaluating and updating the state-level standards will allow teachers an opportunity to increase further the rigor and relevance of SBAE programs across the state. To accomplish this task, it is recommended that a team of SBAE teachers, state agricultural education staff, and faculty be developed. Further research should investigate the level of rigor taught in SBAE classes across South Carolina, comparing the rigor established in the state standards with what has been taught in classrooms. Although this study highlighted concerns with SBAE standards in South Carolina, additional research is needed to determine how other states' SBAE standards align with AFNR standards. SBAE standards provide a structure for teachers, but the impact of these standards on student performance and outcomes remains unknown, although Swafford (2018) connected the implementation of cross-walked AFNR standards in SBAE teacher preparation programs to increased preparation and STEM integration.

Preservice teacher preparation programs should consider preparing SBAE teacher aspirants to recognize and utilize rigorous and relevant higher-order learning standards. Ultimately allowing them to understand and be better prepared to adapt and find support when standards do not provide enough support, such as those identified in this study. Additionally, SBAE teacher aspirants should be familiar with AFNR standards, as they are aligned with the complete SBAE program (i.e., classroom/laboratory instruction, FFA, and SAE), which serves as a valuable resource. SBAE teacher preparation faculty should consider the current standards in their state and how professional development opportunities cross-walking AFNR standards could benefit the rigor and relevance of SBAE teachers and programs across their state.

Parallel to the recommendations for preservice programs expanding instruction on higher-order learning standards, readiness to teach specific agricultural and natural resources content at higher levels could be an equally challenging issue. In a study by Snider et al. (2021), preservice teachers were surveyed to assess their self-perceived competence to teach different topics in the AFNR standards. Students were found to have a "need for competence enhancement in the Power, Structural, and Technical Systems and the Biotechnology Systems Pathways," (Snider et al., 2021, p. 44). Other areas preservice teachers indicated gaps in were Agribusiness Systems and Food Products and Processing Systems. In contrast, preservice teachers indicated greater competence in the Natural Resources Systems, Plant Systems, and Animal Systems pathways. Snider et al. discussed that pathways such as Animal Systems were an established curriculum in their state and that preservice teachers sought out skill development opportunities in these pathways. Does self-efficacy of specific AFNR pathways influence the level that state standards were written?

The Agribusiness Systems career pathway has been noted to have great inservice need for years (Radhakrishna & Bruening, 1994; Joerger & Andreasen, 2000; Layfield & Dobbins, 2002). Further, preservice agricultural education programs have called for increased coursework offerings in agribusiness recently (DiBenedetto et al., 2018; Snider et al., 2021). Might these needs have impacted the lack of alignment between the state and AFNR standards for the Agribusiness and Marketing courses, as shown in Table 3? It is recommended that future research in self-efficacy of AFNR skills areas have any influence on those writing standards for state and national curricula.

Whether the state program adopts the AFNR standards or chooses to revise its current work, this does not guarantee that the new/revised standards will be taught at the higher levels. Ulmer and Torres (2007) found that SBAE teachers exhibit lower-order (knowledge and comprehension) teaching 83% of the time. The same study found that this is not isolated to agriculture teachers, as science teachers were at the lower levels 84% of the time. Similarly, Cano and Metzger (1995) also found that horticulture teachers were at the lower levels 84% of the time. All of these researchers recommended that SBAE teachers were engaged in professional development that would assist them in developing student activities and assignments that encourage higher-order thinking skills. It is recommended that teacher educators develop purposeful professional development that will prepare SBAE teachers to plan activities and assignments at higher-order thinking levels.

Future research should consider the replication of this study on a state-by-state basis as deemed necessary. Additionally, a mixed method approach could be beneficial to assess teachers' current level of self-efficacy to implement STEM-based higher-order instruction in SBAE, aligning with Bloom's (1956) cognitive taxonomy. This study could also establish a repository of resources, materials, and curriculum currently being utilized as a framework to deliver STEM-based higher order instruction, helping prepare future SBAE teachers. Researchers should also consider exploring teachers' content needs, current curriculum resources, and their perspectives on content and performance standards through qualitative interviews. Finally, as state-level changes are made related to SBAE, teachers' perceptions of current standards should be considered to support and improve the adoption of new state standards.

References

Anderson, L. W, Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *A Taxonomy for learning, teaching, and assessing.* Addison Wesley Longman, Inc.

Baker, M. A., Robinson, J. S., & Kolb, D. A. (2012). Aligning Kolb's experiential learning theory with a comprehensive agricultural education model. *Journal of Agricultural Education, 53*(4), 1–16. https://doi.org/10.5032/jae.2012.04001

Blooms, B. (1956). *Taxonomy of educational objectives: The classification of educational goals.* D. McKay.

Cano, J., & Metzger, S. (1995). The relationship between learning style and levels of cognition of instruction of horticulture teachers. *Journal of Agricultural Education, 36*(2), 36–42. https://doi.org/10.5032/jae.1995.02036

Clemons, A., & Smith, A. (2016, March 8–13). Recontextualizing Bloom's Taxonomy: Quantitative measures in formative curriculum. *Proceedings of 28th International Conference of Technology in Collegiate Mathematics*, pp. 111–142. Pearson Education Inc.

Clune, William H. (1993). The best path to systemic educational policy: Standard/centralized or differentiated/decentralized? *Educational Evaluation and Policy Analysis, 15*, 233–54. http://www.jstor.org/stable/1164341

Darling-Hammond, L. (1994). National standards and sssessment: Will they improve education? *American Journal of Education, 102,* 478–510. https://doi/org/01956744/94/0204-0005

DiBenedetto, C., Willis, V., & Layfield, K. D. (2018, May 15–18). Determining content knowledge needs for professional development of in-service agricultural education teachers in South Carolina. 45th Annual National Research Conference of the American Association for Agricultural Education. Charleston, SC.

Joerger, R. M., & Andreasen, R. (2000). Agribusiness standards: A comparison of the choices of Utah agriscience and technology teachers and agribusiness representatives. *Journal of Agricultural Education*, *41*(3), 23–30. https://doi:10.5032/jae.2000.03023

Judson, E., Hayes, K. N., & Glassmeyer, K. (2020). Understanding how educators make sense of content standards. *American Journal of Educational Research*, *8*(11), 812–821. https://doi.org/10.12691/education-8-11-1.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice*, *41*(4), 212–225. http://doi/org/10.1207/s1543042tip4104_2

Molina, Q. (2009). Program & curriculum standards: Mapping the future of agricultural education. *The Agriculture Education Magazine*, *81*(4), 11–12. https://www.naae.org/profdevelopment/magazine/archive_issues/Volume81/2009_01-02.pdf

Nilson, L. B. (1998). *Teaching at its best: A research-based resource for college instructors*. Anker Publishing Company.

Privitera, G. J. (2020). *Research methods for the behavioral sciences* (3rd ed.). SAGE.

Radhakrishna, R. B., & Bruening, T. H. (1994). Pennsylvania study: Employee and student perceptions of skills and experiences needed for careers in agribusiness. *NACTA Journal*, *4*, 15–18. http://www.nactateachers.org/attachments/article/775/

Ravitch, D. (1995). *National standards in American education: A citizen's guide.* Brookings.

Snider, C., Robinson, S., Edwards, C., & Terry, R. (2021). Student teachers' views on their competence to teach the national AFNR career pathways: Implications for the preparation of preservice teachers in agricultural education. *Journal of Agricultural Education*, *62*(3), 34–50. https//doi.org/10.5032/jae.2021.03034

Stanny, C. (n.d.). Action Words for Bloom's Taxonomy. Retrieved January 13, 2016, http://uwf.edu/media/university-of-west-florida/offices/cutla/documents/Action-Words-

South Carolina Cooperative Extension. (2021). *Plant and Animal Pathway*. South Carolina Agricultural Education.

Swafford, M. (2018). STEM education at the nexus of the 3-circle model. *Journal of Agricultural Education*, *59*(1), 297–315. https://doi.org/10.5032/jae.2018.01297

The National Council for Agricultural Education (The Council). (2015). *Animal systems career pathway*. Author. https://www.teamaged.co/CMDocs/IowaTeamAgEd/Animal%20Systems%20Career%20Pathway.pdf

Ulmer, J., & Torres, R. (2007). A comparison of the cognitive behaviors exhibited by secondary agriculture and science teachers. *Journal of Agricultural Education, 48*(4), 106–116. https://doi.org/10.5032/jae.2007.04106