Journal of Agricultural Education, 62(4), 158-172
https://doi.org/10.5032/jae.2021.04158

Classroom and Contest Overlap: Implications for Student Performance

Catlin M. Goodwin[1] and Aaron J. McKim [2]

Abstract

The three-circle model of agricultural education serves as a cornerstone of the discipline; however, empirical evidence analyzing the overlap between components of the model is lacking. The current study explored the overlap between classroom instruction and FFA via a researcher-created Career Development Event and Curriculum Scale (CDECS) within the context of Environmental and Natural Resources curriculum and the Environmental Skills Career Development Event (CDE) in Michigan. Leveraging the ecological systems theory, results from the CDECS were compared to student performance in the Environmental Skills CDE as well as evidence of knowledge transfer. Findings indicated teachers had moderate overlap between classroom curriculum and the Environmental Skills CDE, as measured by the CDECS. In addition, results indicated small, positive correlations between the teacher-reported CDECS and student achievement in the CDE as well as their knowledge transfer. Findings provide empirical evidence of the relationship between classroom and FFA overlap and student performance. Further, findings provide practitioners, teacher educators, CDE coordinators, and researchers with a foundation from which to build additional understanding of the relationships between elements of the three-circle model.

Keywords: career development events; ecological systems theory; environmental and natural resources; three-circle model of agricultural education

Author Note: The authors report no conflicts of interest. Catlin M. Goodwin (https://orcid.org/0000-0003-0312-8504) and Aaron J. McKim (https://orcid.org/0000-0002-0600-3611).

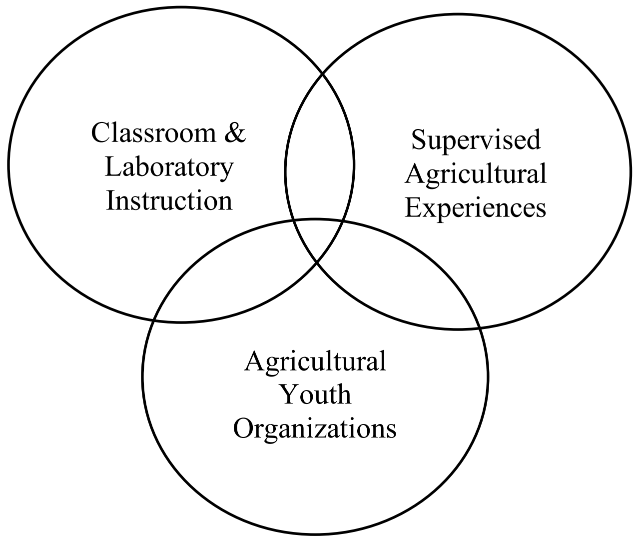
Introduction

Since its formal beginning, school-based agricultural education (SBAE) has focused on developing knowledge and skills to prepare students for successful careers and a lifetime of informed choices in agriculture, food, and natural resources (AFNR) systems (McKim et al., 2017). To accomplish this purpose, SBAE incorporates classroom and laboratory instruction, supervised agricultural experiences, and involvement in agricultural youth organizations, e.g., the National FFA Organization, within a framework commonly known as the three-circle model (see Figure 1; Croom, 2008; National Council for Agricultural Education, 2016; Phipps et al., 2008).

[1] Catlin M. Goodwin is an Agricultural Science Teacher in the Career and Technical Education Department at Granville Jr./Sr. High School, 58 Quaker Street, Granville, NY 12832, pauleycatlin@gmail.com.
[2] Aaron J. McKim is an Assistant Professor of Agriculture, Food, and Natural Resources Education in the Department of Community Sustainability at Michigan State University, 480 Wilson Road Room 131, East Lansing, MI 48824, amckim@msu.edu.

Figure 1

The Three-Circle Model of Agricultural Education



The 1975 FFA Advisors Handbook (National FFA Organization, 1975) is the first known publication containing the visual three-circle model (Croom, 2008). In this publication, the three overlapping circles were used to "justify the integral nature of FFA within the instructional program" (Croom, 2008, p. 117). From its origination to its current use, the visual overlap between components of the three-circle model represents elements being used in conjunction to create rich learning experiences for students by combining classroom learning, and/or leadership and career development, and/or authentic agricultural experiences (Croom, 2008). Most depictions of the three-circle model illustrate a similar overlap between each of the three components (Croom, 2008; Phipps et al., 2008; Talbert et al., 2007). The consistency of depictions indicates a balanced overlap between three-circle model components; however, neither the balanced overlap nor the actual extent of overlap in practice has been empirically explored.

As the three-circle model is the "predominant model for organizing instruction in agricultural education" (Croom, 2008, p. 110), an understanding of its operationalization within AFNR programs, and the associated student outcomes, is crucial to program development and student growth. This study sought to increase understanding of the integrated nature of the three-circle model by measuring the overlap between classroom instruction and FFA components amongst Michigan AFNR educators and its impact on student performance. Specifically, this study explored contest placing and knowledge transfer in relation to overlap between the Environmental and Natural Resources (ENR) curriculum and the Michigan Environmental Skills Career Development Event (CDE).

Environmental Skills CDE Introduction

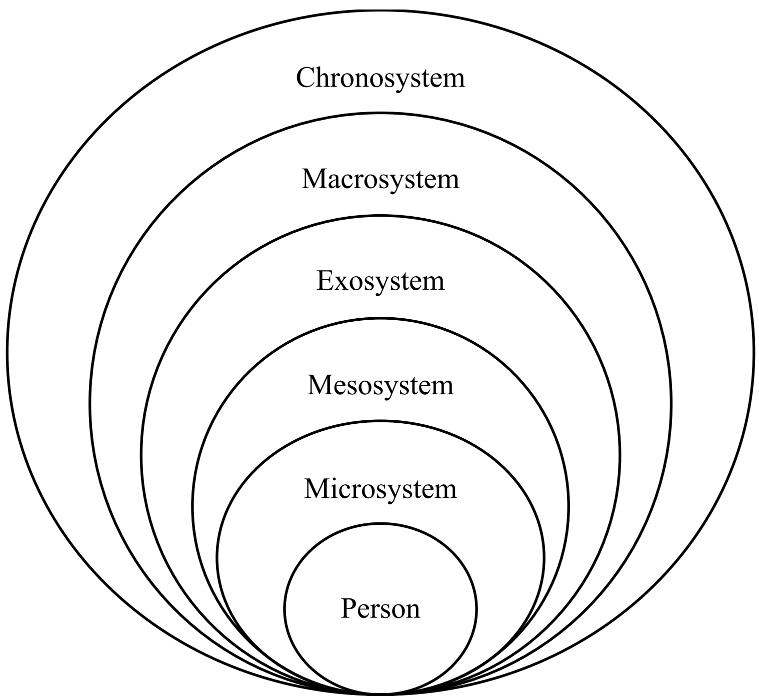
The Michigan Environmental Skills CDE provides opportunities for students to apply knowledge and skills related to ENR systems in a real-world setting (Michigan FFA, 2017). During the CDE, students work together in teams of three to five members to complete nine CDE components: (a) animal and bird identification, (b) ecosystem analysis, (c) environmental tools and invasive species identification, (d) fish and aquatic organism identification, (e) GPS use, (f) plant and tree identification, (g) reptile and amphibian identification, (h) soils analysis, and (i) water quality analysis.

Theoretical Framework

As the aim of the current research is to better understand overlap between curricular experiences and student achievement, a theoretical framework encompassing elements of student development was sought. Bronfenbrenner's (1979, 2005) ecological systems theory was identified as an ideal framework to guide the study as it provides a systemic perspective which focuses on the development of the individual, or, in the context of this investigation, the student. In ecological systems theory, human development is explored through relationships with the dynamic, multidirectional, and nested nature of systems in which humans interact (Bronfenbrenner, 1979). Understanding individuals do not act nor develop independently of one another or their environment, Bronfenbrenner (1979; 2005) described systems, or environments in which people interact as a nested hierarchy with five progressively inclusive levels, (a) microsystem, (b) mesosystem, (c) exosystem, (d) macrosystem, and (e) chronosystem with the person at the center (see Figure 2).

Figure 2

Nested Hierarchy of Systems



The microsystem includes the "pattern of activities, roles, and interpersonal relations experienced by the developing person in a given face-to-face setting with particular physical and material features and containing other persons" (Bronfenbrenner, 2005, p. 148), such as the home or classroom. The next level, the mesosystem, is comprised of the "linkages and processes taking place between two or more settings containing the developing person (e.g., the relations between home and school, school and workplace)" (Bronfenbrenner, 2005, p. 80). Similar to the mesosystem, the exosystem is comprised of connections "between two or more settings containing the developing person;" however, in the exosystem, at least one of the settings "does not ordinarily contain the developing person" (Bronfenbrenner, 2005, p. 80). For example, an exosystem may contain linkages between a teacher's peer group and the school. The idea of indirect influence of the environment on the person is broadened in the macrosystem, which contains "an overarching pattern of ideology and organization of the social institutions common to…a given society or segment thereof" (Bronfenbrenner, 2005, p. 80). Given the inclusion of overarching beliefs and values, resources, and opportunity structures (Bronfenbrenner, 2005), the macrosystem refers less to a physical space and more to environmental conditions.

Though each individual belongs to a nested system containing the five environmental levels, it is the person's interactions within the environment which contribute to his or her development (Bronfenbrenner, 1979, 2005). Each interaction with "persons, objects, and symbols" within an environment provides a developmental opportunity for the individual (Bronfenbrenner & Evans, 2000, p. 118). Therefore, the current study sought to understand microsystem factors (i.e., curriculum and contest overlap) which relate to student development; specifically, placement in the Michigan Environmental Skills CDE and knowledge transfer. Importantly, however, elements of the mesosystem (e.g., teacher philosophy of CDEs) impact the overlap the student will experience in their CDE training. While important, elements of the mesosystem and subsequent levels of the theory are not included in the current analysis.

Literature Review

To situate the current study within the context of existing scholarship, the literature review is organized as a discussion of research exploring the overlap between FFA and classroom curriculum followed by a discussion of learning transfer, an outcome of interest of this study. In the final section, readers are introduced to additional background knowledge about the Environmental Skills CDE in Michigan.

Curriculum Content and FFA Overlap

CDEs, such as Michigan's Environmental Skills event, prove to be valuable opportunities for experiential learning (Ewing et al., 2014); however, debate exists among professionals in SBAE regarding the degree to which CDE preparation should be integrated into classroom curriculum (Ball & Bowling, 2015). There are professionals who feel CDE preparation should not be the focus of curriculum or instruction, and argue AFNR educators should not teach FFA components, such as CDEs, but rather utilize FFA components to support existing classroom curriculum (Melodia & Meyer, 2001). Others advocate for the use of classroom curriculum to prepare students for CDEs (Beekley & Moody, 2002). Meanwhile, others argue both sides of the debate, recognizing the use of class time to prepare students for CDEs has its critics (Russell, Robinson, & Kelsey, 2009) and the potential to disrupt curriculum (Edwards & Booth, 2001) but assert that relating relevant curriculum to the CDE components provides students with valuable opportunities for knowledge and skill acquisition and content application (Edwards & Booth, 2001; Russell et al., 2009).

The curriculum and CDE preparation debate is not just conjecture. A Pennsylvania study by Ewing et al. (2014) identified a large gap in practice between AFNR educators and the preparation of their students for CDEs. In the study, 39% of teachers reported preparing students for CDEs "during the regular school hours in agricultural education classes" (p. 44), and the remaining 61% of teachers reported preparing students during free periods or outside of regular school hours. Though teachers did not report their reasoning for the timing of CDE preparation, findings indicated a clear divide in CDE preparation strategies. As the preparation strategies utilized by AFNR educators have a direct influence on students (Ball & Bowling, 2015; Ewing et al., 2014), an understanding of student outcomes associated with various CDE preparation strategies is beneficial to student growth and optimizing the value of SBAE.

Student Learning Implications: Transfer

Though student success is often measured by top placings at CDEs, it is important to determine whether participants can also be successful outside of the CDE context by transferring knowledge and skills to other applications within their prospective career paths. The transfer of knowledge and skills from one application to another, i.e., far transfer, requires a deep understanding of related concepts (Cree & Macaulay, 2000). Bloom's Taxonomy of Educational Objectives aids in identifying depth of understanding by offering a hierarchical ranking of categories of cognition from simple, concrete objectives to complex, abstract objectives (Krathwohl, 2002). First published by Bloom et al. in 1956, the Taxonomy of Educational Objectives, hereafter referred to as Bloom's Taxonomy, identified six major categories of cognition. Bloom et al. arranged each category, i.e., knowledge, comprehension, application, analysis, synthesis, and evaluation, from lower-order cognition to higher-order cognition. Later, in 2001, Bloom's Taxonomy was revised, reversing the order of the highest two categories to reflect current understanding of cognition (Anderson & Krathwohl, 2001). The first three categories of Bloom's Taxonomy, i.e., remembering, understanding, and applying, are considered lower-order cognitive skills and the highest three categories, i.e., analyzing, evaluating, and creating, are considered higher-order cognitive skills. The use and successful completion of these higher-order cognitive objectives correlates to far transfer, the ability of students to transfer knowledge to other tasks and different contexts (Adams, 2015; Cree & Macaulay, 2000; Reece, 2007). Importantly, far transfer is juxtaposed to near transfer (i.e., applying knowledge in the same context in which it was learned), and aligns more with lower-order learning objectives (Cree & Macaulay, 2000).

The transfer of knowledge between classroom and workplace settings has been studied over time, especially in career and technical education (Daniels et al., 2009; Kilbrink & Bjurulf, 2013; Konkola et al., 2007). In interviews with vocational education teachers and supervisors, Kilbrink and Bjurulf (2013) found the transfer of (a) basic knowledge, (b) principles and skills, (c) written materials, and (d) experiences to be crucial for classroom and workplace success. However, not all scholarship implies such clarity when considering transfer. Daniels et al. demonstrated the lack of evidence of transfer when they related learning and knowledge to an iceberg. They likened the learning of knowledge for educational assessment to the portion of the iceberg above the water as it is "explicit and well supported" (2009, p. 82). The ability to transfer knowledge to other situations is represented by the portion of the iceberg hidden by the ocean as people know it is there, but is largely unexplored. Moving this relationship to SBAE and career preparation, the knowledge students learn and apply to CDEs could be considered the visible portion of the iceberg. Student knowledge and success in the context of CDEs is well documented by SBAE professionals; however, little is known about students' abilities to apply such knowledge and skills in other contexts, or how such abilities are related to the CDE preparation strategies they experienced.

Environmental Skills Career Development Event

This study was situated in the context of the Environmental Skills CDE offered by the Michigan FFA Organization. Although the Environmental Skills CDE fits within the FFA component of the three-circle model of agricultural education, it also aligns closely with the model's classroom instruction component. Table 1 depicts a crosswalk of the Michigan AFNR curriculum segments with components of the Environmental Skills CDE. The Environmental Skills CDE is most closely related to segments twelve, career readiness and leadership, and nine, natural resource systems (see Table 1); however, it is important to note, the Environmental Skills CDE addresses standards in every Michigan AFNR segment except two, i.e., animal genetics and reproduction, animal health and nutrition.

Table 1

Alignment of Michigan AFNR Segments and Environmental Skills CDE Components

	Michigan AFNR Education Segments											
CDE Components	1	2	3	4	5	6	7	8	9	10	11	12
Animal and Bird Identification		X		X					X			X
Ecosystem Analysis	X								X	X	X	X
Environmental Tools and Invasive Species Identification						X			X			X
Fish and Aquatic Organism Identification		X		X					X			X
GPS	X											X
Plant and Tree Identification						X			X			X
Reptile and Amphibian Identification		X		X					X			X
Soils Analysis	X						X	X	X	X	X	X
Water Quality	X								X		X	X

Note. Segments are numbered as follows: 1) Safety, 2) Animal Anatomy and Physiology, 3) Animal Genetics and Reproduction, 4) Domestic Animal Production, 5) Animal Health and Nutrition, 6) Plant Anatomy and Physiology, 7) Soils and Plant Nutrition, 8) Plant Culture and Propagation, 9) Natural Resource Systems, 10) Environmental Service Systems, 11) Agriculture Business and Marketing, and 12) Career Readiness and Leadership.

Connecting Literature and Theory

The ecological systems theory was operationalized by exploring curriculum and contest overlap within the SBAE program, a representation of the microsystem, and student event placing and knowledge transfer, an element or behavioral outcome of the individual. By exploring the relationship between the microsystem and the student, we are acknowledging the interaction between environmental characteristics and individuals, a key element of the ecological systems theory (Bronfenbrenner, 1979, 2005).

Purpose and Objectives

In this study, the relationship between SBAE curriculum's overlap with a CDE and student outcomes associated with the Michigan FFA Environmental Skills CDE was evaluated. The study was guided by two research objectives.

1. Measure the overlap between the Environmental Skills CDE and Michigan AFNR educators' ENR curriculum, (henceforth referred to as curriculum-CDE overlap).
2. Explore the relationship between Michigan AFNR educators' curriculum-CDE overlap and student performance in the Environmental Skills CDE.

The second research objective will test the null hypothesis that no relationship exists between curriculum-CDE overlap and student performance in the Environmental Skills CDE.

This study addresses research priority three of the American Association for Agricultural Education National Research Agenda for 2016-2020 (Roberts et al., 2016). The research priority, Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century, calls for investigations "to draw a connection between the impact of our academic programs and student preparedness and success" (Stripling & Ricketts, 2016, p. 32). We responded to this call by examining student outcomes associated with the relationship between SBAE classroom curriculum and the Environmental Skills CDE. Although existing literature indicates a practical and theoretical debate regarding the use of CDEs in classroom instruction (Beekley & Moody, 2002; Edwards & Booth, 2001; Melodia & Meyer, 2001; Russell et al., 2009), a lack of empirical evidence exists describing the relationship between curriculum-CDE overlap and student outcomes. A more robust understanding of the relationship between curriculum, CDEs, and student learning outcomes would inform future research studies within SBAE.

Methods

Population, Sample, and Data Collection

The target population included all school-based, Michigan AFNR educators during the 2017-2018 school year. A census of the target population (N = 131) was attempted. Names and email addresses for the target population were retrieved from the Michigan AFNR frame, as obtained by State Supervisor for AFNR education. Due to frame error, potential respondents were limited to 127. Usable data were provided by 92 respondents (n = 92), resulting in a 72% response rate. Data were collected April through June of 2018, following completion of the Michigan FFA Agriculture Skills CDE day, held in April 2018.

Dillman's (2007) tailored design method was used to collect the data. All five points of contact were conducted via email, which included a link to take the online Qualtrics® survey. Non-response bias was analyzed by comparing on-time respondents, including those responding within the first three points of contact (n = 65), to late respondents, including those responding within the last two points of contact (n = 27), within the variables of interest. No statistically significant differences were found for the variables measured (Lindner et al., 2001). The choice to accept the evidence against non-response bias is further supported by a comparison of respondents' selected characteristics against the target population, in which the respondents were determined to be similar to the target population.

Instrumentation

Participants indicated whether they trained, helped train, or provided support to a 2018 Environmental Skills CDE team. Only those who indicated such affiliation were allowed to respond to the Environmental Skills Career Development Event and Curriculum Scale (CDECS) construct, which measured the curriculum-CDE overlap. In the researcher-developed Environmental Skills CDECS construct, respondents indicated their level of agreement to four statements on a sliding scale from 0 (*strongly disagree*) to 100 (*strongly agree*). The statements, e.g., "I conduct a replication of the [Environmental Skills] CDE for students to complete during ENR instruction" were adapted from findings of Ewing et al. (2014) related to Pennsylvania AFNR educator's techniques for preparing students for CDEs, a complete list of statements can be found in Table 3.

Data associated with student performance in the Environmental Skills CDE were retrieved from a publicly-available score report on the Michigan FFA website. Data of interest included school of attendance, overall score, and scores on each component of the Environmental Skills CDE, all of which were available at the team level. To determine higher-order educational components of the Environmental Skills CDE, each CDE component was evaluated using Bloom's Taxonomy of Educational Objectives (Bloom et al., 1956). An expanded discussion regarding the identification of higher-order educational components of the Environmental Skills CDE is found in the data analysis section below.

Validity and Reliability

Face and content validity were evaluated by a panel of experts comprised of five faculty members in AFNR education. Their feedback assisted in improving user interaction with the instrument, including suggestions related to question response type and organization, as well as question clarity and improved overlap with common practices related specifically to the Environmental Skills CDE in Michigan, such as the absence of qualifying events to advance to the state event.

Reliability was determined via a pilot test among Ohio agricultural educators (n = 45) who prepared students for a comparable CDE, i.e., Wildlife Management. During the initial test for reliability, the CDECS construct did not yield an acceptable reliability estimate. However, one item within the scale was identified as an outlier. Removal of the item from the CDECS resulted in a Cronbach's Alpha of .72, which was deemed acceptable (Fraenkel & Wallen, 2000). In addition, reliability was established *post hoc* based on the participants' responses (Cronbach's Alpha = .85; Fraenkel & Wallen, 2000).

Data Analysis

To accomplish objective one, determining the overlap between the Environmental Skills CDE and Michigan AFNR educators' ENR curriculum, the Environmental Skills CDECS construct was measured. Construct items were averaged to determine an overall overlap between the Environmental Skills CDE and the ENR curriculum, as reported on a scale from 0 (*completely unaligned*) to 100 (*completely aligned*). For the purpose of this study, CDECS overlap from 0 to 40 is considered "minimal," 40 to 70 "moderate," and 70 to 100 "extensive." A CDECS overlap was recorded for each respondent and the average score for respondents is reported in the findings. Because CDECS overlap was measured through self-reporting, it is important to note the findings represent AFNR educators' perceptions of overlap between the Environmental Skills CDE and their ENR curriculum.

For objective two, the relationship between CDECS overlap and student performance in the Environmental Skills CDE was explored. To start, the higher-order educational components of the Environmental Skills CDE were identified. To identify the higher-order educational objectives, assessments of knowledge and skills within each component of the Environmental Skills CDE were identified in the event handbook (Michigan FFA, 2017) and were evaluated to determine their position within Bloom's Taxonomy (see Table 2; Bloom et al., 1956). For example, the plant and tree identification component of the Environmental Skills CDE requires students identify plant species, therefore, is positioned at the bottom of Bloom's taxonomy. In contrast, the water quality component requires students analyze water quality data obtained from a designated site, therefore, is positioned near the top of Bloom's Taxonomy (Bloom et al., 1956).

Table 2

Michigan Environmental Skills CDE Components Aligned with Cognitive Objectives

CDE Components	Component Objectives	Cognitive Level
Ecosystems Analysis	Assess the site location considering associated products and quality	Higher-order
GPS	Operate a GPS unit to answer questions related to the site location	Higher-order
Soils Analysis	Evaluate a soil pit for soil properties and environmental impact	Higher-order
Water Quality	Analyze water quality data obtained from site location	Higher-order
Animal and Bird Identification	Identify common animals and birds	Lower-order
Environmental Tools and Invasive Species Identification	Identify common environmental tools and invasive species	Lower-order
Fish and Aquatic Organism Identification	Identify common fish and aquatic organisms	Lower-order
Plant and Tree Identification	Identify common plants and trees	Lower-order
Reptile and Amphibian Identification	Identify common reptiles and amphibians	Lower-order

Note. CDE components were retrieved from the Michigan FFA Environmental Skills CDE Handbook (Michigan FFA, 2017) and aligned to Bloom's Taxonomy of Educational Objectives (Bloom et al., 1956).

Participant scores from each higher-order CDE component were averaged to determine an overall higher-order team score. In addition, for schools with two or more teams, team scores from the highest scoring team from the school were recorded for each variable of interest, i.e., overall team score and higher-order component score. For example, if a school entered two teams and team one scored 117 points on the higher-order components and 300 on the overall score while team two scored 110 points on higher-order components and 340 on the overall score, the high-order score from team one, i.e., 117 points, would be the higher-order score of record and the overall score from team two, i.e., 340 points, would be the overall score of record for the school. Correlations between the independent variable, Environmental Skills CDECS overlap, and dependent variables, overall team score and higher-order component team score were analyzed independently. Pearson product moment correlation with the threshold for statistical significance was set *a priori* at p-value < .05 (Hoy, 2010) and effect sizes established as "small effect," $r = .10$; "medium effect," $r = .30$; and "large effect," $r = .50$ (Cohen, 1988).

Findings

The purpose of research objective one was to determine the overlap between the Environmental Skills CDE and Michigan AFNR educators' environment and natural resources (ENR) curriculum. It is important to note the CDECS overlap was measured through self-reporting methods, so the findings represent AFNR educators' perceptions of overlap between the Environmental Skills CDE and their ENR curriculum. Individual items within the CDECS illustrate the average responses for teachers were similar across each of the four questions, mean scores ranged from 60.55 to 68.93. Within the CDECS, scores varied among educators (min = 10.00; max = 100.00); however, overall, results indicated a moderate overlap (*M* = 66.10; *SD* = 23.55) perceived between the Environmental Skills CDE and Michigan AFNR educators' curriculum related to the environment and natural resources (see Table 3).

Table 3

AFNR Educators' Responses to Items on Environmental Skills CDECS

	f	*M*	*SD*	Min	Max
I conduct a replication of the CDE for students to complete during ENR instruction.	44	60.55	30.28	0.00	100.00
All students in the program receive the same instruction of *ENR content* regardless of whether they participate in the CDE.	41	68.93	30.26	3.00	100.00
All students in the program receive the same instruction of *ENR applied skills* regardless of whether they participate in the program.	41	66.41	29.53	6.00	100.00
I include problem-solving components of the CDE in classroom instruction of ENR content and skills.	43	67.30	28.43	3.00	100.00
CDECS	42	66.10	23.55	10.00	100.00

Note. Overlap was measured using the CDECS and is reported on a scale from 0 (*completely unaligned*) to 100 (*completely aligned*) and includes only Michigan AFNR educators who prepared students for the Environmental Skills CDE in 2018.

The purpose of objective two was to determine the relationship between the overlap of the Environmental Skills CDE and Michigan AFNR educators' environment and natural resources curriculum and students' overall scores and performance on higher-order educational objectives in the Environmental Skills CDE (see Table 4). The correlations between both overall team score ($r = .14$; $p = .446$) and higher order team score ($r = .13$; $p = .476$) were similar; both had a small, but statistically insignificant, positive correlation with Environmental Skills CDECS overlap.

Table 4

CDECS and Environmental Skills CDE Scores

	Independent Variable: Environmental Skills CDECS	
Scored CDE Component	Pearson Correlation (*r*)	*p*-value
Overall Team Score	.14	.446
High Order Team Score	.13	.476

Note. Overall team score and higher-order team score represent the total number of points accumulated during the contest. Thus, higher scores indicate better contest performance.

Conclusions

For the first research objective, AFNR educators' perceived overlap between the Environmental Skills CDE and their ENR curriculum was measured using the Environmental Skills CDECS. Though overlap varied among respondents from 10.00 to 100.00, the average Environmental Skills CDECS overlap was 66.10. This finding supports existing literature regarding the integrated nature of the three-circle model of agricultural education (Croom, 2008); indicating, on average, Michigan AFNR educators who prepare students for the Environmental Skills CDE perceived they establish moderate connections between the CDE and the ENR curriculum. When comparing the average Environmental Skills CDECS overlap reported by Michigan AFNR educators to the ongoing professional debate regarding the degree to which CDE preparation should be integrated in the classroom curriculum (Ball & Bowling, 2015; Beekley & Moody, 2002; Edwards & Booth, 2001; Melodia & Meyer, 2001; Russell et al., 2009), it can be reasoned the moderate overlap indicates Michigan AFNR educators value connections between the Environmental Skills CDE and the ENR curriculum. However, the large range and standard deviation of CDECS scores indicated disagreement regarding the ideal overlap.

For research objective two, the relationship between Michigan AFNR educators' Environmental Skills CDECS overlap and their students' overall score and performance on higher-order educational objectives in the Environmental Skills CDE was determined. Findings indicated a small, positive correlation between the Environmental Skills CDECS overlap and both overall team score and team score on the higher-order components of the CDE. The lack of statistical significance, however, between CDECS and student performance underscores the importance of considering the systems of influence impacting individuals (Bronfenbrenner, 1979, 2005). Evidence from our review of literature suggests additional variables, including student motivation and CDE preparation outside of class time (Ball & Bowling, 2015; Ewing et al., 2014), may have contributed to student performance.

Bronfenbrenner's (1979, 2005) ecological systems theory was used to guide the study and is cautiously supported by the findings. Environmental Skills CDECS overlap, a component of the students' microsystem, was found to have a small, positive correlation with student outcomes in the Environmental Skills CDE. While not statistically significant, the evidence of a positive relationship supports Bronfenbrenner's (1979, 2005) description of interactions, in this case occurring between the microsystem and the student, which support student development.

Limitations

It is important to note that due to a small, non-random sample, findings should not be generalized to other populations or contexts. In addition, although "small" effect sizes (Cohen, 1988) existed among relationships of interest regarding objective two, no statistically significant findings resulted from the study. Therefore, in addition to the study's independent variables of interest, other variables outside the study's scope are likely related to the outcomes of interest. However, recommendations, provided below, are based on the "small" effect sizes identified by this study.

Recommendations

AFNR Educators

After receiving scores from the Environmental Skills CDE, or other CDEs, AFNR educators are encouraged to conduct an informal assessment of student performance on the entire CDE, as well as for higher-order educational objective components of the CDE, to determine opportunities to support continued student development of knowledge and skills related to the context, especially those which promote transfer (Cree & Macaulay, 2000).

Teacher Educators and CDE Coordinators

To aid Michigan AFNR educators and pre-service educators in fostering connections between ENR curriculum and the Environmental Skills CDE as envisioned within the three-circle model of agricultural education, teacher educators should illuminate opportunities to operationalize components of the Environmental Skills CDE within the ENR curriculum. To further facilitate these connections, CDE coordinators should include a crosswalk of CDE components and AFNR curriculum (see Table 1) for each CDE offering to identify connections between the CDE and AFNR curriculum. CDE coordinators should also include a table of higher- and lower-order educational objective components (see Table 2) for each CDE offering to identify components which promote a greater depth of student knowledge and skill attainment. Finally, as higher-order educational objectives are correlated with student transfer (Adams, 2015; Reece, 2007), CDE coordinators should increase the proportion of high-order educational objectives in the Environmental Skills CDE. In addition, CDE coordinators should assess other CDEs to identify opportunities to include more CDE components which promote student transfer of knowledge and skills.

Researchers

Future research should replicate the current study in the context of other CDEs to determine how CDECS overlap varies and if correlations between CDECS overlap and student outcomes exist in other CDE contexts. In addition, the Michigan Environmental Skills CDE is a state-level only competition; therefore, this study did not measure differences in CDECS overlap according to other levels of competition, e.g., local, regional, and national. Future research should replicate the current study across CDEs with qualifying events to determine if differences exist among the variables of interest across levels of participation.

The use of higher-order educational objective component performance from the Environmental Skills CDE to measure student ability to transfer knowledge and skills was a limitation of this study; therefore, future studies should measure transfer via a novel context to obtain a more reliable determination of the student outcome. Another limitation of the current study was the incomplete view of Bronfenbrenner's (1979; 2005) ecological systems theory; therefore, future research should collect personal data from students (e.g., motivation, time outside of class preparing) to incorporate the process-person-context model of human development.

Discussion

Professionals within SBAE can take pride in the integrated nature of the three-circle model of AFNR education as it symbolizes a combination of opportunities for students to continuously develop and apply knowledge and skills related to careers and life. However, a lack of best practices for integrating multiple components of the three-circle model forces AFNR educators to make decisions regarding program implementation without knowledge of the potential impact on student development. The current study sought to address this problem regarding classroom and FFA overlap by determining the influence of Michigan AFNR educators' ENR curriculum and Environmental Skills CDE overlap on student achievement.

Through its purpose, we revealed the current practices of Michigan AFNR educators for integrating the classroom and FFA components of the three-circle model through overlap of the ENR curriculum and the Environmental Skills CDE as well as relationships between practice and student achievement. Conclusions and recommendations resulting from the study serve to further knowledge and practice of the educators teaching AFNR curriculum and making CDE connections in Michigan and elsewhere. However, results of this study are only the first steps in exploring curriculum and CDE connections within SBAE. Practice and research implementing and evaluating such connections must continue to provide the most transformative opportunities for student learning and success in the classroom in CDEs, and in their lives.

References

Adams, N. E. (2015). Bloom's taxonomy of cognitive learning objectives. *Journal of the Medical Library Association, 103*(3), 152-153. https://doi.org/10.3163/1536-5050.103.3.010

Anderson, L. W. & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Ball, A., & Bowling, A. (2015). Conceptualizing the process of CDE preparation: A grounded theory approach. *Proceedings of the North Central AAAE Research Conference,* Minneapolis, MN, 39-46.

Beekley, B., & Moody, L. (2002). Career development events: An example of authentic learning. *The Agricultural Education Magazine, 75*(1), 16-17.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives, handbook I: The cognitive domain*. David McKay Co., Inc.

Bronfenbrenner, U. (1979). *The ecology of human development.* Harvard University Press.

Bronfenbrenner, U. (2005). *Making human beings human: Bioecological perspectives on human development.* SAGE.

Bronfenbrenner, U., & Evans, G. W. (2000). Developmental science in the 21st century: Emerging questions, theoretical models, research designs, and empirical findings. *Social Development, 9*(1), 115-125. https://doi.org/10.1111/1467-9507.00114

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Erlbaum.

Cree, V. E., & Macaulay, C. (2000). *Transfer of learning in professional and vocational education.* Psychology Press.

Croom, D. B. (2008). The development of the integrated three-component model of agricultural education. *Journal of Agricultural Education, 49*(1), 110-120. https://doi.org/10.5032/jae.2008.01110

Daniels, H., Lauder, H., & Porter, J. (2009*). Knowledge, values and educational policy: A critical perspective*. Routledge.

Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). John Wiley & Sons, Inc.

Edwards M. C., & Booth, P. (2001). Ten rules of the road – Career development events. *The Agricultural Education Magazine, 74*(2), 24-25.

Ewing, J. C., Clark, R. W., & Threeton, M. D. (2014) Career development event preparation and experiential learning strategies employed by Pennsylvania secondary agricultural education teachers. *Career and Technical Education Research, 39*(1), 37-53. https://doi.org/10.5328/cter39.1.37

Fraenkel, J. R., & Wallen, N. E. (2000). *How to design and evaluate research in education.* McGraw-Hill.

Hoy, W. K. (2010). *Quantitative research in education: A primer*. SAGE.

Kilbrink, N., & Bjurulf, V. (2013). Transfer of knowledge in technical vocational education: A narrative study in Swedish upper secondary school. *International Journal of Technology and Design Education, 23*(3), 519-535. https://doi.org/10.1007/s10798-012-9201-0

Konkola, R., Tuomi-Gröhn, T., Lambert, P., & Ludvigsen, S. (2007). Promoting learning and transfer between school and workplace. *Journal of Education and Work, 20*(3), 211-228. http://dx.doi.org/10.1080/13639080701464483

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice, 41*(4), 212-218. https://doi.org/10.1207/s15430421tip4104_2

Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education, 42*(4), 43-53. https://doi.org/10.5032/jae.2001.04043

McKim, A. J., Velez, J. J., Lambert, M. D., & Balschweid, M. A. (2017). A philosophical review of science and society within agricultural education. *Journal of Agricultural Education, 58*(2), 98-110. https://doi.org/10.5032/jae.2017.02098

Melodia, A., & Meyer, B. (2001). Creating and measuring success: Agricultural education and FFA. *The Agricultural Education Magazine, 74*(2), 16-17.

Michigan FFA Association. (2017). *Michigan FFA environmental skills career development event handbook*. https://www.michiganffa.org/wp-content/uploads/2020/05/environmental_rules_19.pdf

National Council for Agricultural Education. (2016). *National quality program standards for agriculture, food and natural resource education: A tool for secondary (grades 9-12) programs*. National Quality Program Standards. https://www.ffa.org/SiteCollectionDocuments/tc_national_quality_program_standards_revised.pdf

National FFA Organization (1975). *FFA advisors handbook.* National FFA Organization.

Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. (2008). *Handbook on agricultural education in public schools* (6th ed.). Delmar.

Reece, G. J. (2007). Critical thinking and cognitive transfer: Implications for the development of online information literacy tutorials. *Research Strategies, 20*, 482-493. https://doi.org/10.1016/j.resstr.2006.12.018

Roberts, T. G., Harder, A., & Brashears, M. T. (Eds). (2016). *American Association for Agricultural Education national research agenda: 2016-2020.* Department of Agricultural Education and Communication.

Russell, C. R., Robinson, J. S., & Kelsey, K. D. (2009). Motivating agriculture students to participate in career development events. *Career and Technical Education Research, 34*(2), 103-118.

Stripling, C. T., & Ricketts, J. C. (2016). Research priority 3: Sufficient scientific and professional workforce that addresses the challenges of the 21st century. In Roberts, T. G., Harder, A., & Brashears, M. T. (Eds). *American Association for Agricultural Education national research agenda: 2016-2020* (pp. 29-35). Department of Agricultural Education and Communication.

Talbert, B. A., Vaughn, R., Croom, D. B., & Lee, J. S. (2007). *Foundations of agricultural education*. Professional Educators Publications, Inc.