

Factors Relating to Agriculture Teachers' Perceived Use of Instructional Methods

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Abstract

School-based agricultural education (SBAE) teachers have been encouraged to use a variety of instructional methods. Despite teacher education programs covering numerous instructional methods and promoting active teaching strategies, prior research has indicated teachers' predominant use of teacher-centered methods. Guided by social cognitive theory, we sought to determine relationships between teachers' use of instructional methods, belief of method effectiveness, and teacher characteristics. We developed a web survey and administered it to all Florida SBAE teachers. We analyzed 146 usable responses using means, standard deviations, frequencies, zero order correlations, and mixed selection step-wise linear regressions. Findings indicated the most commonly used teaching methods were lecture-discussion, cooperative learning, demonstration, and paired/small group discussion. Teachers believed demonstration and cooperative learning to be most effective and debate and role-play least effective. Significant and positive correlations were found between belief of method effectiveness and method use for lecture-discussion, cooperative learning, demonstration, and paired/small group discussion. Regression models revealed similar trends, with the exception of lecture-discussion. We recommend pre-service and in-service teacher education programs emphasize the importance of student-centered instruction. In this effort, facilitators of teacher education programs should recognize the positive relationships between teachers' beliefs of a method's effectiveness and use of that method.

Keywords

Social cognitive theory, teacher beliefs, teaching effectiveness, teaching methods

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Introduction and Problem Statement

Developing teachers' pedagogy is central to pre-service and in-service teacher education and professional development. The successful teacher not only has a repertoire of teaching strategies but also uses the most appropriate method based on the instructional content, student learning goals, and characteristics of students and the environment (Stronge, 2018). Agriculture teachers have been encouraged to use a broad array of teaching methods (Newcomb et al., 2003; Rayfield et al., 2011), and teacher preparation programs are integral in exposing pre-service teachers to the variety of effective instructional methods (Smith et al., 2015). In fact, most teacher education programs include at least one course specifically on teaching methods (Jao, 2017; McLean & Camp, 2000; Peercy & Troyan, 2016). Ball and Knobloch (2005) reviewed 40 course syllabi for teaching methods courses and determined common methods taught to be the problem-solving approach, discussion, demonstration, and field trips.

School-based agricultural education (SBAE) has long highlighted the importance of experiential and hands-on learning (Phipps et al., 2008). Student-centered teaching strategies have been promoted in agricultural education to improve a variety of learning outcomes (Baker & Robinson, 2016; Thoron & Myers, 2011; 2012). However, teacher educators have questioned teacher preparedness for implementing active teaching strategies for some time (Crunkilton, 1976). Furthermore, teachers themselves have identified concerns related to their effective use of different teaching methods (Duncan et al., 2006; Stair et al., 2012). Despite the promotion of student-centered teaching in SBAE (McLean & Camp, 2000), reports have indicated that teachers consistently use underwhelming rates of student-centered instruction compared to teacher-centered instruction (Martin & Odubiya, 1991; Smith et al., 2015). This phenomenon begs for investigation of factors related to teachers' use of instructional methods.

Theoretical and Conceptual Framework

We used social cognitive theory (Bandura, 1986; 2002) as the theoretical framework to guide this study. According to social cognitive theory, human behavior operates through a multi-dimensional interaction between three influential factors: personal, behavioral, and social/environmental (Bandura, 2002; Schunk & Usher, 2019). In the context of teaching, teachers' personal and environmental factors have influence on their teaching behavior (An & Meaney, 2015; Chan & Yuen, 2014; Dusick, 1998; Holzberger et al., 2014). Prior research in SBAE (Smith et al., 2015; Voges et al., 2020) applied the social cognitive theory to examine agriculture teachers' selection and use of instructional methods. We followed a similar approach and investigated the influence of specific personal and environmental factors on the behavior of use of instructional methods.

Personal Factors

Personal factors are described by an individual's cognitions, beliefs, skills, and affects (Schunk & Usher, 2019). The influence of numerous personal factors have been investigated toward teacher behavior, e.g., pedagogical content knowledge (Gess-Newsome et al., 2017), job satisfaction (Baluyos et al., 2019), and learning style (Young et al., 2021). Bandura (1997) described outcome expectations and self-efficacy as key personal factors. The relationship between teachers' self-efficacy and use of teaching strategies has been well documented (Evans et al., 2014; Gibbs, 2003; Holzberger et al. 2014), whereas the impact of teachers' expected outcome of using specific teaching methods have been studied to a lesser extent. Outcome expectations of the behavior (e.g., believing how effective an instructional method is) may be influenced by teachers' social/environmental factors (e.g., traditional vs. provisional teaching certification), as well as prior reinforcement received after completing the behavior.

Social/Environmental Factors

Social/environmental factors interact with both personal and behavioral factors (Bandura, 1986; 2002). Characteristics of the teaching environment such as grade level-taught (Oliver et al., 2011), administration (Liebowitz & Porter, 2019), access to resources (Mumtaz, 2006), class size (Hattie, 2006) and subjective norms (Van Acker et al., 2013), among other factors, can influence teaching behavior. In a modified model of the social cognitive theory, Smith et al. (2015) included certification type, gender, and length of teaching career as environmental factors, as these are "factors in which each individual interacts with their peers influencing their social environment" (p. 186).

Behavioral Factors

Teachers' behavioral factors, such as the selection and use of a teaching method, are a result of multi-dimensional interactions between environmental and personal factors. Behavioral factors influence future behavior and behavior intention through the response an individual receives after a behavior is performed (Zhou & Brown, 2017). Prior studies on SBAE teachers' use of instructional methods report teacher-centered instructional methods as the most commonly used (Martin & Odubiya, 1991). Smith et al. (2015) found lecture to be the most used method (23.6%), followed by demonstration (15.8%). In a study on early-career, Texas SBAE teachers, Voges et al. (2020) found cooperative learning (37.6%), demonstration (32.8%), and lecture (32.7%) to be the most frequently used instructional methods.

Purpose

SBAE teachers have been encouraged to use a variety of instructional methods. Despite teacher education programs covering many instructional methods and promoting active teaching strategies, prior research has indicated teachers' limited use of active teaching methods. The purposes of this study were to establish a baseline for Florida agriculture teachers' perceived

use of instructional methods and to explore the influence of personal and environmental factors on the use of instructional methods. Findings from this study can be used to inform SBAE pre-service teacher education and in-service teacher professional development with the goal to increase teachers' use of a variety of instructional methods, and in particular, active teaching methods rooted in the philosophy of agricultural education. The following objectives guided this study:

1. Describe agriculture teachers' use of instructional methods in agricultural courses.
2. Describe agriculture teachers' belief of effectiveness of instructional methods.
3. Determine the relationships between teacher characteristics (i.e., environmental factors), belief of method effectiveness (i.e., personal factor), and perceived use of instructional methods (i.e., behavior factor).

Methods

All SBAE teachers in Florida were the target population for this study. From the state's agriculture teacher database, we generated a list of all teacher names, teaching positions, and emails. We developed and administered through Qualtrics a survey instrument to collect quantitative data. The first section of the instrument collected voluntary participant consent and contained a screening question to ensure that respondents were currently teaching SBAE in Florida. The second question asked participants to indicate agriculture course areas they were currently teaching in from a given list. Next, for each course area that was selected, participants were given a list of instructional methods and were asked to indicate the percentage of teaching time they used each instructional method. The combined use of teaching methods for teaching time was required to be 100%. The list included the name and definition for 12 common instructional methods and is shown in Table 1. The list was generated by a panel of four agricultural education faculty to ensure content validity and was similar to lists generated in related studies (Smith et al., 2015; Voges et al., 2020).

Table 1*Instructional Methods and Corresponding Definitions*

Instructional Method	Definition
Brainstorming.....	Quick and creative analysis of a topic by generating ideas.
Case Study.....	Actual or hypothetical scenario that require one or more decisions or actions.
Cooperative Learning.....	Learner-centered instruction that groups of 3-5 students work together on a well-defined learning task.
Debate.....	Formal discussion of the pros and cons of an issue in a timed format.
Demonstration.....	Step-by-step explanation and visual example of a procedure or practice.
Experiment.....	An investigation conducted to determine the effects of a procedure or device.
Field Trip.....	Firsthand observation and study of an off-site business, agency, enterprise, or other entity.
Lecture-Discussion.....	Presentation of information and questioning that provides students opportunities for interaction with the presenter.
Paired/Small Group Discussion.....	Structured discussion of a topic by students organized in small groups or pairs.
Resource Person.....	Outside guests/experts who are invited to share special knowledge, views, or skills.
Role Play.....	An acting out of a scenario or situation by students pretending to be characters in a scenario.
Supervised Study.....	Teacher supervision of students as they independently examine a reference or information item.

The next section of the survey asked participants to indicate their belief of method effectiveness using a 5-point Likert-type scale (*1 = not effective at all to 5 = extremely effective*) for each of the 12 instructional methods. For each course area taught, instructors also indicated their degree of confidence teaching the course content through a similar 5-point Likert scale (e.g., *1 = not at all confident to 5 = extremely confident*). The last section of the survey collected respondent demographics: age, gender, years teaching, teaching grade level, and teaching certification type.

Survey Delivery and Data Analysis

The survey was administered as a census sample (N = 406 teachers) during the spring 2018 semester and followed the Tailored Design Method (Dillman et al., 2014). A customized email was sent to all participants with a link to complete the survey. When responses dropped to zero, a reminder email was sent to non-respondents. A second reminder was sent following the same method. R version 4.0.3 (R Core Team, 2020) was used for data analysis. Data were

compared between early and late respondents to identify response bias (Lindner et al., 2001) and no significant differences were detected. Descriptive statistics in the form of means and standard deviations were used to address Objective 1, and frequencies were used to address Objective 2. Zero order correlations and mixed selection step-wise linear regressions were used to address Objective 3 using the *stats* package. An *a priori* alpha significance was established at .05.

Findings

We received 183 responses, a response rate of 45.1%. Of the 183 responses, 30 were incomplete and seven responders did not meet the criteria to complete the survey, resulting in 146 usable responses. Table 2 illustrates respondent characteristics.

Table 2

Demographic Characteristics of Respondents (n = 146)

Demographic Variable	<i>n</i>	%
Gender		
Male	58	39.7
Female	87	59.6
Age		
20 to 30	38	26.0
31 to 40	32	21.9
41 to 50	40	27.4
Older than 50	35	24.0
Highest Degree Level Earned		
Bachelor's Degree	96	65.8
Master's Degree	46	31.5
Doctoral Degree	3	2.1
Years Teaching Experience		
Less than 5 years	43	29.5
Five to 15 years	42	28.8
More than 15 years	61	41.8
Certification Type		
Traditional Agriculture Teaching Certification	48	32.9
Provisional Agriculture Teaching Certification	86	58.9
Unsure	11	7.5

Teachers reported teaching courses in the following areas: Introduction to Agriculture (n = 112); Animal Science (n = 73); Plant Systems / Horticulture (n = 57); Agribusiness (n = 29); Agricultural Mechanics (n = 26); Environmental Sciences / Natural Resource Management (n = 26); Food Products (n = 25); and, Biotechnology (n = 18).

Objective 1

Objective 1 was to describe teachers' perceived use of instructional methods. Teachers indicated their use of each instructional method for each course taught, and use of each method was averaged across all courses for each teacher. Teachers reported using lecture-discussion the most often ($M = 30.3\%$; $SD = 18.9$). Cooperative learning was found to have the second highest mean percentage ($M = 16.3\%$; $SD = 14.23$), followed by demonstration ($M = 12.23\%$; $SD = 8.55$) and paired/small group discussion ($M = 11.68\%$; $SD = 9.09$). Resource person, debate, field trip, case study, and role play had the lowest perceived uses, with mean percentages below 3%. Table 3 displays agriculture teachers' perceived use of instructional methods as a percentage of allocated class time.

Table 3

Teachers' Perceived Use of Instructional Method by Percent Class Time

Instructional Method	Mean	SD
Lecture-Discussion	30.28	18.91
Cooperative Learning	16.26	14.23
Demonstration	12.23	8.55
Paired/Small Group Discussion	11.68	9.09
Experiment	6.70	7.39
Supervised Study	6.64	9.51
Brainstorming	5.50	6.17
Resource Person (e.g., Guest Speaker)	2.77	4.16
Debate	2.61	3.73
Field Trip	2.59	4.44
Case Study	2.09	3.66
Role Play	0.64	2.13

Objective 2

Objective 2 was to describe teachers' belief of effectiveness of each instructional method. Results indicated that teachers believed demonstration to be the most effective, with 78.8% of teachers believing demonstration to be very effective or extremely effective. Teachers also perceived cooperative learning to be highly effective, with 74% of teachers believing the method to be very effective or extremely effective. Other methods showing an overall high belief of effectiveness were experiment, field trip, supervised study, and paired/small group discussion. More than half of teachers believed lecture, case study, brainstorming, and debate to be moderately effective or slightly effective. Role play had the lowest perceived effectiveness with 11.6% ($n = 17$) of teachers believing the method is not effective at all, and 30.8% ($n = 45$) believing that it is only slightly effective. Table 4 displays frequencies for teachers' belief of effectiveness of each instructional method.

Table 4*Frequency of Teachers' Belief of Effectiveness by Instructional Method*

Instructional Method	Not effective at all	Slightly effective	Moderately effective	Very effective	Extremely effective
	<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)
Demonstration	-	3 (2.1)	28 (19.2)	76 (52.1)	39 (26.7)
Cooperative Learning	1 (0.7)	6 (4.1)	31 (21.2)	75 (51.4)	33 (22.6)
Experiment	-	6 (4.1)	37 (25.3)	76 (52.1)	27 (18.5)
Field Trip	2 (1.4)	10 (6.8)	37 (25.3)	63 (43.2)	32 (21.9)
Supervised Study	1 (0.7)	9 (6.2)	48 (32.9)	65 (44.5)	22 (15.1)
Paired/Small Group Discussion	-	8 (5.5)	54 (37.0)	71 (48.6)	13 (8.9)
Resource Person/Guest	1 (0.7)	9 (6.2)	53 (36.3)	66 (45.2)	17 (11.6)
Lecture-Discussion	-	13 (8.9)	63 (43.2)	62 (42.5)	8 (5.5)
Case Study	5 (3.4)	14 (9.6)	67 (45.9)	46 (31.5)	12 (8.2)
Brainstorming	1 (0.7)	23 (15.8)	69 (47.3)	44 (30.1)	9 (6.2)
Debate	2 (1.4)	28 (19.2)	64 (43.8)	45 (30.8)	6 (4.1)
Role Play	17 (11.6)	45 (30.8)	53 (36.3)	23 (15.8)	6 (4.1)

Objective 3

Objective 3 was to test for relationships between teacher characteristics, belief of method effectiveness, and perceived use of instructional methods. Zero order correlations were first used to analyze associations between teacher demographics, confidence teaching subject matter, instructional method use, and belief of method effectiveness. The four most commonly used teaching methods reported in Objective 1 were used in our analysis. These methods were lecture-discussion, demonstration, cooperative learning, and paired/small group discussion.

Several significant correlations were found, all of which can be interpreted between a low and medium effect size (Cohen, 1988). More years teaching was associated with less use of paired/small group discussion ($r = -.199, p = .037$) and teaching higher grade levels was associated with higher use of demonstration ($r = .190, p = .047$). Higher reported confidence teaching subject matter was positively associated with belief in effectiveness for all methods except for cooperative learning (lecture-discussion: $r = .279, p = .003$; demonstration: $r = .211, p = .027$; paired/small group discussion: $r = .253, p = .008$). Pearson coefficients and corresponding p-values are reported in Table 5.

Table 5

Zero Order Correlations for Teacher Demographics, Confidence Teaching Subject Matter, Method Use, and Belief of Method Effectiveness

Variable	Lecture-Discussion		Demonstration		Cooperative Learning		P/S Group Discussion	
	Use	Effect.	Use	Effect.	Use	Effect.	Use	Effect.
Age	-.017	-.115	.026	.112	.017	-.103	-.134	-.116
Gender (Female)	-.008	-.025	.028	-.182	-.034	.142	.013	-.007
Years Teaching	.074	-.033	.056	.154	-.012	-.107	-.199*	-.117
Advanced Degree	-.161	-.037	.035	.101	.019	-.024	-.051	.066
Traditional Cert.	-.059	-.075	.160	.146	-.084	-.102	-.032	-.081
Grade Level (HS)	-.036	.075	.190*	.176	-.021	-.066	-.122	.087
Confidence	-.015	.279*	.035	.211*	.068	.022	.014	.253*

Note. * $p < .05$

Zero order correlations were used to determine associations between method use and belief of method effectiveness. Most notably, positive and significant correlations were found between belief in method effectiveness and method use for each respective method type (lecture-discussion: $r = .250$, $p = .008$; demonstration: $r = .300$, $p = .002$; cooperative learning: $r = .334$, $p < .001$; paired/small group discussion $r = .301$, $p = .001$). The found associations can be interpreted as approximately, medium effect sizes (Cohen, 1988). Three other significant correlations were found. These correlations indicated negative relationships between belief of method effectiveness and method use, but notably, between different method types (e.g., lecture-discussion use and belief of effectiveness of paired/small group discussion; $r = -.278$, $p = .003$). Zero order correlations between method use and belief of method effectiveness are reported in Table 6.

Table 6

Zero Order Correlations between Method Use and Belief of Method Effectiveness

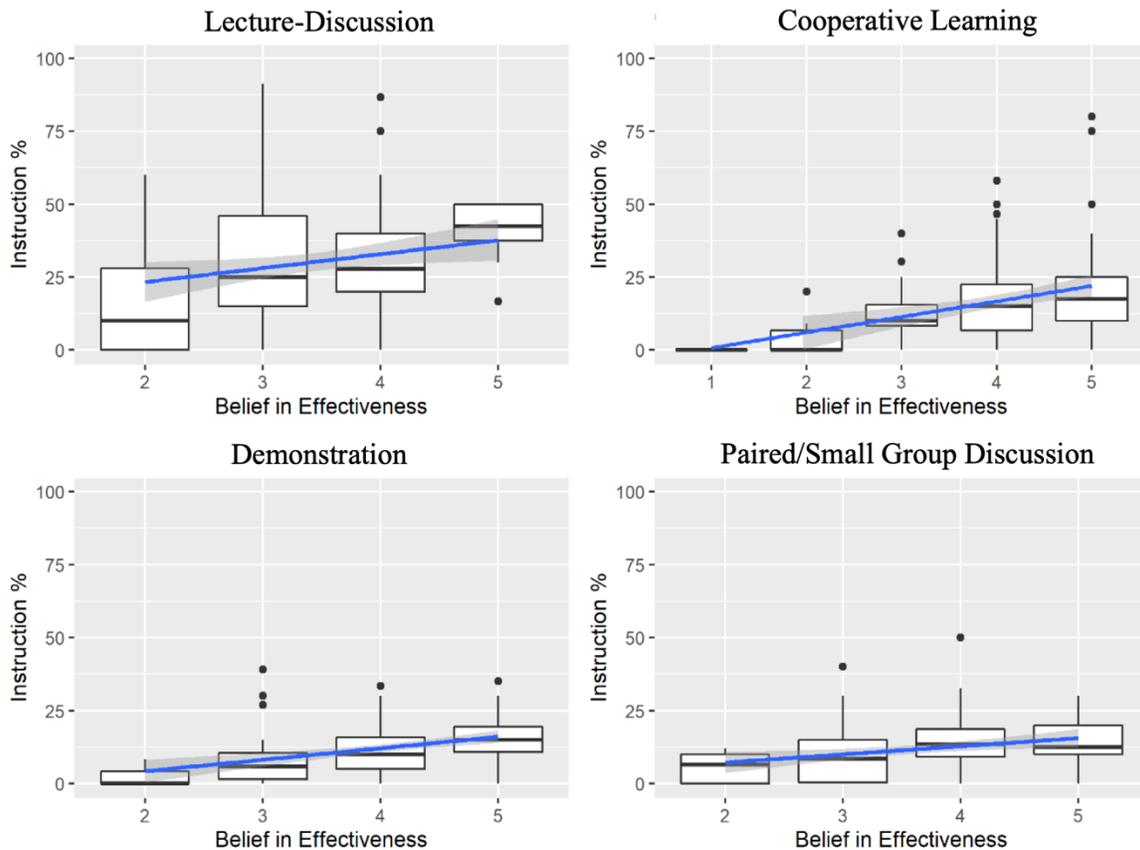
Method Use	Belief of Method Effectiveness			
	Lecture-Discussion	Demonstration	Cooperative Learning	P/S Group Discussion
Lecture-Discussion	.250*	-.135	-.199*	-.278*
Demonstration	-.085	.300*	-.027	.003
Cooperative Learning	.079	-.147	.334*	.127
P/S Group Discussion	-.244*	.011	.147	.301*

Note. * $p < .05$

To provide a visual summary of the relationship between teachers' belief of method effectiveness and percentage of use of the most commonly used methods found in our study, boxplots were made and are shown in Figure 1.

Figure 1

Boxplots Showing Percentage of Time Spent Teaching in Each Method Based on Teacher Belief in Said Method's Effectiveness.



Note. All models reveal a positive trend such that as belief in effectiveness increases, the percentage of time used teaching in that method also increases.

In addition to zero order correlations, mixed selection stepwise regressions were fit to average use data for the four most commonly used methods in our study. Predictor variables treated as continuous were teacher age, years teaching, belief of method effectiveness, and confidence teaching the subject matter. Predictor variables treated as binary were gender (male = 0, female = 1), degree level (bachelor's degree = 0, graduate degree = 1), teaching grade level (middle school = 0, high school = 1), and certification type (provisional = 0, traditional = 1). The full model also included interactions between beliefs in effectiveness and all other predictors.

The model fit to lecture-discussion use data revealed a single significant predictor of graduate degree such that those who did not hold graduate degrees used the lecture-discussion method more than those who did (Adj. $R^2 = .14$, $F [6, 103] = 2.688$, $p = .018$). The model fit to demonstration use data revealed several significant predictors. Belief of method effectiveness was a significant predictor, as well as gender, such that males were overall less likely to report

using the demonstration method. Additionally, a significant and positive interaction effect between belief in effectiveness and gender was revealed, such that reported use was higher in males compared to females when considering higher beliefs in effectiveness (Adj. $R^2 = .126$, $F [11, 98] = 2.425$, $p = .01$). The models fit to cooperative learning use (Adj. $R^2 = .103$, $F [1, 108] = 13.54$, $p < .001$) and paired/small group discussion use (Adj. $R^2 = .12$, $F [5, 104] = 3.837$, $p = .003$) both revealed belief in effectiveness as a significant predictor such that a higher belief in effectiveness predicted a higher use of each method. The significant predictors for each of the four final models are reported in Table 7.

Table 7

Regression Model Outputs for Factors Predicting Higher Method Use by Method Type

Model	Significant Predictors	Estimate	SE	t	p	η_p^2
Model 1						
Demonstration	<i>Effectiveness</i>	8.76	3.57	2.45	.02	0.08
	<i>Gender (Female)</i>	22.37	8.57	2.61	.01	0.10
	<i>Effectiveness*Gender</i>	-6.29	2.56	-2.46	.02	.058
Model 2						
Lecture-Discussion	<i>Degree (Graduate)</i>	-7.75	3.68	-2.11	.04	.041
Model 3						
Cooperative Learning	<i>Effectiveness</i>	6.29	1.71	3.68	< .01	.111
Model 4						
P/S Group Discussion	<i>Effectiveness</i>	16.76	7.96	2.11	.04	.091

Conclusions, Discussion, and Recommendations

Findings from our study provide baseline data for Florida agriculture teachers' use of instructional methods and belief of method effectiveness. Our findings show that teachers reported using lecture-discussion the most often (30.3%), followed by cooperative learning (16.3%), demonstration (12.2%), and paired/small group discussion (11.7%). Least used were role play (<1%) and case study (2.1%). The dispersion of method use, with teacher-centered methods being highly used, support the findings from similar studies in other states (Martin & Odubiya, 1991; Smith et al., 2015; Voges et al., 2020). Florida agriculture teachers reported the highest belief in method effectiveness for demonstration, cooperative learning, and the use of experiments. These results align with Smith et al. (2015) who found teachers believed demonstration and experiments to be the most effective.

According to social cognitive theory (Bandura, 1986; 2002), interactions exist between personal, environmental, and behavioral factors. We found several significant correlations between demographic factors and method use, and between demographic factors and belief of method effectiveness. More years teaching was associated with less use of paired/small group discussion, teaching high school was associated with higher use of demonstration, and higher confidence teaching subject matter was associated with higher belief in effectiveness for all

methods except cooperative learning. More robust, significant correlations were found between teachers' belief of method effectiveness and use of the same method for lecture-discussion, cooperative learning, demonstration, and paired/small group discussion. Other significant correlations between these variables were negative. For example, higher belief in the effectiveness of cooperative learning was associated with less use of lecture-discussion.

Follow-up regression models supported our overall observations that belief of a method's effectiveness is positively associated with that method's use. Belief of a method's effectiveness was a significant predictor for the use of cooperative learning, demonstration, and paired/small group discussion. The regression analysis did not yield a significant interaction of belief in lecture-discussion effectiveness and average reported lecture-discussion use; so the significant correlation found may be due to other latent factors. These results may suggest that the use of lecture-discussion does not necessarily depend on teachers' beliefs in that method's effectiveness. Graduate education was the single significant predictor of use for lecture-discussion, such as teachers who held graduate degrees used lecture-discussion less often. Interestingly, teachers' age and certification type were not significantly associated with the use of a particular teaching method in any of our analyses.

Results of this study provide strong evidence toward the positive relationship between teachers' beliefs of a teaching method's effectiveness and their level of use of that method. This finding is valuable to guide pre-service and in-service teacher education programs, particularly programs designed to encourage teachers to use specific instructional methods to meet learning objectives and student characteristics (Newcomb et al., 2003). This study is limited in that: (a) we measured teachers' perceptions of their retroactive use of teaching methods in lieu of physical observations; (b) our respondents' interpretation of teaching methods, although guided by given definitions, could have varied; (c) our results do not necessarily illustrate cause and effect, but rather infer associations between variables, and (d) our results are limited to the state of Florida. We recommend future research to seek why teachers believe some methods are more effective than others. Additional research that examines why teachers utilize lecture-discussion more than other methods would be beneficial, as teacher-centered instruction remains highly used in SBAE. Lastly, we recommend replication of this study or conducting similar studies on a state-by-state basis or on a national level.

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Author Contribution Statement

B. Colclasure – writing-original draft, writing-review and editing, investigation, methodology, formal analysis, conceptualization; **T. Thoron** – writing-review and editing, investigation, methodology, conceptualization; **J. Dempsey** – writing-original draft, writing-review and editing, formal analysis

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