

## Do Teachers Have the Skills: 21st Century Skills in the Agricultural Education Classroom?

Kisia J. Weeks<sup>1</sup>, Rebecca G. Lawver<sup>2</sup>, Tyson J. Sorensen<sup>3</sup>, and Brian K. Warnick<sup>4</sup>

### Abstract

*Research has shown 21st century skills are essential to a student's success outside of the high school classroom. The 21st century skills prepare students to enter the workforce or higher education with the ability to think critically and creatively, collaborate with others, take the initiative when approached with a task, and use technology to its fullest potential. This study examined school-based agricultural education teachers' perceived knowledge, ability, and importance of implementing 21st century skills into the classroom. Upon identifying teachers perceived level of importance, knowledge, and ability, results were analyzed to determine the professional development needs of school-based agricultural education teachers in particular 21st century skills. Results concluded professional development is needed to further educate and equip agriculture teachers with specific and applicable strategies to implement Critical Thinking, Communicating, and Technology Literacy skills into their classrooms.*

**Keywords:** 21st century skills; needs assessment; school-based agricultural education; professional development

**Author Note:** Correspondence concerning this article should be addressed to Rebecca Lawver, Utah State University, Logan, UT 84321. Email: [rebecca.lawver@usu.edu](mailto:rebecca.lawver@usu.edu)

### Introduction

Over the last several decades, demands in employment, business, and the growing global economy have changed. These changes have required workers to be educated, flexible, and have excellent communication skills. Industry has also recognized the need for today's workforce to develop this skillset, known as 21st century skills (National Research Council, 2012; Rotherham & Willingham, 2010). In order to adapt to the growing global economy and prepare students to have the necessary technical skills and 21st century skills to be successful in today's workforce the American education system must adapt (Jacobson-Lunddeberg, 2016; Rotherham & Willingham, 2010). Educators, business leaders, and policy makers have determined the 21st century skills are essential to succeed in our dynamic, growing global economy (Rotherham & Willingham, 2010). These changes require the workforce to be educated, flexible, and have excellent communication skills and students deserve an education that prides itself in 21st century learning for college and career readiness (Vockley, 2010).

Similar college and career ready standards have been in place for many years recent studies have identified the importance of exploring 21st century skills in the classroom (Girlando, 2013;

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<sup>1</sup> Kisia J. Weeks is an agriculture teacher at White Hall High School. 700 Bulldog Dr, White Hall, AR 71602 ([weeksk@whitehallsd.org](mailto:weeksk@whitehallsd.org))

<sup>2</sup> Rebecca Lawver is an Associate Professor in the Applied Sciences, Technology and Education Department, Utah State University 1498 N 800 E, Logan, UT 84322 ([rebecca.lawver@usu.edu](mailto:rebecca.lawver@usu.edu))

<sup>3</sup> Tyson Sorensen is an Assistant Professor in the Applied Sciences, Technology and Education Department, Utah State University 1498 N 800 E, Logan, UT 84322 ([Tyson.sorensen@usu.edu](mailto:Tyson.sorensen@usu.edu))

<sup>4</sup> Brian Warnick is a Professor in the Applied Sciences, Technology and Education Department, Utah State University 4800 Old Main Hill, Logan, UT 84322 ([brian.warnick@usu.edu](mailto:brian.warnick@usu.edu))

Rotherham & Willingham, 2010; Scott, 2017; Yoest & Kane 2015) and career and technical educators have been teaching these skills for years (Symonds et al., 2011). Where agricultural education is poised to prepare students beyond high school (Davis & Jayaratne, 2015) aligning the 21<sup>st</sup> century skills to instruction should be a priority. School-based agricultural education prepares students for our global society by utilizing experiential learning and intentional engagement of students in 21st century skill development (Thiel & Marx, 2019). While there are few studies that have included the application of 21st century skills in the agricultural education classroom, this study sought to identify the professional development needs of school-based agriculture teachers and addresses the American Association of Agricultural Education research priority area 3 “sufficient scientific and professional workforce that addresses the challenges of the 21st century” (Stripling & Ricketts, 2016).

### **Review of Literature**

Demands in employment, business, and globalization have changed the way people work. Workers need to be educated, flexible, and have excellent communication skills in order to thrive in our global economy. Shuman et al. (2005) stated the American education system is driven by globalization, rapid information technology, downsizing of corporations and outsourcing. To combat this issue, the American education system must begin to adapt to the growing global economy by preparing students to not only have the technical skills necessary for the workforce, but also the soft skills to succeed (Jacobson-Lundeberg, 2016).

The American education system is not considerably different than it was in the 20th century (Girlando, 2013). Teachers continue to teach students how to read, write, and calculate math problems, yet students often do not process the information and apply it to real-world situations and are unable to communicate their ideas orally or in writing (Wagner, 2008). In our technology rich environment students have access to a wealth of information, constant innovations, and the opportunity to collaborate and communicate with those around the world. Rather than being taught to make use of this information, students are trained to memorize information and not necessarily retain the information over an extended period of time (Wagner, 2008). This calls for a shift from rote memorization and brief recall to teaching students how to think critically about the ways of knowing information (Rotherham & Willingham, 2010; Wagner, 2008). While learning academic material is valuable, students must also learn to make innovative use of what they learn and understand how to apply core content learned to real-world situations (Kay, 2009), which supports the incorporation of 21st century skills in the classroom.

Further, providing students with opportunities to apply these skills within the core content would enhance career and college readiness. According to the National Center for Education Statistics (2018), approximately 69% of high school graduates enrolled in college immediately following graduation, leaving 31% who enter the workforce, military, or other services. Many students do not have the skills they need to flourish after high school (Vockley, 2010). With technology ever present in the 21st century, education must adapt to the growing needs of skilled laborers in the workforce, which is where school-based agricultural education can be part of the solution.

### **Career Skills in the School-Based Agricultural Education Classroom**

Today, industry seeks to employ graduates with a wide-ranging collection of knowledge and skills—not just particular content knowledge, but skills that transfer, such as critical thinking, problem-solving, and effective communication (Lumina, 2018). The Association of Career and Technical Education (2010) identifies 21st century skills as well as academic and technical skills

as crucial in preparing students to become career ready. School-based agricultural education as a whole must strive to create a pool of qualified candidates that have a developed set of skills qualifying them for jobs in the industry. Twenty-first century skills have become increasingly important for students to possess due to the growing demand of a qualified candidate pool with a broad skill set – especially in technical professions because of the rising global competition and search for innovations related to profit and productivity (Bancino & Zevalkink, 2007). School-based agricultural education teachers must customize their program to prepare students to enter the workforce directly after high school or post-secondary education (Schneider, 2016). It is possible that 21st century skills can be developed in a number of different ways including inquiry-based teaching, experiential learning, and involvement in FFA (Thiel & Marx, 2019).

Abundant literature notes utilizing experiential learning for enhanced student learning (Bloom, 1974; Carroll, 1989; Darling-Hammond & Falk, 1997; Glaser, 1963) and is implemented in many school-based agricultural education classrooms. Students enroll in school-based agricultural education for experiential, hands-on learning (Swinehart, 2013). According to Roberts and Ball (2009), agricultural educators should use experiential learning to teach agriculture-based content as well as life lessons. Both Dewey (1944) and Kolb (1984) have reported the importance of experiential learning to a student's academic success. While, school-based agricultural education has a history of experiential education through Supervised Agricultural Experiences (SAE); in the 21st century, fewer students involved in school-based agricultural education have a direct connection to agriculture than agriculture students did in the 20th century (Stone, 2014).

According to the Lumina Foundation (2018), the workplace skills employers consider most important are critical thinking and problem-solving, collaboration and teamwork, communication, and the technical skills associated with the job. The skills reported by the Lumina Foundation (2018) coincide directly with the 21st century skills reported by the Partnership for 21st Century Learning (Battelle for Kids, 2020), all of which have been embraced in career and technical education (Clark et al., 2010). Only 11.0% of industry leaders feel strongly that students are graduating from college with the skills necessary for success in the workplace (Lumina, 2018). The FFA and school-based agricultural education provide students with the opportunity to develop 21st century skills through employing knowledge learned in the classroom to Career Development Events (CDEs), SAEs, leadership conferences and activities, and other events (Swinehart, 2014).

School-based agricultural education allows students to learn 21st century skills through the three-component model (Yoest & Kane, 2015). The three-component model of agricultural education consists of classroom/laboratory instruction including inquiry-based learning through interactive classroom and laboratory instruction; SAEs consisting of experiential, service and/or work-based learning; and the National FFA Organization (FFA) including engagement of premier leadership, personal growth and career success (National FFA, 2018a). When all three components are implemented into school-based agricultural education, it prepares students for successful careers and a lifetime of informed choices in the global agriculture, food, fiber, and natural resources systems (National FFA, 2018a) and may be the ideal place for the development of skills needed to be competitive in the workforce and succeed in the 21st century.

### **Framework for 21st century Learning**

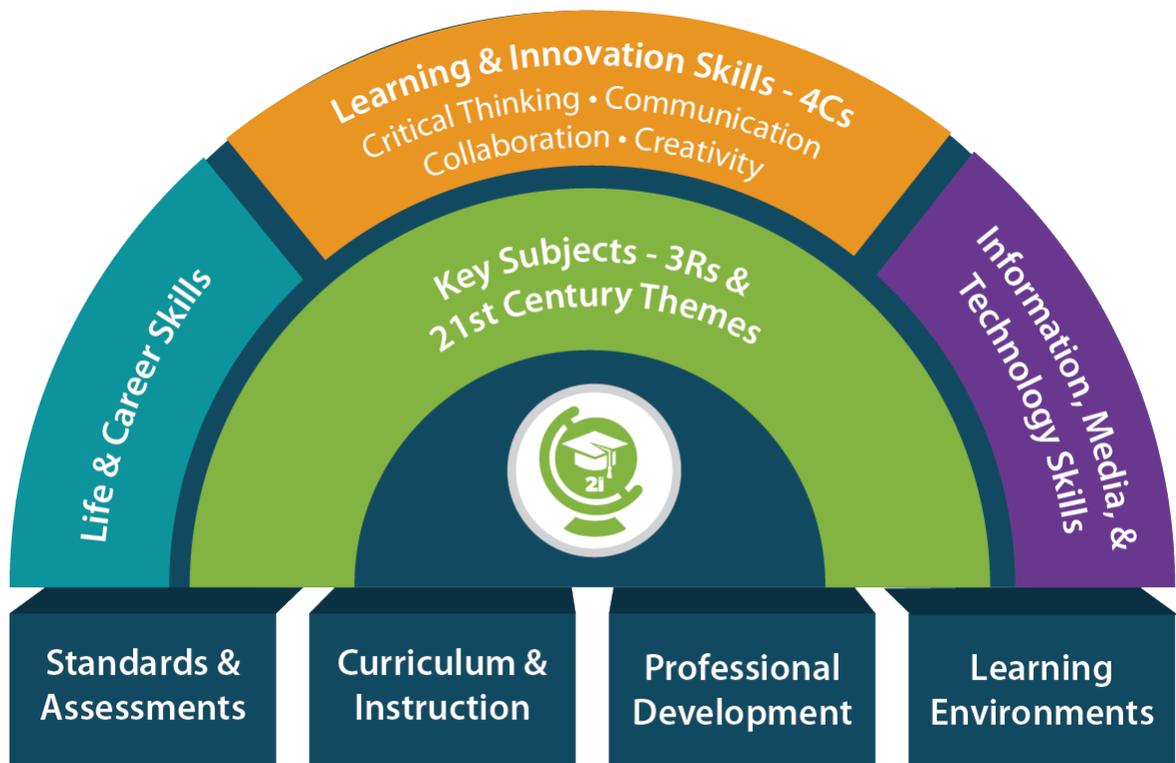
The Partnership for 21st Century Learning (Battelle for Kids, 2020) validates the belief that assessments must be produced that evaluate content simultaneously with 21st century skill development. The Partnership for 21st Century Learning (Battelle for Kids, 2020) has identified four characteristics when implemented promotes the adoption of 21st century skills in the classroom. This includes creating necessary standards; developing, implementing, evaluating, and

improving assessment methods; aligning formative and summative assessments to curriculum and instruction; and developing a professional development strategy. The past few decades have seen significant progress pertaining to American education reform and has dramatically benefited students who are less advantaged. Yet, additional change is still needed to ensure our students are prepared to succeed in a growing global economy (Rotherham & Willingham, 2010). To make the needed changes in education, educators must teach students core content and interlace 21st century skills throughout the curriculum and daily lessons in every subject (Battelle for Kids, 2020).

The framework that guides this study was developed by the Partnership for 21st century Learning organization (Battelle for Kids, 2020) and was developed in collaboration with teachers, educational experts, and industry leaders to determine the skills and knowledge needed to succeed in work, life, and citizenship in the 21st century.

### Figure 1

*Framework for 21st Century Learning (Permission granted ©2020, Battelle for Kids. All Rights Reserved. www.bfk.org)*



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The framework indicates the supports necessary to lead to appropriate student outcomes. The support systems associated with the Framework for 21st century Learning (Battelle for Kids, 2020) are standards and assessments, curriculum and instruction, professional development, and learning environments. The student outcomes include life and career skills; learning and innovation skills; information, media, and technology skills; and key subjects. According to the Partnership for 21st century Learning, the 21st century outcomes (the skills, knowledge, and expertise) are those which a student should master to be successful in life and workforce in today's growing

global economy (Battelle for Kids, 2020). This framework provides a guide for this study, as it embraces and defines 21st century learning skills.

The Partnership for 21st Century Learning defines 21st century skills as the skills required to succeed in work and life in the 21st century. Describing the framework, the key subjects include content knowledge that can be described as the mastery of core subjects such as English, reading, arts, world languages, mathematics, science, and history. Learning and innovation skills include creativity and innovation, critical thinking and problem-solving, communication, and collaboration. Information, media and technology skills is described as information literacy, media literacy, and information and communication technologies. Life and career skills into flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility (Battelle for Kids, 2020).

Theorists such as Dewey (1944) and Kolb (1984) suggested that learning is gained through experience-based settings with hands-on learning, which is not a new concept, but one that must be capitalized on. Larson and Miller (2011) suggested that teachers take advantage of the opportunity to engage students by creating lessons that enhance problem-solving, integrate technology, and stimulate critical thinking.

Content knowledge is necessary but not nearly enough for success in the 21st century. Students must have skills that enable them to apply their knowledge and continue learning. Otherwise, students leave the knowledge learned in the classroom and seldom connect it to their personal lives (Girlando, 2013). However, Vockley (2010), posited students learn more when their work is connected to their interests, to problems they may face in the real world, and to work and college. While the mastery of fundamental content knowledge is crucial, students must understand how to make use of the knowledge they learn (Girlando, 2013). Students must be able to encounter and solve real-world problems while taking knowledge from the situation and applying it to others (Larson & Miller, 2011).

There have been numerous needs assessment studies that have identified the pedagogical and professional development needs of school-based agricultural education teachers (DiBenedetto et al., 2018; Dossett, et al., 2019; Garton & Chung, 1996; Joerger, 2002; Mckim & Saucier, 2011; Smalley et al., 2019; Smalley & Smith, 2017; Stair et al., 2019). This study is an exploration of Joregers' (2002) recommendation to aggregate, validate, test, and refine a contemporary list of professional competencies and in-service education needs of teachers, which includes 21st century skills. This study examined participating agriculture teachers' ability to teach 21st century skills, the perceived importance of 21st century skills in the agriculture classroom, and knowledge of the 21st century skills. Research on teacher's ability to teach 21st century skills align with Smalley and Smith (2017) assertion about the need for targeted professional development and is supported by DiBenedetto et al. (2018) which highlighted 21st century skill development.

### **Purpose**

The purpose of this study was to identify and prioritize professional development for school-based agricultural education teachers related to 21st century skills. The specific research objectives were as follows:

1. Describe school-based agricultural education teachers' perceived level of importance of 21st century learning skills.
2. Describe school-based agricultural education teachers' perceived knowledge level regarding 21st century learning skills.

3. Describe school-based agricultural education teachers' perceived ability to teach 21st century learning skills.
4. Identify and prioritize the professional development needs of school-based agricultural education teachers' 21st century learning skills.

### **Methods**

The population for this study included all school-based agricultural education teachers in the 2018 – 2019 school year. Of the approximately 12,000 school-based agricultural education teachers (National Association of Agricultural Educators, 2018), a systematic random sample of school-based agricultural education teachers was obtained from the National FFA Organization. According to Krejcie and Morgan (1970), the sample size needed for the study was 373 participants. Due to traditionally low response rates among agriculture teachers when using E-mail and web-based surveys (Fraze et al., 2003), oversampling was used to obtain a frame of 560 school-based agricultural education teachers, representative of all regions of the National FFA Organization.

The Borich (1980) needs assessment model was used to conceptualize the data collection and analysis in this study. The model allows teachers to rate their perceived level of importance of a concept, perceived knowledge, and their perceived ability. Borich stated that a need is defined as a discrepancy between “what is” and “what should be.” Scores are then compared, and a mean weighted discrepancy score (MWDS) is generated. When a discrepancy score is high, this is an area in which professional development and training is needed regarding the concept researched. Competencies are ranked in order from highest to lowest, with higher MWDS indicating a need for in-service training. This allows researchers to purposefully prioritize competencies, so teachers can receive training in the most needed areas first (Yopp et al., 2017). Borich defined knowledge as the ability to accurately recall, paraphrase, or summarize the procedural mechanics of the behavior on a paper and pencil test. Ability is defined as accurately executing the behavior in a real or simulated environment in the presence of an observer (Borich, 1980). Using the Borich (1980) needs assessment model assessing each participants' perceived importance, knowledge, and ability likely would have led to respondent fatigue or non-response.

According to Bradley and Daly (1994), “... respondent ‘fatigue’ may cause people to make choices less carefully as the number of choices increases” (p. 171). To lessen the probability of respondent fatigue or item non-response, we developed two shorter versions of the survey. Each participant was asked to respond to identical questions targeted at perceived importance and demographics. The two versions of the survey differed by asking unique questions with Group I indicating perceived ability and Group II indicating perceived knowledge. We used systematic random sampling to assign each participant a version (version 1 or version 2) of the survey (see Figure 2). Splitting the sample in half and asking each group a different form of the instrument reduced the length of the needs assessment by 25%, ensuring respondents were less likely to experience respondent fatigue (Dillman et al., 1993). The instrument did not collect identifiers and produced a combined response rate of 18% ( $n = 98$ ); Group I had a response rate of 18% ( $n = 49$ ) and Group II had a response rate of 16% ( $n = 44$ ). A noted limitation of this study was the low response rate and missing responses. The scope of this study was limited to the respondents of this study and do not reflect that of the entire population of school-based agricultural education teachers.

**Figure 2**

*Two Instruments Were Developed to Measure Teachers' Perceived Levels of Competency of 21st Century Skills*

Group	Importance	Knowledge	Ability	Demographics
Group I	Importance of 21st Century Skills (12 Items)	Knowledge of 21st Century Skills (12 Items)		Demographics
Group II	Importance of 21st Century Skills (12 Items)		Ability to Teach 21st Century Skills (12 Items)	Demographics

### Instrumentation

The instrument used in this study was previously developed by and adapted from Magno et al. (2016) and was administered through Qualtrics online web survey software. The instrument was modified to obtain demographic information and develop the Borich needs assessment from the Magno et al. (2016) survey. The instrument focused on the school-based agricultural education teachers' perceived importance of the 21st century learning skills, knowledge of the 21st century learning skills, and their perceived ability to teach the principles of 21st century learning in the school-based agricultural education classroom. The following area of the 21st century learning skills were measured: critical thinking, creative thinking, collaborating, communicating, information literacy, media literacy, technology literacy, flexibility, initiative, social skills, productivity, and leadership. A Likert-type scale was used to measure importance; 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important; and ability; 1 = Not Competent, 2 = Somewhat Competent, 3 = Competent, 4 = Very Competent.

A panel of experts comprised of faculty in career and technical education at Utah State University, faculty in agricultural education from three outside universities, and a needs-assessment expert who reviewed the instrument to determine face and content validity. A Cronbach's alpha coefficient was calculated to determine the reliability of the instrument after data collection had been completed. A Cronbach's alpha coefficient for importance ( $\alpha = .85$ ) and ability ( $\alpha = .85$ ) were calculated and were deemed reliable (Cronbach, 1951).

When Likert-type questions were compared using *t*-tests on their responses to perceived importance questions, no difference between early and later responders were identified (Lindner et al., 2001). Data were analyzed using an Excel-based Mean Weighted Discrepancy Score calculator developed by McKim and Saucier (2011). The average age of respondents was 36.7 ( $SD = 11.22$ ) years old, 49.5% of respondents were male, 50.5% female, and the average number of years taught were 11.1 years ( $SD = 9.4$ ).

### Findings

The purpose of this study was to examine the perceived importance, knowledge, and ability to teach 21st century learning skills in the school-based agricultural education classroom nationwide. The following information reflects responses from teachers nationwide who responded

to this research and their perceptions regarding the importance of teaching 21st century skills, knowledge of these skills, and their perceived ability to teach 21st century skills in the agriculture classroom.

### Teachers' Perceived Level of Importance of 21<sup>st</sup> Century Learning Skills

Group I and Group II received 12 questions regarding the perceived importance of 21st century skills in the school-based agricultural education classroom. Table 1 includes the combined data from both groups I and II. As shown in Table 1, the majority of respondents felt the 12 identified 21st -century skills were important. Overall, respondents indicated on average each 21st century skill was "Important" or "Very Important." The majority of respondents indicated the following 21st skills as "very important" to integrate into the classroom they include: collaborating ( $M = 3.66$ ;  $SD = .50$ ), communicating ( $M = 3.86$ ;  $SD = .45$ ), creative thinking ( $M = 3.49$ ;  $SD = .61$ ), critical thinking ( $M = 3.78$ ;  $SD = .44$ ), flexibility ( $M = 3.43$ ;  $SD = .60$ ), information literacy ( $M = 3.45$ ;  $SD = .71$ ), initiative ( $M = 3.65$ ;  $SD = .52$ ), leadership ( $M = 3.58$ ;  $SD = .59$ ), productivity ( $M = 3.58$ ;  $SD = .59$ ), social skills ( $M = 3.61$ ;  $SD = .53$ ), and technology literacy ( $M = 3.48$ ;  $SD = .54$ ).

**Table 1**

*School-Based Agricultural Education Teachers' Perceived Level of Importance Per 21st Century Learning Skill Item (n = 98)*

Item	<i>M</i>	<i>SD</i>	<i>N</i>
Communicating	3.86	.45	98
Critical Thinking	3.78	.44	98
Collaborating	3.66	.50	98
Initiative	3.65	.52	96
Social Skills	3.61	.53	96
Productivity	3.58	.59	96
Leadership	3.58	.59	96
Creative Thinking	3.49	.61	98
Technology Literacy	3.48	.54	97
Information Literacy	3.45	.60	97
Flexibility	3.43	.60	93
Media Literacy	3.18	.71	97

*Note.* Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important

### Teachers' Perceived Knowledge Level Regarding 21st Century Learning Skills

Group I was asked to indicate their knowledge about the 21st century learning skills. On average, the respondents indicated they were "Knowledgeable" about teaching leadership, communication, social skills, productivity, initiative, and collaborating. However, teachers indicated they were only "Somewhat Knowledgeable" in regard to critical thinking, flexibility, creative thinking, information literacy, technology literacy, and media literacy (Table 2).

**Table 2**

*School-Based Agricultural Education Teachers Perceived Level of Knowledge Per 21st Century Learning Skill Item (n = 49)*

<i>Item</i>	<i>Mean</i>	<i>SD</i>	<i>N</i>
Leadership	3.27	.64	48
Communicating	3.17	.67	47
Social Skills	3.15	.58	48
Productivity	3.06	.67	48
Initiative	3.06	.67	48
Collaborating	3.02	.53	47
Critical Thinking	2.98	.60	48
Flexibility	2.94	.60	48
Creative Thinking	2.91	.62	47
Information Literacy	2.84	.66	49
Technology Literacy	2.76	.75	49
Media Literacy	2.73	.67	49

*Note.* Scale: 1 = Not Knowledgeable, 2 = Somewhat Knowledgeable, 3 = Knowledgeable, 4 = Very Knowledgeable

### Teachers' Perceived Ability to Teach 21st Century Learning Skills

As shown in Table 3, Group II respondents indicated their perceived level of ability to teach the 21st century learning skills. The respondents believed they were competent in terms of teaching leadership, social skills, flexibility, communicating, collaborating, initiative, and productivity. However, on average, believed they were "Somewhat Competent" in their ability to teach critical thinking, information literacy, creative thinking, media literacy, and technology literacy.

**Table 3**

*School-Based Agricultural Education Teachers Perceived Level of Ability Per 21st Century Learning Skill Item (n = 44)*

<i>Item</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>
Leadership	3.35	.78	43
Social Skills	3.30	.74	43
Flexibility	3.26	.73	42
Communicating	3.16	.61	44
Collaborating	3.11	.75	44
Initiative	3.09	.75	43
Productivity	3.02	.64	43
Critical Thinking	2.98	.67	44
Information Literacy	2.95	.62	43
Creative Thinking	2.89	.69	44
Media Literacy	2.60	.66	43
Technology Literacy	2.60	.79	43

*Note.* Scale: 1 = Not Competent, 2 = Somewhat Competent, 3 = Competent, 4 = Very Competent

### Identify and prioritize the professional development needs of school-based agricultural education teachers' 21st century learning skills.

To identify and prioritize the professional development needs of school-based agricultural education teachers in regard to 21st century learning skills a MWDS calculated the discrepancy between both importance as indicated and knowledge as perceived by Group I and importance and ability as perceived by Group II. The discrepancy scores were weighted by multiplying each score by the mean of the importance scores which was then averaged to create a MWDS. The higher the MWDS, the more professional development is needed in that area.

Table 4 illustrates the discrepancy between the importance of the 21st century skill and teachers' ability to teach that skill and the discrepancy between importance of the 21st century skill and teachers' knowledge of that skill. Both groups indicated a discrepancy between the importance of 21st century skills and their perceived knowledge and ability to teach the skills. The areas of highest discrepancy between importance and ability were critical thinking, technology literacy, and communicating, indicating that teachers found these items important but indicate a lower perceived ability to teach them. Comparing importance and knowledge also identified communicating, critical thinking, and technology literacy as the highest discrepancy which indicated a need for professional development in these areas.

**Table 4**

*Mean Weighted Discrepancy Score Between Importance and Ability*

<i>Item</i>	MWDS	MWDS
	Importance and Ability Group I	Importance and Knowledge Group II
Critical Thinking	3.47	2.70 <sup>2</sup>
Technology Literacy	2.98	2.48 <sup>3</sup>
Communicating	2.52	2.82 <sup>1</sup>
Collaborating	2.24	1.65
Productivity	2.19	1.70
Creative Thinking	1.96	2.00
Initiative	1.94	2.13 <sup>5</sup>
Information Literacy	1.58	2.19 <sup>4</sup>
Social Skills	1.27	1.74
Leadership	1.20	1.20
Media Literacy	1.19	1.89
Flexibility	0.66	1.48

*Note.* Importance Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important; Ability Scale: 1 = Not Competent, 2 = Somewhat Competent, 3 = Competent, 4 = Very Competent; Knowledge Scale: 1 = Not Knowledgeable, 2 = Somewhat Knowledgeable, 3 = Knowledgeable, 4 = Very Knowledgeable

### Conclusions and Recommendations

Based on the findings of this study we can conclude that the school-based agricultural education teachers in this study perceived 21st century learning skills as important yet lack the knowledge and ability needed to teach specific skills and is apparent that these teachers have not mastered implementing the 21st century skills into their classroom. Saavedra and Opfer (2012) suggest strategies that can be used to implement 21st century skills in the classroom that may be beneficial for agriculture teachers. These strategies include designing relevant, discipline specific,

developing thinking skills, encouraging the transfer of learning, teaching students how to learn, addressing misunderstandings, using teamwork as an outcome, using technology to support learning and fostering creativity (Saavedra & Opfer, 2012). Further, DiBenedetto et al. (2018) found that as agricultural education has changed, so has the professional development, this includes development in the 21st century competencies. Teachers need training and support to unpack and fully implement the competencies in their instruction and assessments.

The data in this study suggests that teachers need assistance teaching students how to think critically as it had the highest discrepancy between importance and knowledge and the second highest discrepancy between importance and ability. It should not be surprising that very few teachers actually teach critical thinking or even understand what it is (Paul & Elder, 2013). Further, critical thinking is one of the most cognitive traits and has been linked to individual success (Lamm et al., 2011) and one of the most important intellectual skills for the 21st century (Halpern, 2002). Further, Akins et al. (2019) posited in order to solve the issues in agriculture and natural resources industries now and in the future, students must be able to engage in critical thinking. It is imperative that teacher educators and state staff assist our teachers with gaining the knowledge and ability to do so. Professional development through peer mentoring and focused workshops connected teachers own ability to think critically would be beneficial. Further, pre-service teacher education programs must also teach students how to think critically as it must become standard that pre-service preparation programs integrate these concepts into the curriculum (Abrami et al., 2008). Further, Abrami et al., found students learn critical thinking only after teachers receive training on how to teach it and have the opportunity to design courses explicitly and intentionally to foster critical thinking skills.

The importance of the 21st century skill in communication and technology literacy is also apparent in the findings. According to the National Association of Colleges and Employers Job Outlook (2015) survey, more than 80% of employers look for leadership, written communication skills, problem-solving skills, strong work ethic, and verbal communication skills. This is a well-known benefit of school-based agricultural. School-based agricultural education provides excellent opportunities for students to develop leadership and communication skills (Lundry et al., 2015). Interestingly the teachers in this study felt communication was important yet, did not have the knowledge or ability to teach communication skills. Teacher communication skills are viewed as necessary for improving student learning (O'Hair & Wright, 1990). Teaching is all about communication and school-based agriculture teachers must possess the confidence to communicate with various groups and through various channels. Pre-service teacher preparation programs must include the ability to measure effective communication in addition to delivering appropriate content. Further, specific training and educational programs that develop teacher communication competence would be beneficial.

The ability to use technology efficiently through research, evaluation and communication was also found to be important. Educators must stay up to date with and be relevant to the culture of their students (Girlando, 2013) thus increasing the need for technology literacy. Further, agricultural education teachers need to adapt to an ever-changing educational environment and must possess the skills necessary to integrate technology into their classrooms (Williams et al. 2015). Since technology plays such an essential role in students' lives, the 21st century teacher must be flexible and adaptable in order to integrate and utilize technology quickly. Current studies in agricultural education have included smartphone use (Smith et al., 2018), Virtual Reality (Wells & Miller, 2020), and emerging technologies such as Second Life™, social networks and Twitter™ (Murphrey et al.). While the use of technology to improve education and the teaching and learning process has been studied from multiple perspectives in agricultural education (Murphrey et al.,

2012) focused professional development in emerging educational technologies is of particular importance to support student learning.

### Recommendations for Further Research

Despite the average school-based agricultural education teacher possessing the knowledge and ability, professional development is needed to further strengthen their capacity to teach 21st century skills. Twenty-first skills should be integrated into the agricultural education program and provide opportunities for students to apply them before they ever graduate from high school. This begins with providing teachers with the appropriate tools to be able to incorporate these skills into the classroom. While teaching students these skills in high school sets them up for success in college, their career, and when entering the workforce, it is the teacher who is the key. Researchers could use this preliminary data to further investigate the professional development needs of agriculture teachers in developing the necessary competence to teach critical thinking, communication, and technology literacy.

McCarthy (2015), stated being intentional with the implementation and teaching of 21st century skills is the key to learner growth. Being intentional with professional development is the only way teachers and students can consciously develop 21st century skills. While 21st century skills should not take center stage in the classroom, they should act as springboard which allows students to dive deeper into the content. Educators have the responsibility of teaching students to master academic content, but also to acquire, recognize, and use the 21st century skills which are necessary for success in a growing global economy (Girlando, 2013).

According to Kivunja (2015), teacher educators should consider providing pre-service teachers with the opportunity to learn 21st century skills and in-service teachers should focus on ways they can explicitly integrate these skills into their classrooms. Through proper and applicable professional development, teachers will gain skills needed to implement 21st century skills into the agriculture classroom more explicitly, which in turn will allow them to better educate their students. These findings are consistent with previous research (Robinson & Garton, 2008; Billing, 2003; Schmidt, 1999;) that have found problem solving, communicating, collaboration, and critical thinking to be important skills students must possess to be considered employable.

Additional research should be conducted to determine if school-based agricultural education teachers explicitly teach these skills and if so, how they are being taught. A study identifying school-based agriculture teachers or pre-service teacher communication competence may provide a starting point for instructional planning. Further research should be conducted to dive deeper into each of the 21st century learning skills. Thiel & Marx (2019) launched an initial exploratory study focused on students, perhaps an instrument should be developed to measure teacher self-efficacy.

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