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The Validation of the Effective Teaching Instrument for School-Based Agricultural Education Teachers

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Abstract

Producing competent, qualified, effective teachers to meet a growing nationwide demand is a daunting task. Identifying and preparing school-based agricultural education teachers is no exception. The purpose of the study was to validate and refine a 58-item effective teaching instrument for SBAE teachers. The population of interest was SBAE teachers nationwide (N = 12,690). Through principal component analysis, 26 of the original 58 items were retained as measures of SBAE teacher effectiveness. The instrument was validated and found to have acceptable Cronbach's alpha levels for each of the six components. As a result, we conclude the instrument is appropriate for measuring the effectiveness of SBAE teachers and recommend it being used with other teachers, especially those in the Career and Technical Education fields.

Keywords: effective teaching; school-based agricultural education; teacher evaluation

Introduction and Review of Literature

Effective teaching is a multidimensional concept and can be described in numerous ways (Farrell, 2015). At the most fundamental level, effective teachers are those who have expertise in their subject matter, hold at least a baccalaureate degree, and have passed the required certification examinations in their respective states (U.S. Department of Education, n.d.). Specific characteristics of effective teachers include servant leadership, self-efficacy, and nonverbal communication (Steele, 2010). In addition, effective teachers are those who provide clarity, variability, enthusiasm, task-oriented business-like behavior, and the opportunity for their students to apply their learning (Rosenshine & Furst, 1971). Teachers in school-based agricultural education (SBAE) programs have additional expectations and duties outside of classroom instruction, and therefore must be effective in multiple areas. Specifically, SBAE consists of a three-component model, including "(1) classroom/laboratory instruction (contextual learning), (2) supervised agricultural experience programs (work-based learning), and (3) student leadership organizations" (National FFA Organization, 2015, para. 2). In addition to these three components, effective SBAE teachers must be proficient in the following areas: community relations, marketing, professionalism/professional growth, program planning/management, and personal qualities (Roberts & Dyer, 2004). Evaluating these components of the overall program requires a more diverse and in-depth assessment regarding teacher effectiveness (Enns et al., 2016; Roberts & Dyer, 2004).

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"Teachers of agricultur[al] education teach in what may be perceived as a unique environment when compared to other teachers in a secondary school" (Harper et al., 1990), as SBAE is an intracurricular elective taught as a Career and Technical Education (CTE) program in a public school setting (Association for Career and Technical Education, 2019). Therefore, the criteria for assessing effective SBAE teachers is unique as well. Producing competent, qualified, effective SBAE teachers to meet a growing nationwide demand is a daunting task (Foster et al., 2018). According to Roberts and Dyer (2004), however, it is a necessity. They concluded "creating effective agriculture teachers is imperative for the long-term sustainability of agricultural education programs" (p. 94). The *No Child Left Behind Act* of 2001 aimed to improve primary and secondary schools, with a main focus of providing highly qualified teachers in all classrooms; although, the law only requires teachers to acquire state teacher licensure requirements (U.S. Department of Education, n.d.). The added focus on highly qualified teachers was initiated through a teacher quality grant program available to states for the purpose of preparing, training, and recruiting teachers (United State Department of Education, n.d.). Unfortunately, school districts "are [only] required to demonstrate annual progress in ensuring that all teachers teaching in core academic subjects within the State are highly qualified" (U.S. Department of Education, n.d., p. 3). Alas, defining and measuring teacher effectiveness is a difficult proposition. Teaching effectiveness is "an elusive concept . . ." and a ". . . complex task . . ." considering ". . . the multitude of contexts in which teachers work" (Stronge et al., 2011, p. 340).

Considering the uniqueness of the program (Harper et al., 1990), determining teacher effectiveness in SBAE is perhaps even more challenging. Blind Authors (2019) conducted a nationwide study for that purpose. An expert panel in their study identified 58 characteristics, or guiding principles, that a SBAE teacher needed to possess to be deemed effective. As a result of that study, it was recommended that the guiding principles be validated as an instrument to measure the effectiveness among pre-service and in-service SBAE teachers to help improve their effectiveness and delivery of a complete program.

Theoretical/Conceptual Framework

This study was undergirded in the human capital theory. Human capital evaluates the stock an individual takes in his or her own education, skills, experiences, and training (Becker, 1964; Little, 2003; Schultz, 1971; Smith, 2010; Smylie, 1996) with the goal of becoming gainfully employed (Becker, 1964). Human capital can be general or specific and is advantageous on numerous levels in various sectors of particular industries (Smith, 2010). Human capital of teachers, writ large, is developed more quickly when it "is directly related to the similarity between past and future tasks performed (Ost, 2009, p. 18). Pil and Leana (2009) stated, when teachers apply their human capital to specific tasks, it can have a positive effect on student success.

SBAE teachers work to increase their own human capital, while also striving to foster the development of human capital within their students. When furthering their personal human capital, they improve personal competence as it relates to their vocation (Heckman, 2000). The necessary or expected human capital differs based on a person's profession of choice (Lepak & Snell, 1999). For traditionally certified SBAE teachers, it begins with the skill set learned through a teacher preparation program, followed by a student teaching internship (NCATE, 2010), and finally through professional development in-service or continued education. Alternatively, certified SBAE teachers are relegated to developing their task-specific human capital while teaching. Although, both groups acquire necessary human capital, the timing and route to developing such can look very different. Therefore, an assessment tool that addresses the human capital needs of SBAE teachers is warranted (Blind Authors, 2019; Smith, 2010), because current literature related to this phenomenon ". . . is lacking" (Robinson & Baker, 2013, p. #).

Schultz (1971) stated, education is "an investment activity undertaken for the purpose of acquiring capabilities that render future satisfaction or that enhance future earnings of the person as a

productive agent" (p. 78). Smith (2010) stated individuals begin life "with the same innate characteristics" (p. 37), although they have the opportunity to choose the amount of development they receive over their lifetime. Even for those whose abilities are innate, they still require specialized training to become productive in a chosen skilled sector (Smith, 2010).

An impactful portion of traditional teacher preparation includes a student teaching internship, which serves to develop in human capital in aspiring teachers. Schultz (1971) stated:

> Although it is obvious that people acquire useful skills and knowledge, it is not obvious that these skills and knowledge are a form of capital, that this capital is in substantial part a product of deliberate investment . . . and that its growth may well be the most distinctive feature of the economic system. (p. 24)

This development of knowledge and skills comes at a cost but is purposeful in pursuing a desirable or better job (Schultz, 1961). Due to the current climate related to the supply and demand of SBAE teachers, with approximately 60% prepared to teach SBAE actually entering the profession (Eck & Edwards, 2019), school administrators fill the void with alternatively, emergency, or non-certified teachers. Although the leading cause is undetermined, Schultz (1961) discussed the idea of human resources being a form of capital.

> Failure to treat human resources explicitly as a form of capital, as a produced means of production, as the product of investment, has fostered the retention of the classical notion of labor as a capacity to do manual work requiring little knowledge and skill, a capacity with which, according to this notion, laborers are endowed about equally. (p. 3)

One of the five major categories for developing human capital is "on-the-job training, including old-style apprenticeship" (Schultz, 1961, p. 9). Traditionally certified SBAE teachers are afforded this opportunity through their student teaching internship. To accomplish this task, SBAE teachers should consider their own skillset and further develop their human capital, to improve their teaching effectiveness (Blind Authors, 2019).

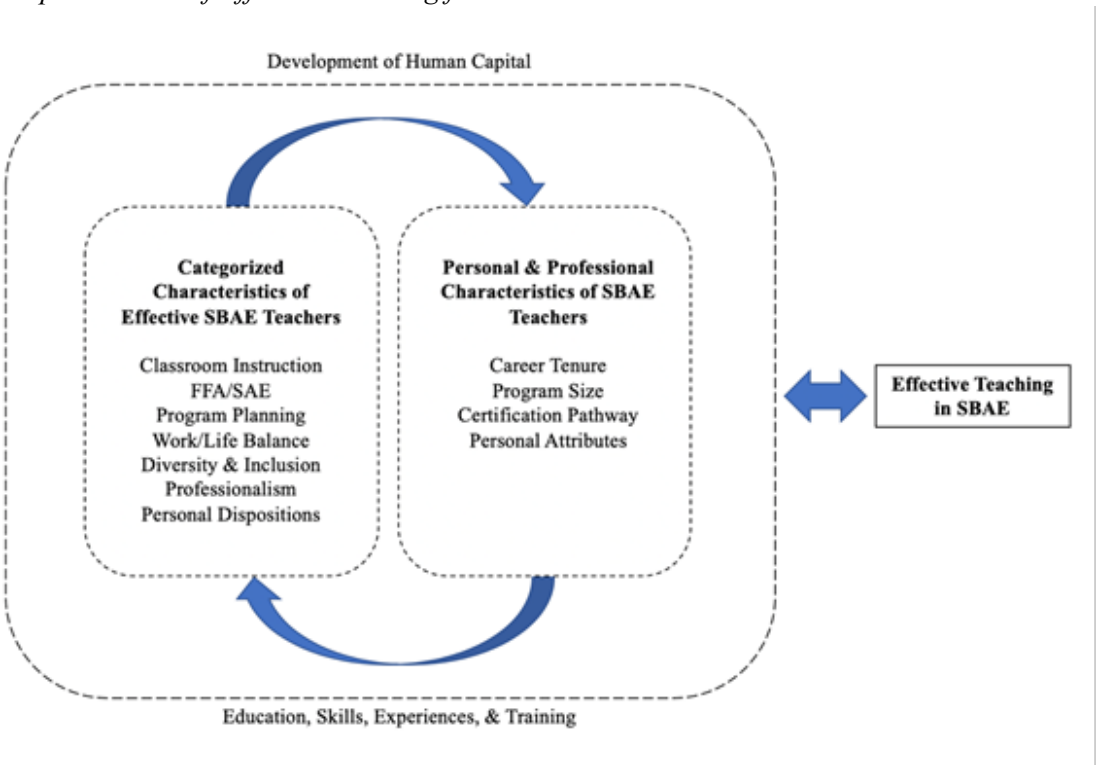
Considering the potential factors impacting the effectiveness of SBAE teachers, a conceptual framework was developed for this study. Myung et al. 2013 stated the need for schools to acquire, develop, sustain, and evaluate the human capital of teachers through a comprehensive program. More specifically "the Acquire, Develop, and Sustain subsystems have a strong, direct influence on enhancing the teacher workforce, while the Evaluate subsystem's main contribution is through activities that inform the other three subsystems" (Myung et al., 2012, p.3). Therefore, Figure 1 represents the conceptual factors impacting teaching effectiveness for SBAE teachers, including the characteristics of effective SBAE teachers (Blind Authors, 2019) and the personal and professional characteristics identified within the study. The factors can be encompassed in the development of human capital, supporting the personal and professional characteristics of effective SBAE teachers (Blind Authors, 2019). The development of human capital for SBAE teachers includes education, skills, experiences, and training (Becker, 1964; Little, 2003; Schultz, 1971; Smith, 2010; Smylie, 1996) necessary for gainful employment (Becker, 1964) as an effective teacher.

Through a Delphi study, a panel of experts identified 58 items across 7 categories deemed to be essential to the development of effective SBAE teachers (Blind Authors, 2019). Those categories included: classroom instruction, FFA/SAE, program planning, work/life balance, diversity and inclusion, professionalism, and personal dispositions. The personal and professional characteristics of SBAE teachers also impact teaching effectiveness and include the following: career tenure (Barrick et al., 1983; Layfield & Dobbins, 2002; Roberts & Dyer, 2004; Washburn et al., 2001), i.e., number of years teaching SBAE, number years in current position, and intent to retire as an SBAE teacher; program size (McKim et al., 2017; Wheeler & Knobloch, 2006; Whittington et al., 2006), i.e., number of SBAE teachers and number of students in the SBAE program; certification pathway (Darling-Hammond et al., 2002; National Council for Accreditation of Teacher Education, 2010; Robinson &

Edwards, 2012), i.e., traditional, alternative, or emergency certification; and personal attributes (Birkenholz & Harbstreit, 1987; McKim et al., 2017; Rodriguez, 1997; Washburn et al., 2001; Wolf, 2011), i.e., age, sex highest degree earned, and geographical location. The development of effective teaching characteristics and personal and professional characteristics enhances an individual's human capital and has implications on one another. Increasing the human capital of SBAE teachers can ultimately improve teaching effectiveness in agricultural education, as illustrated in Figure 1. Additionally, effective SBAE teachers work continually to improve their capital through participating in professional development opportunities (Roberts & Dyer, 2004). Therefore, effective teaching in SBAE plays a role in the continual development of human capital (see Figure 1), as it focuses on ". . .the day-to-day operations of teacher human capital processes, which directly influence student outcomes" (Myung et al., 2012, p.5), which are often ignored.

Figure 1

Conceptual Model of Effective Teaching for SBAE Teachers



Purpose of the Study

The purpose of this study was to validate the effective teaching instrument for SBAE teachers, as identified by Blind Authors (2019). Three research questions guided this study:

1. Determine the primary components of an effective SBAE teacher,
2. Validate the effective teaching instrument for SBAE teachers, and
3. Determine the internal consistency reliability of the components of the effective teaching instrument for SBAE teachers.

Methods and Procedures

This non-experimental study implemented a descriptive survey research design. A non-experimental research design is one in which the procedures used to measure variables associated with the research problem do not involve any manipulation of circumstances revolving around the study (Gay et al., 2012).

Population

The population of interest was all SBAE teachers across the United States (N = 12,690) in 2017 (Smith et al., 2018). A distribution frame was constructed for 48 states, including 9121 individual email addresses, along with agricultural education email listservs for 15 states. Four U.S. states/territories (Hawaii, Michigan, Puerto Rico, and the U.S. Virgin Islands) failed to respond to the request to participate.

Procedures

After the frame was established, the effective teaching instrument was submitted to SBAE teachers using electronic mail. Specifically, a Qualtrics Survey link was sent to all 9121 individual email addresses and state listservs. The email followed the Tailored Design Method (Dillman et al., 2014) ensuring it addressed the usefulness of the study and included the limited response time, a cash incentive drawing for participants, the Oklahoma State University logo, and the lead researcher's pertinent contact information. In addition, the participation request was submitted to each state individually to "personalize all contacts, to the extent possible" (Dillman et al., 2014, pp. 332-333). Instruments were received from 3339 individuals representing 45 states, resulting in a 28.2% response rate. No responses were received from Alaska, Vermont, or Virginia. After excluding incomplete instruments, the sample was reduced to 2807 valid responses.

Instrumentation and Data Collection

The instrument was developed based on the findings of Eck et al. (2019), which was a nationwide replication of a study conducted originally in Florida by Roberts and Dyer (2004). Dillman et al. (2014) recommended grouping related questions. Therefore, the 58 effective teaching items (Blind Authors, 2019) were organized into seven categories: classroom instruction, FFA/SAE, program planning, diversity and inclusion, work-life balance, professionalism, and personal dispositions. The original categories of FFA and SAE were combined due to their close association and the low number of items in those categories (Dillman et al., 2014).

Data Analysis

Principal Component Analysis (PCA) was employed to answer Research Questions 1 and 2. PCA is used to reduce the number of items in a dataset to a smaller set of related components (Costello & Osborne, 2005). The usable sample size in this study exceeded the 10:1 recommended participant-to-item ratio as recommended by Comrey and Lee (1992). The initial analysis evaluated all 58 items using PCA and a Varimax rotation. A Varimax rotation, developed originally by Kaiser (1958), was chosen based on the design of the instrument, with the assumption the seven components would be correlated since they all are related with effective teaching in SBAE (Blind Authors, 2019). With the assumption of seven independent components, an orthogonal rotation was needed (Field, 2013) in which case a Varimax rotation is most common (Abdi, 2003). The output was then evaluated beginning with the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, with a minimum acceptable value of 0.6, and an ideal value closer to 1.0 (Beavers et al., 2013; Cerny & Kaiser, 1977).

Eigenvalues greater than 1.0 identified potential components to retain, which were then evaluated against those obtained through parallel analysis. Any observed eigenvalues greater than those obtained through parallel analysis were retained as established components. Parallel analysis is a "recommended procedure for deciding on the number of components involv[ing] extracting eigenvalues from random data sets that parallel the actual data set with regard to the number of cases and variables" (O'Connor, 2000, p. 397).

SPSS was used to employ a simulation of 1000 matrices to mimic the 2442 cases and 58 uncorrelated variables. Eigenvalues of the uncorrelated dataset provide a minimum benchmark of observed eigenvalues to the true data (O'Connor, 2000). In addition to eigenvalues, the cumulative

percentage of total explained variance was evaluated, along with communalities, identifying all communality extractions for items greater than 0.5. Using the number of statistically significant components identified by the parallel analysis, the PCA was fit to a given number of components. The new output was then analyzed assessing communalities and rotated component loadings to determine which items (i.e., those with a value greater than 0.6) to retain. The retained items were fit to another PCA with a Varimax rotation. Output was then compared to a new parallel analysis, updated to reflect the reduced number of variables. Using the parallel analysis to determine the number of statistically significant variables, a final PCA was analyzed based on the retained items and the reduced number of components. Any items loading at a 0.6 or higher on a single component were retained for inclusion on the final instrument.

Validity

"The validity of a measurement is the extent to which a measurement for a variable or construct measures what it is purported or intended to measure" (Privitera, 2017, p. 113). With the complete 58-item instrument deemed valid (Blind Authors, 2019), the reduction of any items through a PCA will result in a valid instrument, as those items are part of the complete construct (Privitera, 2017) of effective teaching in SBAE. In addition to face and content validity established through the initial instrument development, the PCA served as an opportunity to further the construct validity of the instrument (Privitera, 2017). The retained items in the PCA measure the components identified, allowing them to be operationalized (Privitera, 2017). The overall reliability was established through a Cronbach's alpha, which provided an overall reliability measure of the complete effective teaching instrument for SBAE teachers.

Reliability Estimation

"Reliability is the consistency, stability, or repeatability of one or more measures or observations" (Privitera, 2017, p. 109). Reliability of an instrument is extremely valuable; therefore, the retained items were checked for reliability as a complete instrument and within each of the statistically significant components to answer the second and third research questions. Specifically, the reliability measure focused on the internal consistency of the instrument to determine the relationship between the items (Privitera, 2017) measuring teaching effectiveness in SBAE. Based on the items, Cronbach's alpha was used to determine the overall reliability of the instrument. "Cronbach's alpha measures the internal consistency of a group of items by measuring the homogeneity of the group of items" (BrckaLorenz et al., 2013, para. 3). To verify the overall reliability estimate, the item-total statistics were analyzed to determine if deleting any item would increase the Cronbach alpha level. Cronbach alpha levels ranged from zero to one, and any value greater than or equal to 0.7 is considered reliable (BrckaLorenz et al., 2013). An overall instrument reliability score was established before moving into component-specific reliability. Each of the validated components were assessed for reliability statistics considering their corresponding items. The Cronbach alpha values for the items were considered along with the evaluation of the alpha level if an item was removed to establish reliability of each of the components. Together, the initial Delphi design, the implementation of a PCA, and an overall acceptable Cronbach's alpha level can produce a valid instrument.

Controlling Threats to Validity and Reliability

Researchers face constant threats to validity and reliability within a study (Dillman et al., 2014). Survey error, including sampling error, coverage error, measurement error, and non-response error tends to be the most persistent threat (Dillman et al., 2014). To help overcome this common threat, the tailored design method was employed, which often leads to higher response rates with lower error rates (Dillman et al., 2014). To encourage response rate a $100 cash incentive was awarded to ten randomly drawn participants who completed the study and provided a valid school-issued email address.

During instrument development, conventions from Dillman et al. (2014) were used to develop a quality questionnaire with the incorporation of: (a) ensuring the questions displayed appropriately across multiple devices and platforms, such as mobile devices; (b) creating welcome and closing screens that were informative and interesting; (c) using consistent page layouts optimized by Qualtrics; (d) allowing the respondents to return to a former page or start and stop the questionnaire whenever necessary; (e) forgoing the use of a progress indicator; and (f) personalizing the correspondence specific to each state. Multiple items were included for the targeted components, which is found to be more reliable than single-item components (Dillman et al., 2014). Following these recommendations reduced potential measurement error by producing more accurate data that can be interpreted appropriately (Dillman et al., 2014).

Findings

Research Question 1: Determine the Primary Components of an Effective SBAE Teacher

The 58-item instrument (see Table 1) was analyzed using a PCA to determine the primary components of an SBAE teacher and reduce the instrument into components accounting for maximum variance.

Table 1

Categorized Characteristics of Effective SBAE Teachers

Category	Identified Characteristic	Item Number
Instruction	I am passionate about education.	I_1
	I provide a variety of learning opportunities to meet the needs of all students.	I_2
	I guide students to grow personally.	I_3
	I am a leader for students.	I_4
	I demonstrate pedagogical knowledge.	I_5
	I am a good communicator.	I_6
	I demonstrate sound educational practices.	I_7
	I am prepared for every class.	I_8
	I demonstrate classroom management.	I_9
	I understand the experiential learning theory.	I_10
	I am motivated for student success.	I_11
	I am knowledgeable about agriculture.	I_12
	I am first and foremost a classroom teacher.	I_13
	I am innovative.	I_14
	I am engaging.	I_15
FFA/SAE	I advise the FFA chapter.	F_1
	I am not just a facilitator of record keeping for degrees and awards.	F_2
	I instruct students through FFA.	F_3
	I am passionate about FFA.	F_4
	I advise the FFA officers.	F_5
	I prepare students to be leaders.	F_6
	I instruct students through supervised agricultural experiences.	F_7

Table 1

Categorized Characteristics of Effective SBAE Teachers, Continued…

Program Planning	I use the complete agricultural education model as a guide to programmatic decisions and practices.	PP_1
	I am resourceful as an administrator of my program.	PP_2
Balance	I lead a balanced life.	B_1
	I have the ability to say no.	B_2
	I am never afraid to ask for help.	B_3
	I demonstrate a willingness to put in extra hours.	B_4
Diversity and Inclusion	I understand student needs.	D_1
	I am an advocate for all students.	D_2
	I value students regardless of sex.	D_3
	I value students regardless of economic status.	D_4
	I value students from all ethnic/racial groups.	D_5
	I understand diversity.	D_6
	I am culturally relevant.	D_7
	I care about all students.	D_8
	I understand there is not an award for all students, but that does not mean they are not valuable.	D_9
Professionalism	I am a purposeful lifelong learner.	P_1
	I demonstrate adaptability.	P_2
	I am a dedicated professional.	P_3
	I am an advocate for public education.	P_4
	I am engaged in an appropriate professional organization.	P_5
Personal Dispositions	I am fair.	PD_1
	I am student focused.	PD_2
	I am trustworthy.	PD_3
	I am honest.	PD_4
	I am passionate about agriculture.	PD_5
	I am respectful.	PD_6
	I show empathy.	PD_7
	I am dependable.	PD_8
	I am responsible.	PD_9
	I am relatable.	PD_10
	I am genuine.	PD_11
	I am a hard worker.	PD_12
	I am organized.	PD_13
	I am helpful.	PD_14
	I have patience.	PD_15
	I show integrity.	PD_16

The KMO measure of sampling adequacy equaled 0.94, which was deemed acceptable in accordance with Cerny and Kaiser (1977). The initial PCA resulted in 10 components with eigenvalues greater than 1.0. The results of the PCA comparison to parallel analysis indicated only eight components were necessary, as they were above the output of parallel analysis. Data were then re-

analyzed (PCA with Varimax rotation) fitting the 58-items to eight components. The communalities and the component loadings of the rotated component matrix of all 58-items were analyzed to determine which items to retain. Thirty (of 58) items were retained from a Varimax-rotated PCA fixed to eight components, based on component loadings greater than or equal to 0.6 on at least one component. The 28 items not retained included characteristics such as, *I am willing to put in extra hours, I am passionate about education*, *I demonstrate pedagogical content knowledge, I am first and foremost a classroom teacher*, *I am engaging*, *I am passionate about agriculture*, *I am fair*, *I am an advocate for all students*, and *I am knowledgeable about agriculture*. The 30 retained items were then re-analyzed using an additional PCA (without specifying a specific number of components) to verify the number of components in the reduced dataset. The resulting analysis had a KMO measure of 0.89. Seven components had initial eigenvalues greater than 1.0. Six components had initial eigenvalues above parallel, resulting in the need to re-analyze the PCA with a Varimax rotation, limiting the items to fit within six components. Communalities and the component loadings of the rotated component matrix were analyzed, based on a Varimax rotation, of the retained 30 items to determine the final component structure of the items resulting from the six components (see Table 2).

Table 2

Retained PCA Communalities and Component Loadings (30 items, n = 2442)

	Component						
Items	1	2	3	4	5	6	Communality
F_3	.835						.73
F_5	.794						.66
F_1	.781						.62
F_2	.759						.60
F_4	.722						.55
F_7	.676						.53
PP_1	.636						.49
PD_3		.799					.69
PD_9		.787					.66
PD_8		.765					.64
PD_4		.765					.65
PD_16		.674					.56
PD_12		.619					.46
D_4			.889				.83
D_5			.874				.80
D_3			.856				.78
D_8			.621			.340	.51
D_9			.618				.50
I_9				.743			.60
I_7				.695			.56
I_8				.630			.51
~~I_4~~				.567			.45
~~I_3~~				.522			.37
B_2					.852		.74
B_1					.782		.64
B_3					.695		.74
PD_15						.725	.58
PD_7						.684	.55
~~P_1~~						.476	.32
~~P_4~~						.459	.32

Note. Factor loading below .300 are not displayed; Extraction values are based on communalities; I = Instruction, F = FFA/SAE, PP = Program Planning, B = Balance, D = Diversity, P = Professionalism, PD = Personal Dispositions. Items with a strikethrough were not retained.

The PCA fit to 6 components resulted in 26 (of 30) items loading at or above a 0.6, accounting for 58.1% of the explained variance. The six components are outlined in Table 3 with the corresponding items and the updated item numbers to represent the complete effective teaching instrument for SBAE. The four items that did not fit the six-component model included *I am a leader for students*, *I guide students to grow personally*, *I am a purposeful lifelong learner*, and *I am an advocate for public education*.

Table 3

Retained Items and Emerging Components (26 items)

Component Title	Item	Corresponding Item Description
1. Intracurricular Engagement	IE_1	I instruct students through FFA.
	IE_2	I advise the FFA officers.
	IE_3	I advise the FFA chapter.
	IE_4	I facilitate record keeping for degrees and awards.
	IE_5	I am passionate about FFA.
	IE_6	I instruct students through SAEs.
	IE_7	I use the complete agricultural education 3-component model as a guide to programmatic decisions.
2. Personal Dispositions	PD_1	I am trustworthy.
	PD_2	I am responsible.
	PD_3	I am dependable.
	PD_4	I am honest.
	PD_5	I show integrity.
	PD_6	I am a hard worker.
3. Appreciation for Diversity and Inclusion	AD_1	I value students regardless of economic status.
	AD_2	I value students of all ethnic/racial groups.
	AD_3	I value students regardless of sex.
	AD_4	I care about all students.
	AD_5	I understand there is not an award for all students, but that does not mean they are not valuable.
4. Pedagogical Preparedness	PP_1	I demonstrate classroom management.
	PP_2	I demonstrate sound educational practices.
	PP_3	I am prepared for every class.
5. Work-Life Balance	B_1	I have the ability to say no.
	B_2	I lead a balanced life.
	B_3	I am never afraid to ask for help.
6. Professionalism	P_1	I have patience.
	P_2	I show empathy.

Note. IE = Intracurricular Engagement, PD = Personal Dispositions, AD = Appreciation for Diversity and Inclusion, PP = Pedagogical Preparedness, B = Work-Life Balance, P = Professionalism. Item numbers presented in this table will be used from this point forward.

Research Question 2: Validation of the Effective Teaching Instrument for SBAE Teachers

The instrument resulted in 26 items loading on 6 components. All 26 items loaded at a value greater than .60 (Guadagonli & Velicer, 1988) and have communality extractions at an acceptable level according to Hair et al. (2010). Instrumentation began with a 58-item instrument that was validated

through a nationwide Delphi study (Blind Authors, 2019), of which 17 panelists reached consensus on 58 items at an a priori rate of 85% agreement. Those 58 items were reduced through three systematic Delphi rounds from 121 initial statements (Blind Authors, 2019). The resulting 26 items are considered valid based on the PCA results measuring the component (Privitera, 2017) of effective teaching in SBAE. In addition to validity of the previously developed items, a reliability estimate based on 26 items resulted in an acceptable Cronbach's alpha of 0.87 (Nunnally, 1978). We evaluated the deletion of any item which may have increased the total Cronbach's alpha score. After analysis of the item-total statistics, it was determined that the removal of any item would actually decrease the total Cronbach's alpha level instead of increasing it (see Table 4), resulting in the retention of all 26 items as part of the valid effective teaching instrument for SBAE teachers.

Table 4

Item Means and Adjusted Cronbach Alpha Levels for the Complete Instrument ($\alpha = 0.87$, $n = 2454$)

Item	*Mean*	*SD*	Cronbach's alpha if item deleted
IE_1	3.56	.65	.83
IE_2	3.65	.63	.83
IE_3	3.72	.58	.83
IE_4	3.13	.88	.83
IE_5	3.72	.57	.83
IE_6	3.27	.85	.83
IE_7	3.26	.78	.83
PD_1	3.93	.27	.83
PD_2	3.89	.32	.83
PD_3	3.88	.34	.83
PD_4	3.93	.27	.83
PD_5	3.89	.33	.83
PD_6	3.90	.30	.83
AD_1	3.93	.27	.84
AD_2	3.92	.28	.83
AD_3	3.92	.27	.84
AD_4	3.89	.34	.83
AD_5	3.89	.33	.83
PP_1	3.40	.65	.83
PP_2	3.49	.57	.83
PP_3	3.03	.67	.83
B_1	2.58	.90	.84
B_2	2.74	.85	.84
B_3	2.89	.86	.84
P_1	3.34	.70	.83
P_2	3.61	.61	.83

Note. Items were on a 4-point scale of agreement, where 1 = Very Weak, 2 = Weak, 3 = Strong, 4 = Very Strong; IE = Intracurricular Engagement, PD = Personal Dispositions, AD = Appreciation for Diversity and Inclusion, PP = Pedagogical Preparedness, B = Work-Life Balance, P = Professionalism.

Research Question 3: Determine the Internal Consistency Reliability of the Components of the Instrument

Although the 26-item instrument was deemed valid through a PCA loading on six components, with a Cronbach's alpha of 0.87, reliability estimations were analyzed for the corresponding items within each of the six components.

The first component included FFA and SAE, two of the three parts of the complete three-component model of agricultural education (National FFA Organization, 2015). The Intracurricular Engagement component resulted in a Cronbach's alpha of 0.88 based on seven items. The removal of any of the seven items would result in a decreased Cronbach alpha for the component; therefore, all items were retained for the first component. The seven items have moderate to substantial positive correlations (Davis, 1971), demonstrating interrelated items measuring Intracurricular Engagement (Field, 2013).

The second component centered on Personal Dispositions of SBAE teachers. The Personal Dispositions component had a Cronbach's alpha level of 0.86 based on six items. The Personal Dispositions component was composed of six items with strong reliability coefficients; therefore, all six items were retained. According to Davis (1971), the six items measuring Personal Dispositions are interrelated with moderate to very strong positive correlations.

The third component, labeled *AP,* was composed of five items with a Cronbach's alpha level of 0.87. Five items were retained with strong reliability coefficients representing the component for Appreciation for Diversity and Inclusion. Moderate to very strong positive correlations (Davis, 1971) existed, showing the intercorrelation of the items within the Appreciation for Diversity and Inclusion component (Field, 2013).

The fourth component, Pedagogical Preparedness, resulted in a Cronbach's alpha of 0.71 and was composed of three items. All three items were retained for this component, as the deletion of any item would result in a reduced Cronbach alpha. According to Davis (1971), the inter-item correlations for the three items measuring Pedagogical Preparedness were moderately positively correlated.

The fifth component*,* Work-Life Balance, was composed of three items, for which the Cronbach alpha was 0.73. Although, removal of one of the items (B_3) increased the Cronbach alpha for this component, the item was retained on the basis of Yang's and Green's (2011) assertion that "items that are eliminated based on their effect on coefficient alpha [alone] can [still] contribute substantially to the overall psychometric quality of a scale" (p. 389). In addition, the correlation matrix identifies moderate to substantial positive correlations (Davis, 1971) between the three items, identifying the items as measuring an interrelated component (Field, 2013).

Each of the first five components have Cronbach's alpha levels greater than 0.70, which is considered to be acceptable (Nunnally, 1978). The alpha for the sixth component was below the *acceptable* threshold with a Cronbach's alpha of 0.58 based on two items. Research suggests a coefficient alpha is a meaningless measure when dealing with two-item scales and recommends reporting the Spearman-Brown reliability indicator (Eisinga et al., 2013). The Spearman-Brown formula resulted in a reliability estimate of 0.58. Because this component was associated with Professionalism and was part of the total 26-item reliable instrument, with a Cronbach's alpha of 0.87, the researchers opted to retain the items, although a two-item component is problematic (Yang & Green, 2011). In addition to the two items being included in the greater reliable instrument, the inter-item correlation matrix provided rationale for retaining the items as they displayed a moderate positive correlation for the component (Davis, 1971).

Conclusions

This study validated the instrument for effective teaching in SBAE. The nationwide Delphi study identified eight categories of effective SBAE teachers, including: instruction, FFA, SAE, program planning, balance, diversity and inclusion, professionalism, and personal dispositions (Blind Authors, 2019). Through PCA, the findings of this study generated six components including: Intracurricular

Engagement, Personal Dispositions, Appreciation for Diversity and Inclusion, Pedagogical Preparedness, Work-Life Balance, and Professionalism. Although only six components emerged from the PCA, they encompassed all eight categories identified by Eck et al. (2019). The emerging Intracurricular Engagement category included items related to FFA, SAE, and program planning, condensing three categories into one component. This combination of items aligns with standard four from the American Association for Agricultural Education (AAAE) (2017) of program planning, which encompasses FFA and SAE responsibilities, with the addition of publicizing the SBAE program to key stakeholders (i.e., parents, students, and community members). The remaining five categories identified by Eck et al. (2019) each emerged as an independent component in the PCA of this study. Similarly, the emerging six components aligned with six of the eight factors identified by Roberts and Dyer (2004), with marketing and community relations being the two categories not identified in this study.

The six components spanned 26 items, which were validated as a complete instrument, resulting in an acceptable Cronbach's alpha of 0.87 (Nunnally, 1978). Additionally, the reliability of the instrument was established by individually analyzing each of the six components identified from the PCA (i.e., Intracurricular Engagement, Personal Dispositions, Appreciation for Diversity and Inclusion, Pedagogical Preparedness, Work-Life Balance, and Professionalism). Each of the components resulted in moderate to very strong correlations between items (Davis, 1971) and exhibited acceptable Cronbach alpha levels (Nunnally, 1978). It was determined that the removal of any items from the components would result in decreased Cronbach alpha levels; so, all 26 items were retained for the complete, validated effective teaching instrument for SBAE. Therefore, it is concluded that the effective teaching instrument for SBAE (ETI-SBAE) teachers is an appropriate tool for assessing SBAE teacher effectiveness.

Personal dispositions comprise the largest single component related to SBAE teacher effectiveness. The Personal Dispositions component corresponded to six items which include: being trustworthy, responsible, dependable, honest, and a hard worker, and maintaining integrity. The need for personal dispositions for high quality and effective SBAE teachers has been identified in multiple studies (Blind Authors, 2019; Goe & Stickler, 2008; Mitchell et al., 2001; Roberts & Dyer, 2004; Steele, 2010; Stronge et al., 2011; Williams et al., 2018) in addition to being recognized by the AAAE (2017) as one of the six standards for SBAE teacher preparation. Teacher preparation programs accredited by the Council for the Accreditation of Educator Preparation (CAEP) (2015) are charged with developing and assessing professional dispositions per Standard 1 of their teacher candidates. Therefore, the area of personal dispositions is of importance for effective teachers due to the frequency and consistency of items related to that component. Therefore, evaluating an individual's task-specific human capital assets and needs (Becker, 1964; Little, 2003; Pil & Leana, 2009; Schultz, 1971; Smith, 2010; Smylie, 1996) are vital to the development of SBAE teachers regarding their teaching effectiveness and employability (Becker, 1964; Robinson & Baker, 2013).

Recommendations

When considering recommendations for practice, the ETI-SBAE is useful in determining factors related to effective teaching in SBAE. Faculty members in SBAE teacher preparation programs should use this instrument to measure growth and development of future teachers related to the effective characteristics an SBAE teacher should possess. The instrument should be administered at key points throughout a student's undergraduate program to determine his or her preparedness to enter the SBAE classroom. These key points for evaluation might include the beginning and end of each semester in the SBAE teacher preparation program. Allowing teacher preparation faculty to establish a baseline and then evaluate the growth in human capital of future SBAE teachers throughout the program would assist university supervisors in placing student teachers in their internships. These evaluation methods would serve as a measure of purposeful improvement for future SBAE teachers based on the recommendations of Myung et al. (2013), since "little is done to manage the processes by which districts identify, acquire, develop, and sustain teacher human capital" (p. 5).

Additionally, SBAE teacher preparation faculty need to implement the validated ETI-SBAE to identify the human capital needs of pre-service SBAE teachers. The implementation of the ETI-SBAE could result in optimizing purposeful, pointed, individualized plans of study for pre-service teachers who wish to increase the human capital necessary for becoming effective. Further, school administrators should use the validated ETI-SBAE to evaluate their SBAE teachers and use the results of their evaluations to provide or support sustained, prolonged, and intense professional development of their teachers. The ETI-SBAE also should be paired with current program evaluations used by state program specialists, who might provide another metric to determine overall program quality. Additionally, this metric could be used for purposeful coaching for SBAE teachers, helping them develop human capital in areas that are identified as lacking (Robinson & Baker, 2013).

Recommendations pertaining to future research begin with the replication of this study. Although this study was a national census, replication on the state level could provide a more detailed overview of SBAE teachers across various geographic locations. Providing an opportunity for increased participation from each state could lead to an increased understanding of SBAE teachers' needs on a state level.

In addition, examining the key components within SBAE teacher preparation programs that impact teacher effectiveness is necessary. The ETI-SBAE provides insight into the specific human capital being developed in program-specific courses (Smith, 2010), allowing program improvement to prepare SBAE teachers with increased teaching effectiveness. Therefore, the ETI-SBAE should serve as an evaluation metric in agricultural education teacher preparation programs nationwide.

Further, the need exists to identify effectiveness needs of early-career SBAE teachers to provide targeted professional development. Allowing early-career SBAE teachers an opportunity to self-assess their teaching effectiveness based on the ETI-SBAE provides SBAE teacher preparation faculty an opportunity to identify pertinent training needs. According to Myung et al. (2013) "building a stronger teacher workforce requires the thoughtful orchestration of multiple processes working together in a human capital system" (p. 3); therefore, establishing the human capital needs of SBAE teachers is pivotal. Additionally, using the ETI-SBAE to examine the growth of future SBAE teachers within teacher preparation programs at pivotal stages can be instrumental to their human capital development. After the initial evaluation of future SBAE teachers when entering the program, additional evaluation is recommended at the end of each semester to determine the growth in human capital related to effective teaching in SBAE.

Discussion

The agricultural industry is changing rapidly to meet consumer demands (McCalla et al., 2010), while adjusting to changing climate patterns (Gornall et al., 2010) and the introduction of new technologies (Percy, 2018). Similarly, the educational system is in a state of flux attempting to meet various challenges of the 21st Century (Bar-Yam et al., 2002; Filippousis, 2019). Therefore, SBAE must constantly adapt to meet the changes associated with agriculture, the educational system, and the learning needs of students. Part of meeting the need of 21st Century students is adjusting to a new kind of learning. Students today prefer to receive information through technology and learn at their own pace (Marx, 2014; Winthrop & McGivney, 2016). With the ongoing changes facing SBAE, the demand for high quality, effective teachers is perhaps greater now than ever before (Smith et al., 2018).

This demand continues as new SBAE programs are added. Teachers from the *Baby Boom* generation are retiring in masses, and young, early-career teachers are exiting the profession prior to retirement (Smith et al., 2018). Although the demand is evident, the knowledge, roles, and requirements of a SBAE teacher today continue to evolve. The knowledge needed by current SBAE teachers includes agricultural content knowledge (Doerfort, 2011), an understanding of natural and social sciences (National Research Council, 2009), the ability to teach math, science, leadership, communications, technology, and management (National Association of Agricultural Educators, 2019), and the ability

to inform an agriculturally illiterate society (Dale et al., 2017). The roles and requirements of 21st century SBAE teachers continues to grow beyond the three components identified by the National FFA Organization (2015). Due to continuous changes in agriculture and education, how SBAE teachers are prepared, supported, and evaluated needs to be reconsidered based on the findings of this study.

The validated ETI-SBAE is comprised of six constructs measuring 26 items, including Intracurricular Engagement, Personal Dispositions, Appreciation for Diversity and Inclusion, Pedagogical Preparedness, Work-Life Balance, and Professionalism. The ETI-SBAE supports the knowledge, roles, dispositions, and responsibilities of a complete SBAE teacher and supports the findings of multiple studies in the agricultural education literature (Blackburn et al., 2017; DiBenedetto et al., 2018; Blind Authors, 2019; Roberts & Dyer, 2004; Terry & Briers, 2010; Torres et al., 2008). Although the ETI-SBAE does not include agricultural content knowledge as a construct, its aim was to evaluate teaching effectiveness for SBAE teachers. Further, the nationwide Delphi study (Blind Authors, 2019) did not include items related to agricultural content knowledge; therefore, the inclusion of related items was not an option within the complete instrument.

SBAE teacher preparation programs should evaluate their pre-service SBAE teachers at key points in the students' academic career based on the program's structure and needs. Potentially, these evaluations can be used to identify areas for improvement of the pre-service teacher and tracking individual growth throughout the program. This ultimately culminates with increased effectiveness in the clinical teaching internship, as the ETI-SBAE considers the multidimensional nature of teaching effectiveness (Farrell, 2015). The use of the ETI-SBAE can allow pre-service teachers' a chance to develop and improve on a personal and professional level within the six constructs relevant to effective teaching in SBAE. Teacher preparation programs strive to produce a supply of SBAE teachers to fill the annual national demand, which reached an all-time high, with 75% of the prepared and credentialed potential SBAE teachers accepting SBAE teaching position for the 2017 to 2018 school year (Smith et al., 2018). Unfortunately, the 2018 nationwide supply of SBAE teachers still fell short of the demand (Smith et al., 2018). Finally, it is possible the use of the instrument could improve the development of human capital of pre-service and in-service SBAE teachers, which might result in improved self-efficacy. As teacher self-efficacy increases, career satisfaction improves (Blackburn et al., 2017). Therefore, perhaps the implementation of the ETI-SBAE could positively impact the supply of SBAE teachers entering the profession by improving their effectiveness.

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