



The Importance of
Agricultural Mechanics
Skills Training:

Implications for Post-
Secondary Education

Introduction

- Prepare students to enter demanding and needed occupations or post-secondary programs (Chumbly, Haynes, & Stofer, 2015).
- Agricultural education improves science and mathematics skills (Whent & Leising, 1988; Stripling & Roberts, 2014; Parr, Edwards, & Leising, 2006).
- No significant reduction in technical skills (Parr & Edwards, 2008).

Introduction

- Agricultural mechanics is a popular content area among secondary programs and their students (Hubert & Leising, 2000).
- A large amount of time is dedicated to agricultural mechanics instruction.
 - Two courses per semester (Hoerner and Bekkum, 1990).
 - 7.48 hours per week (Byrd, Anderson, & Saucier, 2016).

Introduction

- Agricultural mechanics solves realistic problems (Parr & Edwards, 2004).
 - Technical knowledge and academic knowledge are required (Wells, Matthews, Caudle, Lunceford, Clement & Anderson, 2015).
- It is important that skills learned are relevant (Davis & Jayaratne, 2015).
 - Liard (1994) identified 60 skills and Shultz, Anderson, Shultz, and Paulsen (2014) identified 54
- Two decade span includes many technological advancements
 - GPS, CNC plasma cutting, renewable energy

Introduction

- Tools available are inadequate (McCubbins, Anderson, Paulsen, & Stremsterfer, 2015).
- 90% of Iowa agricultural education programs have only one teacher (Wells, Perry, Anderson, Shultz, & Paulsen, 2013).
- To better prepare schools for what they should be teaching, it may also be helpful to look into what skills will be important to teach in the future.

Theoretical Framework

- Attitude theory (Fishbein & Ajzen, 1975)
- Intentions toward an action tend to foretell the behavior (Ajzen & Fishbein, 2005).
- Three influences can result in a person engaging in a specific behavior.

Theoretical Framework

1. Positive or negative consequences of the behavior.
2. Approval or disapproval of the behavior by respected individuals or groups.
3. Factors that may facilitate or impede performance of the behavior.

(Ajzen & Fishbein, 2005)

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Theoretical Framework

1. Positive or negative consequences of the behavior.
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 - Administrators, industry leaders, post-secondary experts, community.
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Theoretical Framework

1. Positive or negative consequences of the behavior.

-Impact on their students.

2. Approval or disapproval of the behavior by respected individuals or groups.

-Administrators, industry leaders, post-secondary experts, community.

3. Factors that may facilitate or impede performance of the behavior.

-laboratory size, adequacy of equipment, teachers' subject knowledge, or lack of support from the administration, community or industry (Buabeng-Andoh, 2012).

(Ajzen & Fishbein, 2005)

Methods

- Population:
 - 202 Iowa secondary agricultural education teachers
- Modified from Liard (1994) and Shultz et al. (2014)
 - Cronbach's alpha reliability coefficient of 0.97

Methods

- Eight constructs
 - Carpentry and Woodworking
 - Metal Processes and Metalworking
 - Electrical Power
 - Farm Structures
 - Farm Power and Machinery
 - Natural Resource Management
 - Shop Safety
 - Computer and Problem Solving

Methods

- Nine-point summated rating scale allowing two responses.
 - Depth taught (1 = no depth ... 9 = utmost depth)
 - Rating of perceived importance in ten years (1 = not important ... 9 = very important)
- Personal and demographic information was collected.

Methods

- Reviewed by eight experts to determine face validity.
 - 102 skills
- Pilot tested using 10 agricultural education teachers from an adjoining state.
 - High reliability ($\alpha = 0.95$) (Ary, Jacobs, Razavieh, & Sorensen, 2006).
- Data collection steps outlined by Dillman (2009) was used for this study.

Methods

- 64 completed surveys for a 31.7% response rate.
- Compared respondents' personal and program demographic data to data from the Iowa Department of Education (2015) (Miller & Smith, 1983)

This Study	Iowa Department of Education
Male (55%)	Male (63%)
39.75 years of age	39 years of age
Bachelor's degree (57%)	Bachelor's degree (58%)

- Minimal differences between the participants and the population.

Purpose and Objectives

- Describe the perceived level of importance in regards to specified agricultural mechanics skills.
 - 1. Identify the demographic characteristics of the secondary agricultural education programs and teachers in Iowa.
 - 2. Determine the current depth agricultural mechanics skills are taught by Iowa secondary agricultural education teachers.
 - 3. Determine Iowa secondary agricultural education teachers' perceived importance to teach agricultural mechanics skills in ten years.

Results

- Demographics

- Male (55%)
- 39.75 years of age
- Bachelor's Degree (57%)
- Taught fewer than 10 years (54%)
- Enrollment between 101 and 250 students (41%)
- Agricultural education program enrollment between 51 and 100 students (51%)

Results

Grand Mean Scores for Each Construct

Instructional Topic	<u>Current</u>		<u>Future</u>		ΔM
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Shop Safety	4.99	1.74	6.89	1.26	1.90
Carpentry and Woodworking	4.08	1.85	5.71	1.73	1.63
Computer and Problem Solving	3.70	1.35	5.89	1.43	2.19
Electrical Power	3.63	2.25	6.29	1.95	2.66
Metal Processes and Metalworking	3.40	1.62	5.56	1.76	2.16
Farm Structures	2.93	1.71	5.69	1.82	2.76
Farm Power and Machinery	2.84	1.70	5.63	1.87	2.79
Natural Resource Management	2.89	1.67	5.68	1.80	2.79

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Carpentry and Woodworking Skills at the Secondary Level

Instructional Topic	<i>n</i>	Current		<i>n</i>	Future		ΔM
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	
Power Tools	63	5.22	2.64	60	6.67	2.14	1.45
Concrete	63	2.95	2.18	60	5.12	2.27	2.17
Painting and Preserving	61	2.10	1.01	59	3.19	1.11	1.09

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Metal Processes and Metalworking Skills at the Secondary Level

Instructional Topic	Current			Future			ΔM
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
Welding Safety	63	6.06	3.13	61	7.72	2.06	1.66
Mechanical Safety	63	5.73	3.10	61	7.44	2.14	1.71
Plasma Cutting (CNC)	62	2.74	2.70	60	6.68	2.19	3.94
Oxy-propylene Cutting	60	1.60	1.38	58	4.00	2.37	2.40

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Electrical Power Skills at the Secondary Level (N = 63)

Instructional Topic	n	Current		n	Future		ΔM
		M	SD		M	SD	
Electrical Safety	63	4.70	3.14	61	7.38	2.03	2.68
Electric Motors	63	2.73	2.05	61	5.66	2.30	2.93
Electric Controls and Automation Devices	62	2.45	1.91	60	5.78	2.34	3.33

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Farm Structure Skills at the Secondary Level (N = 63)

Instructional Topic	n	Current		n	Future		ΔM
		M	SD		M	SD	
Energy Conservation	62	3.61	2.34	60	6.38	2.02	2.77
Roofing	62	2.56	2.10	60	5.63	2.19	3.07
Fencing	62	2.50	1.98	59	4.93	2.47	2.43
Plumbing	61	2.48	1.87	60	5.55	2.17	3.07

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Farm Power and Machinery Skills at the Secondary Level (N = 63)

Instructional Topic	Current			Future			ΔM
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
Small Engine Safety	61	4.31	3.10	60	6.60	2.32	2.29
Tractor Safety	61	3.39	2.78	59	6.76	2.25	3.37
Tractor Selection	60	2.07	1.78	58	4.95	2.43	2.88
Transmissions	61	1.56	1.30	59	5.17	2.37	3.61

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Natural Resource Management Skills at the Secondary Level (N = 63)

Instructional Topic	Current			Future			ΔM
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
Legal Land Descriptions	60	3.90	2.51	59	6.03	2.02	2.13
Global Positioning Systems	61	3.62	2.35	59	6.76	1.78	3.14
Alternative Energy- Hydro	58	2.95	2.38	58	6.14	2.04	3.19
Profile Leveling	60	2.17	2.00	58	4.62	2.41	2.45
Pumps	58	1.83	1.37	58	4.66	2.28	2.83

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)
 Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Shop Safety Skills at the Secondary Level (N = 63)

Instructional Topic	Current			Future			ΔM
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	
Safety Clothing and Protective Devices	62	6.63	2.34	60	7.90	1.61	1.27
CPR and First Aid	62	4.21	2.44	60	7.48	1.96	3.27
Shop Layout	61	2.11	0.97	58	3.29	1.11	1.18

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Results

Secondary Agricultural Education Teachers' Current and Future Perceptions on the Importance of Teaching Problem Solving Skills at the Secondary Level (N = 63)

Instructional Topic	<i>n</i>	Current		<i>n</i>	Future		ΔM
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	
Problem Solving Strategies	61	5.33	2.34	59	7.36	1.89	2.03
Careers	62	3.53	1.00	59	4.32	0.80	0.79
Robotics	60	2.12	1.91	58	5.91	2.47	3.79

Current (1 = no depth, 3 = little depth, 5 = some depth, 7 = much depth, 9 = utmost depth)

Future (1 = not important, 3 = of little importance, 5 = somewhat important, 7 = important, 9 = very important)

Conclusions, Recommendations, Implications

- Skills are not taught in the depth teachers perceive the importance will be in ten years.
 - Small program sizes (51-100 students)
 - One teacher (Byrd et al., 2016)
 - Two agricultural mechanics courses per semester (Hoerner and Bekkum, 1990)
- Not enough time to teach 102 skills in great depth.

Conclusions, Recommendations, Implications

- Important skills related to safety.
 - Welding Safety
 - Mechanical Safety
 - Electrical Safety
 - Small Engine Safety
 - Power and Machinery Safety
 - Safety Clothing and Protective Devices
 - Shop and Tool Safety

Conclusions, Recommendations, Implications

- Professional development should focus on safety (Saucier, Vincent, & Anderson, 2014).
- Attitude theory connection
 - There is a focus on safety skills due to the positive impact it will have on the students' wellbeing
 - Decisions based on industry influences which beginning teachers may not have.

Conclusions, Recommendations, Implications

- All 102 skills included in this study were rated as being more important in the future than they are currently being taught.
- Greatest construct increases
 - Electrical Power
 - Farm Structures
 - Farm Power and Machinery
 - Natural Resource Management

Conclusions, Recommendations, Implications

- Greatest increases were seen in skill currently taught in little depth.
- Skills related to emerging technologies saw large increases in mean scores.
 - Robotics, Virtual Reality Welding, Virtual Assisted Welding, CNC Plasma Cutting all had more than a 3.25 change in mean scores.
- Tools and training are inadequate (Burris, Robinson, Terry, 2005; McCubbins et al., 2015).
 - Improper equipment, knowledge, skills, and facilities can impede ability to teach (Buabeng-Andoh, 2012)

Conclusions, Recommendations, Implications

- 25 skills showed a change in mean scores greater than 3.0.
 - Starting point for professional development facilitators.
- Further research
 - Determine industry's perceptions of importance.
- Continue to reevaluate curricula, focusing on important skills.

Questions
