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Introductory animal science-based instruction influences attitudes on animal agriculture issues

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**ABSTRACT:** The demographics of incoming university animal science majors have shifted from students with a farm background to urban students with no history of direct livestock contact. Research completed before the Internet was a central source of information indicated that incoming urban students tend to express no opinion or a neutral opinion regarding livestock agriculture issues. Due to the changing background of incoming students enrolled in introductory university-level animal science classes, we sought to determine: 1) if livestock background (self-identified as raised in a farm or urban setting), sex, or animal science career interest influenced the opinions of incoming students regarding critical issues involving livestock farming practices, and 2) if 15 weeks of introductory animal science instruction changed student opinions. A total of 224 students were given 2 identical anonymous surveys (start and end of 15 weeks) with 5 demographic questions and 9 animal issue statements. For each statement, students marked their opinion by placing a vertical line on a continuous 130mm horizontal line, where a vertical line placed at 0mm= strongly agree and 130mm= strongly disagree. Data were analyzed by ANOVA to determine any significant effects of instruction, background, sex, and future career preference on survey responses. Prior to instruction, urban students were less agreeable than farm students that animal farming was moral and humane and that farmers are concerned about animal welfare and livestock are of value to society \((P \leq 0.05)\). Urban students were more likely than farm students to purchase organic foods or food based on environmental/welfare standards \((P \leq 0.05)\). Introductory animal science instruction resulted in students becoming more agreeable that animal farming was humane, farmers are concerned about animal welfare, and animal agriculture is a value to society \((P \leq 0.05)\). Post-instruction, students were more likely to buy food products based on price \((P \leq 0.05)\). Males found farm practices more humane than females \((P \leq 0.05)\), but sex differences were not evident for other questions. Future professional career plans did not
affect student opinions. Data showed that incoming urban students tend to be more neutral with regards to animal farming issues, and introductory animal science instruction fosters a more agreeable attitude towards animal farming practices, especially in students with urban backgrounds.

Key words: animal agriculture, career goals, instruction, opinion, gender, university student
INTRODUCTION

In the past 10 years, the demographics of incoming university animal science majors at the University of Wisconsin-Madison (UW-Madison) have shifted from a rural student population to an urban student population with no history of direct farm animal contact. In 2005, the percentage of students enrolled in an introductory animal science class who were not majoring in the animal sciences was 11% (total student n=102). This grew to 23% in 2009 (total n=106), and 44% in 2011 (total n=115). National statistics report that less than 1% of U.S. households are involved in any aspect of agricultural animal production, yet 75% of U.S. citizens surveyed in a nationwide telephone interview would vote to enact stronger welfare laws (Prickett et al., 2010). Surveys of incoming university freshmen regarding their opinion of critical animal welfare issues show that urban students were more likely than rural students to take neutral positions (Walter and Reisner, 1994). Both urban and rural students, regardless of agricultural experience, held a more positive view of agriculture and increased knowledge of husbandry practices after completion of a 2-week animal agriculture course (Nordstrom et al., 2000; Walter and Reisner, 1994).

In the decade since the Nordstrom et al. (2000) study, the Internet and social media have increasingly become a source of information (both correct and incorrect) for the development of opinions on issues including animal welfare and the use of animals in agriculture (Pew Research Center, 2013). Due to the rapidly changing background of incoming students enrolled in Animal Science/Dairy Science 101 (AS/DS 101) at UW-Madison, we sought to determine: 1) if livestock animal background, sex, or interest in an animal-related future career influenced the opinions of incoming students on critical animal farming issues; and 2) if 15 weeks of instruction involving basic principals and issues involving animal farming could change student opinions.
MATERIALS AND METHODS

Survey and instruction components

Experimental data collection methods and anonymous surveys were approved through the UW-Madison Education Research Institutional Review Board (IRB). Animal Science/Dairy Science Livestock Production 101 (AS/DS 101, 4 credits, one 15 week semester) is a core class and requirement for all students majoring in Animal and Dairy Sciences and meets the science requirement for any major on campus. Two separate classes of incoming AS/DS 101 students (n=114 in 2010, and 118 enrolled in 2011, respectively, Table 1A) were administered identical surveys at the beginning and end of the semester (instructional period) with 5 questions regarding demographics (used for group separation for final statistical analysis, Table 1B) and 9 statements related to animal use issues (Table 2 contains complete list of issue statements). All students attending class on the first day of AS/DS 101 received a handout that included a consent form and a survey. Students who were 18 years of age or older were given the opportunity to complete the survey (17 and under were excluded as per UW-Madison Education Research IRB). All students had the right to refuse to take the survey.

Demographic questions included sex, year in school, future career goals (either animal science related or not, hereafter labeled “career), animal experience (A) I grew up on a farm, B) I did not grow up on a farm but I have farm animal experience (i.e. extended family has a farm, own a horse and board it, work as a large animal vet assistant, etc.), C) I grew up in the city with little/no farm contact. Instruction comprised of three 50-minute class periods per week for 15 weeks, plus one 3-hour hands-on laboratory per week. Curriculum during the instructional period was broken down into 4 categories as follows: 1) Social issues, which included domestication, ethics/welfare, humane slaughter, biotechnology, organic/conventional farming,
animals/environment, and companion animals; 2) Biology, which included nutrition/growth, physiology/adaptation, genetics/breeding, reproduction, muscle biology/meats, disease/safety, and lactation; 3) Agribusiness, which included low input/high input agriculture, international agriculture, market futures, animal byproducts, careers, breeding technology, and meat/milk marketing; and 4) Animal handling, which included understanding behavior and direct handling of swine, dairy, beef, poultry, sheep, and equine species. Anonymously marked surveys (no identifiers were associated with the survey) were distributed to 2 separate semesters of students (Fall 2010 and Fall 2011) and answers were pooled for data analysis.

When responding to the opinion-based statements, students were asked to place a vertical line on a 130mm continuum from agree to disagree (left to right) that indicated their personal agreeability or disagreeability (opinion) of the statement. The responses of each student were then quantified by measuring the distance (in millimeters) of their vertical line from the left side of the continuum, where agree=0mm and disagree=130mm. A continuous line was utilized as a response format (as opposed to discrete categories) because the statements were declarative in nature, and previous work has found that a continuous scale increases statistical sensitivity in the response (DeVellis, 2003). After the survey was marked by the students, final responses in millimeters were then converted to percent agreeability from 0-100%, where, in accordance with the original data collection method, 0= disagree and 100%= agree. The following equation was used to produce final % agreeability numbers: 100 – (100 * (mm response/130 mm). Relative agreeability or disagreeability with each statement was determined by dividing final responses from 0-100% agreeability into 5 regions, where 0-20%= strongly disagree, 21-40%= disagree, 41-60%= neutral, 61-80%= agree, and 81-100%= strongly agree. Assigning 5 regions of agreeability through division of the continuum was only for ease of discussing the findings and
comparison to other existing student survey literature, and students were not made aware of these regions when surveys were distributed.

**Statistics**

Pooled survey results quantified as millimeters measured from 0 to 130 (left to right) were converted to percent (%) agreeability as discussed above and analyzed as three 2 x 2 factorial arrangement of treatments (Proc Mixed; SAS Inst. Inc., Cary, NC): instruction versus livestock contact background, instruction versus sex, and instruction versus career. Only surveys where students marked strictly farm or urban backgrounds were used because the livestock animal experience of “did not grow up on a farm but have animal experience” was considered highly variable due to the imprecise wording used in the surveys. Proc mixed was utilized for its ability to control for unequal group sizes. Year in school was not used in the final analysis due to small sample size. Data were considered significantly different at $P \leq 0.05$.

**Demographic summary**

Of the 224 students who were enrolled in the class at the beginning of the semester, 86% were declared science majors, 77% were female, and 51% were incoming freshmen (Table 1A). Of those enrolled, 212 students attended class and actually took part in the first survey at the beginning of the semester. Within the 212 students who completed the first survey, 45% (95 students) classified themselves as “did not grow up on a farm but have animal experience”, and this subset was removed from analysis due to the highly variable experience and/or contact with livestock animals. Hence, the remaining subset of 117 of the total 212 students (55%) that returned the first survey classifying themselves as being strictly urban or strictly farm
background was used for the final data analysis of both pre- and post-instruction surveys (Table 1B). The demographics of this strictly urban or farm subset resembled the larger population when based on sex and future career interest. Strict urban students made up 33% of the total group of all students who took the first survey and 60% of the subset of students used in the final analyzed subset. Strict farm students made up 22% of the all students taking the first survey and 40% of the students used in the final analyzed subset. Of the final analyzed subset, 73% were female and 79% expressed interest in a career related to animal science.

RESULTS

Influence of instruction and background

Before instruction, urban students were less agreeable that animal farming was moral (79.8 ± 1.80%), concerned about animal welfare (57.7 ± 2.15%), humane (57.4 ± 1.92%), and of value to society (85.8 ± 1.31%) than students with farm backgrounds (92.9 ± 1.80, 75.2 ± 2.15, 76.8 ± 1.92, 95.2 ± 1.31% respectively, \( P \leq 0.05 \), Table 2). Urban students were also less agreeable (69.2 ± 2.23%) about the acceptability of breeding animals for valuable traits than farm students (90.6 ± 2.23%); however, urban students agreed with the statements in general. Farm students were less likely to buy organic animal products (25.2 ± 2.92% agreeability) or purchase food based on environmental or welfare standards (30.8 ± 2.85%) than urban students (54.6 ± 2.92% and 51.7 ± 2.85%, respectively, \( P \leq 0.05 \)). Farm students disagreed with these two statements while urban students were neutral on the statements. Farm and urban students had similar opinions on farm size (neutral) and the purchase of food based on price (agreed).

After instruction, farm and urban students were more agreeable that animal producers are concerned about livestock welfare (89.9 ± 2.15 and 78.9 ± 2.15%, respectively), livestock
farming was humane (87.1 ± 1.92 and 74.8 ± 1.92%), of value to society (96.3 ± 1.31 and 89.4 ± 1.31%) than before instruction (P ≤ 0.05). Farm and urban students were also more agreeable to breeding for valuable traits after instruction (92.9 ± 2.23 and 82.4 ± 2.23%, respectively) than before (90.6 ± 2.23 and 69.2 ± 2.23%, P ≤ 0.05). Regardless of instruction, students’ responses to the statements fell into in the categories of agree to strongly agree. After instruction, farm and urban students were more likely to buy food based on price (72.1 ± 2.69 and 67.4 ± 2.69%), and less likely to state that farms size is too large (37.5 ± 2.85 and 41.5 ± 2.85%) than before instruction (60.2 ± 2.85 and 57.8 ± 2.85%; 49.3 ± 2.85 and 55.2 ± 2.85%, respectively, P ≤ 0.05). The general position on food price moved from neutral to agree, and farm size being too big from neutral towards disagree after instruction. Instruction did not influence opinions with regards to moral acceptability of farming livestock, purchase of organic foods or based on environmental/welfare labeling. In general, students disagreed with purchasing environmental/welfare standard-labeled foods, but strongly agreed that farming livestock was morally acceptable. No significant interactions were found between instruction and background (with the exception of breeding livestock for valuable traits).

Influence of instruction and sex

Both before and after instruction, male students were more agreeable that livestock agriculture practices were humane (male before and after= 71.8 ± 2.31% and 84.9 ± 2.31%, female before and after= 62.5 ± 2.31% and 79.0 ± 2.31%) and that it was acceptable to breed for valuable traits than females (male before and after= 87.3 ± 2.15% and 90.4 ± 2.15%, female before and after= 74.4 ± 2.15% and 85.8 ± 2.15%, P ≤ 0.05); however, both male and female responses fell in the categories of agree to strongly agree. Significant sex differences were not
observed for the other remaining statements. When data were segregated based on sex, instruction showed changes similar to what was seen in the instruction versus background analysis. No interactions between instruction and sex were observed, suggesting that instruction changed opinions in males and females equally.

Influence of instruction and career goals

Students who reported that they plan to pursue a career in the field of animal sciences/livestock agriculture had similar opinions on all the issues as those students who had no plans to work in livestock agriculture (i.e., future career did not affect opinion). When data were segregated based on career goals, instruction showed changes similar to what was seen in the instruction versus background analysis. With the exception of the purchase of livestock products labeled based on environmental or welfare standards, no interaction between instruction and career goals was observed. These results would suggest that instruction changed opinions of animal science careerist and non-careerist in a similar manner. The one exception involved labeling for environmental and welfare standards: the non-careerist became less opposed to buying labeled products after instruction (moved from $28.2 \pm 3.62\%$ to $38.5 \pm 3.62\%$, $P \leq 0.05$) while the careerist became more opposed to purchasing these products after instruction (moved from $47.2 \pm 3.62\%$ to $35.2 \pm 3.62\%$).

DISCUSSION

At the university level, absence of animal issue knowledge in incoming freshmen students with an urban background may be attributed to a lack of “agricultural literacy” in U.S. primary and secondary schools. Other researchers have suggested that this non-familiarity with agriculture during primary and secondary schooling may be due to a lack of urban school
teachers’ familiarity with and use of agricultural examples and material in their own teaching (Balschweid et al., 1998; Trexler and Suvedi, 1998). However, certain subsets of students may have more exposure to agriculture-based topics during school, as secondary school teachers from smaller cities were reported to be more knowledgeable in agriculture-related topics than their counterparts in larger cities (Frick et al., 1995).

Over the past 2 decades of research in the area of student opinions regarding livestock agriculture issues, methods by which information is obtained and disseminated have drastically changed; hence, the novelty of this present work lies within the changing demographics of students enrolled in AS/DS 101 paired with the increased accessibility of information due to the widespread use of the Internet. The daily source of news and information for U.S. citizens has largely shifted towards internet-based news and social media sites. Internet use by adults aged 18-29 averaged 46% in 2000 and increased to 85% in 2009 (Pew Research Center, 2013). In 2000, just 12% of all adults (18+) used the Internet specifically to get news, an incidence that increased to 54% by 2009. The increase in availability of knowledge due to the Internet may be confounded by the quality, scientific-basis, and “shock-factor” of the information, especially when the information is obtained through social networking sites. Studies show evidence that the typical incoming student in a university-level animal science class does not have a working knowledge of or direct experience in general livestock husbandry and holds neutral opinions regarding contemporary livestock agriculture issues (Heleski and Zanella, 2006; Nordstrom et al., 2000; Walter and Reisner, 1994). Importantly, results reported here show that even though information is now more accessible (largely due to the Internet) than in the years 2006 and prior, and livestock agriculture has been receiving negative publicity via Internet news and social media, incoming urban students prior to a semester of university level instruction still remain
more neutral in their opinion of livestock agricultural issues.

Previous work with student opinions of livestock agriculture showed that sex influenced the student’s opinion of livestock welfare. In a veterinary student population, a significant interaction was seen regarding empathy, year of study, and sex (Paul and Podberscek, 2000). These data suggested that female students maintained high levels of empathy throughout 3 surveyed stages of veterinary school (1st year preclinical, 1st year clinical, and final year clinical), while male students reported lower empathy during their later years of veterinary school. In a separate study, after 14 weeks of undergraduate instruction-in the animal sciences, females showed more concern for livestock welfare than males (Heleski and Zanella, 2006). Solid data regarding opinions based on sex are important to note, as trends show that women are increasingly becoming involved in veterinary care and other aspects of livestock agriculture. Current enrollment statistics for public colleges report an approximate 44:56 male to female enrollment ratio (Digest of Education, 2011). In 2012, 78% of all veterinary school seats were held by women (AVMA, 2013). Between 1997 and 2007, the U.S. experienced a 46% increase in the number of farms owned and operated by females, for a total of 14% of all farms (USDA, 2007). In the dataset studied here and following the trends of recent female university enrollment, 73% of respondents were female, hence a female bias to the results does exist.

Our data disagree with previous student survey results and show that for 7 out of 9 statements, sex did not significantly alter responses. Sex had a significant main effect for the following two statements, “Modern animal agricultural practices are humane” and “Breeding animals for valuable traits is acceptable,” but no significant differences were found in other statements. Females were less likely than males to agree modern animal agricultural practices are humane; however, their responses still fell in the “agree” category before and after instruction,
while males were “agree” before instruction and moved up into the “strongly agree” category post-instruction. Regarding breeding for valuable traits, males strongly agreed both pre- and post-instruction, while females moved from agree to strongly agree post-instruction.

Results from incoming student data (pre-instruction survey) suggest that current instruction regarding livestock animal agriculture (consisting of any instruction received from sources including K-12 schooling, media) has not dramatically affected students because incoming urban students hold neutral opinions. Post-instruction surveys show opinions moving away from neutral; hence one could argue that students formed opinions based on the scientific information presented to them during the semester. In contrast, the student with extensive farm background held very strong opinions pre-instruction and these opinions were strengthened by further instruction. As expected, instruction was a predictor of changes in opinion, significantly affecting 6 out of 9 statements in all categories analyzed (background, career, sex). For example, instructing students with urban backgrounds in the animal sciences caused a shift in opinion from neutrality to agreeing with the statements “Modern animal producers are concerned about animal welfare” and with “Modern animal agriculture practices are humane”. After instruction, opinions of farm and urban students tended to move in the same direction, and to the same degree, to become more favorable towards animal agriculture. Instruction for 15 weeks caused males and females and students pursuing both animal-related and animal-unrelated careers to strongly agree or agree on questions involving morality, welfare, humaneness, breeding for valuable traits, purchase of food based upon price, and value of farm animals to society. These groups became neutral or disagreed on questions involving purchase of organic products, purchase based upon environmental and welfare standards, and animal farm size is too large. In all questions except for the statement “Farm animals are valuable to society”, significant interactions were not seen
because both of the sampled groups (i.e. farm versus urban, male versus female, future career yes versus no) changed due to instruction and often changed in parallel in the same direction and in similar distances (i.e. both move further towards agree or disagree). Students were different based on demographics but were equally affected by instruction (main effect).

In 7 of 9 statements, background significantly influenced opinions, as seen in previous work. Students with a farm background tended to strongly agree or agree with questions involving morality of farming, welfare, humaneness, breeding for valuable traits, purchase of food based upon price, and value to society, and disagreed with purchasing organic or welfare-standard labeled animal products, while urban students tended to agree or be neutral before instruction (Backstrom, 2001; Britt et al., 2008; Nordstrom et al., 2000; Nordstrom et al., 1999). When exposed to science-based instruction on animal farming, urban students’ attitudes changed to agree more closely with students with farm backgrounds entering the class, and farm students became more extreme in their views regarding welfare and humaneness (i.e. if they agreed before instruction, they strongly agreed after instruction).

Opinions between students of differing majors were relatively similar; however, students with farm backgrounds or recent instruction in animal sciences were more likely to hold opinions (i.e. they were not neutral) (Walter and Reisner, 1994). These data show that once a student develops knowledge, they are then capable of forming an opinion (main effect of instruction). With the exception of breeding animals for valuable traits, there was no interaction between instruction and background for issues surveyed. This finding suggested that independent of background, students respond in a similar manner to the instructional process used. While farm student’s views on breeding for valuable traits did not change as a result of instruction (strongly
agreed with the value before and after instruction), urban students became significantly more agreeable to the practice after instruction than before ($P \leq 0.05$).

Nationwide trends show that shifting opinions and consumer demand have led to changes in animal production. In 2000, organic animal agriculture, including cows, pigs, sheep, and poultry, totaled 56,028 animals and increased 8.5-fold to 475,829 total animals in 2008 (USDA, 2010), hence one could argue that students currently enrolled in university have had more experience with organic products than students 10 years ago and may hold stronger opinions. In 2010, Prickett et al conducted a survey and found 64% of the general U.S. population agrees with the statement "farmers and food companies put their own profits ahead of treating farm animals humanely," yet 68% of respondents indicated that low meat and food prices are important, indicating a disconnect between perception and actual food purchasing habits (Prickett et al., 2010). Instruction had no effect on the response to the two statements involving purchasing organic animal products and purchasing based on environmental and welfare standards. In these statements, background was the only significant predictor of purchasing habits, with urban students remaining neutral in their likelihood to purchase organic and based on welfare standards while farm students remained in the disagree category.

No differences were found when data were analyzed according to future career preference for any issue (animal agriculture versus non-animal agriculture-related), showing that students motivated to work an agriculture-related career hold opinions no different than any other career field, except for the statement regarding purchase animal food products based on environmental and welfare standards, where a significant interaction occurred. While opinions were significantly different before instruction regarding purchase of animal food products based on environmental and welfare standards ($P \leq 0.05$), careerist and non-careerist opinions were not
significantly different post-instruction, as the non-careerist numerically moved from disagree towards neutral (while still remaining in the disagree category) while the careerist moved from neutral to disagree. We are uncertain why this occurred; however, it could be possible that the students had a better understanding of the definition of environmental and welfare labeling post-instruction and hence became more neutral. Opinions were significantly different before instruction, but were similar post-instruction. In contrast, previous survey research in an enrolled veterinary student population, students aspiring to work with food animals considered more procedures to be humane for all species versus students who planned to work with small animals (Levine et al., 2005). Data reported here suggest sex and career do not cause a divergent opinion, and that instruction has more of an effect in altering opinion than sex or future career.

In previous studies, authors have used a 1-5 Likert scale as a response scale, where whole numbers 1-5 or phrases are selected based on 1= disagree strongly, 2= disagree, 3= neutral, 4= agree, and 5= agree strongly, or categorical yes/no response criteria (Heleski and Zanella, 2006; Nordstrom et al., 1999; Prickett et al., 2010; Walter and Reisner, 1994). Previous work has shown that a continuous scale could afford an analytical advantage over a discrete scale (block vs. sliding scales) (DeVellis, 2003); however, while statistically analyzing the scale used to collect data was not the purpose of this work, results presented here agree with previous student survey work which utilized categorical response formats and suggest, in this case, that the continuous scale afforded no advantage over discrete response scales.

Animal science departments must evolve to cope with society’s changing views of livestock animals, because the majority of U.S. citizens have only experienced animals as companions (Britt et al., 2008). Data clearly show that instruction in animal agriculture and urban versus farm background influence opinion of animal agriculture issues; however, as was
seen in previous research prior to the widespread use of the Internet, current urban students are still entering the university setting with neutral views of animal agriculture. Importantly, within the limits of the questions that were asked, the views of animal science students before instruction towards animal agriculture may not be as negative as one might presume.

Overall, incoming urban students in 2010 and 2011 still held neutral views of animal agriculture, just as students did in 2006 and prior. Both farm and urban backgrounds were influenced to the same degree by instruction, and the questions here show positive attitudes towards the current state of agriculture, including production, welfare, humaneness, and animal food purchasing habits. Sex (male vs. female) did not result in significant differences in response. In a society where very little of the population is directly involved with the production of livestock animals, yet most are consumers of animal products, introductory instruction in the animal sciences gives urban students the ability to form an opinion based upon science in subjects where they previously held neutral opinions, and these opinions tended to resemble those of incoming students with farm backgrounds.

A criticism in the current work is the non-analysis of students’ opinions by class year (freshman, sophomore, junior, senior) and also a non-representative and unequal distribution of all majors on campus. Data were not analyzed by year due to the majority of respondents falling in the “freshmen” and “female” categories (54% of final respondents were freshmen and 74% were female); hence further restricting these groups would have made unequal group sizes where in some cases, analysis would be based on responses from less than 10 students (Table 1A). To complete a survey experiment that would reflect the breadth of diversity in a university setting such as UW-Madison, students would have to be incentivized to take the class. In this course, 14% of the students were from outside of agriculture and sciences, and 19% were in non-
agriculture science fields, hence approximately one third of the students represented the larger university community. In addition, 60% of students taking the survey had an urban background and no animal experience. While it is true that students taking this class may have had interest in animal science (and hence a potential bias), the survey results represent a cross-section of university students, at least university students interested in animals, who are not identical in their demographics and are somewhat representative of several majors on campus.

In the demographics section of the survey, the Educational Research IRB rules and review process assured no questions could be asked that would directly lead to the ability to identify a student (i.e. major) and reduce the confidential nature of the survey, hence, Table 1A contains a general description for the entire population prior to the final subset selection for analysis, whereas Table 1B contains only the final subset of surveyed students but no additional specific demographic data. Had it been possible to obtain the majors of the students that were selected for final analysis, an analysis to identify any additional biases in the final study population would have been completed.

A second criticism of the dataset is the exclusion of 45% of respondents. The farm background wording of “I did not grow up on a farm but I have farm animal experience (i.e. extended family has a farm, own a horse and board it, work as a large animal vet assistant, etc.)” contained a continuum of students from extensive farm experience to experiences with only companion animals. The exclusion of this varied category resulted in two discrete categories for analysis. Future survey work should include more defined questions to determine a student’s experience with livestock agriculture and the subsequent categorization of their livestock contact background. For example, a students’ experience with livestock agriculture could be based on hours of contact per week in addition to several general questions that more precisely determine
the nature of their livestock animal contact. Furthermore, future surveys should include definitions of livestock animal species and a list of what is considered as “livestock animal contact/experience” to avoid confusion when answering demographic questions.

This study examined the effects of science-based instruction on attitudes of students enrolled in a science-based animal agriculture class. The course was directed towards students in specific majors because it’s a requirement for animal and dairy science students, and presumably those students outside these two majors with an interest in learning more about animal science. Additionally, 79% of the final analyzed subset expressed an interest in a future career related to animal science. Therefore, incoming students, regardless of animal contact background, may enter the class with a bias because they chose to take a course related to livestock animal production. Although every attempt was made to present both sides of current practices in animal agriculture, including debate days with viewpoints from both animal welfare/rights and current livestock production standpoints, as well as scientific papers in support of and against current livestock management practices, the instruction itself may present a second bias, because the purpose of the class was to use scientific and peer-reviewed information to teach students about the current standards in livestock production. Because students in this study took both lecture and lab sections in the course, the findings in this study may not reflect students that take only a lecture or an on-line course, where hands-on experiences are not provided. A study investigating the value of the lab section of an introductory animal science could prove insightful to improve future curriculum (focus curriculum where most “learning” happens). Another interesting addition to the current study would be to quantify the amount, exposure, and effect of anti-agriculture information on the Internet (including but not limited to “viral” anti-agriculture videos) that students receive prior to entering the University setting, and determining if the rate is
constant or increasing over time. While we do not know the current frequency of anti-agriculture publicity on the Internet, this type of information could prove useful when used as a teachable moment (for example, pointing out incorrect information in agriculture-related food commercials that have become popular). Using Internet examples along with monitoring the changing demographics and incoming opinions of animal science students may help departments tailor their curriculum to current students and information trends.

The results of this study support earlier findings that students from urban background hold opinions about animal farming practices that are neutral, but different from students with livestock animal experience. Instruction moved the urban student opinion closer to that of the farm student, and to a large degree, sex and career goals had little impact on how students responded. Even though student demographics continue to shift to urban upbringing paired with greater access to information through electronic media and Internet, the students’ opinions of animal agriculture continue to remain neutral and largely shift to favorable opinions post-instruction, within the framework of this study.

ACKNOWLEDGEMENTS

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### TABLES AND FIGURES

**Table 1A.** Student enrollment data obtained from the Registrar’s Office regarding the demographics of students enrolled in AS/DS 101. Data comprises all enrolled students from both survey years (2010 and 2011) and is divided by sex, major, and year in school. Number in each group equals number of students. Data from both years were used in the analysis to determine the effects of instruction on student opinions on issues involving animal use.

<table>
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<tr>
<th>Major</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>Total</th>
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<td>1</td>
<td>1</td>
<td>22</td>
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<tr>
<td>Animal Scientist Female(^1)</td>
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<td>17</td>
<td>2</td>
<td>110</td>
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<tr>
<td>Agriculture Scientist Male(^2)</td>
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<td>2</td>
<td>4</td>
<td>0</td>
<td>9</td>
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<tr>
<td>Agriculture Scientist Female(^2)</td>
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<td>2</td>
<td>2</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>General Scientist Male(^3)</td>
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<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>General Scientist Female(^3)</td>
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<td>9</td>
<td>11</td>
<td>8</td>
<td>36</td>
</tr>
<tr>
<td>Other Male(^4)</td>
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<td>5</td>
<td>2</td>
<td>14</td>
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<tr>
<td>Other Female(^4)</td>
<td>9</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>115</td>
<td>48</td>
<td>45</td>
<td>16</td>
<td>224</td>
</tr>
</tbody>
</table>

\(^1\)Animal Scientist category includes animal and dairy science majors

\(^2\)Agriculture Scientist includes Agriculture Business Management, Agronomy, Applied Agriculture Economics, Horticulture, and Life Science Communications majors

\(^3\)General Scientist includes Biology, Biological Systems Engineering, Zoology, Genetics, Biochemistry, Immunology, Molecular Biology, Nutritional Science, and Wildlife Ecology majors
Other includes Economics, History, Mathematics, Philosophy, Spanish, Afro-American Studies, Consumer Affairs, Art, English, Journalism, Religious Studies, Social Welfare, and Undeclared majors (defined as students who have yet to officially declare a major with their respective school).
### Table 1B.

Demographics of the analyzed subset of students from Table 1A who attended class and took the surveys at the beginning and end of the semester. The analyzed subset contained only students who answered that they had a strictly farm background (survey 1, n=47; survey 2, n=42) or strictly urban background with no livestock animal contact (survey 1, n=70; survey 2, n=52). Students were excluded (45%) if they indicated urban with farm animal/horse/veterinary contact due to highly varied experiences. Compiled data was from year 2010 and 2011 and consisted of 117 surveys before instruction (survey 1) and 94 surveys after instruction (survey 2).

<table>
<thead>
<tr>
<th>Survey 1</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Male$^1$</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Farm Female$^1$</td>
<td>21</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td>Urban Male$^2$</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Urban Female$^2$</td>
<td>28</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>52</td>
</tr>
<tr>
<td>Career Yes Male$^3$</td>
<td>11</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>Career Yes Female$^3$</td>
<td>47</td>
<td>10</td>
<td>15</td>
<td>4</td>
<td>76</td>
</tr>
<tr>
<td>Career No Male$^3$</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Career No Female$^3$</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey 2</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Male$^1$</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Farm Female$^1$</td>
<td>21</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>Urban Male$^2$</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Urban Female$^2$</td>
<td>23</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>----</td>
</tr>
<tr>
<td>Career Yes Male$^3$</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Career Yes Female$^3$</td>
<td>42</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>63</td>
</tr>
<tr>
<td>Career No Male$^3$</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Career No Female$^3$</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>

$^1$Farm male and female refer to students who indicated they grew up on a farm.

$^2$Urban male and female refer to students who indicated they grew up in a city with no farm animal contact.

$^3$Career Yes and Career No refer to the students’ future careers, where ‘Yes’ denotes an anticipated future career in or related to Agriculture and ‘No’ denotes anticipated future career not in or related to Agriculture.
Table 2. Responses to survey statements analyzed by three demographics categories; grew up in farm or urban setting, sex, and intended future career. Before and after refers to instruction, where “before” results correspond to surveys given at the beginning of the semester and “after” results correspond to identical but new surveys administered at the completion of the semester. “Career Yes” indicates future career involving animal science, whereas “Career No” indicates career will not involve animal science. Numbers shown are mean agreeability for each statement from 0% to 100% agreeability (0%= disagree, 100%= agree) with pooled SEM and main effects/interaction P-values shown for each question.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agreeability (0-100%)</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Category</td>
<td>Before</td>
</tr>
<tr>
<td>1. It’s morally acceptable to farm animals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farm</td>
<td>92.9</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>79.8</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>83.4</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>89.5</td>
</tr>
<tr>
<td></td>
<td>Career Yes</td>
<td>83.6</td>
</tr>
<tr>
<td></td>
<td>Career No</td>
<td>90.5</td>
</tr>
<tr>
<td>2. Modern animal producers are concerned about animal welfare.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farm</td>
<td>75.2</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>57.7</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>63.1</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>68.5</td>
</tr>
<tr>
<td></td>
<td>Career Yes</td>
<td>64.7</td>
</tr>
<tr>
<td></td>
<td>Career No</td>
<td>63.5</td>
</tr>
<tr>
<td>3. Modern animal agriculture practices are humane.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farm</td>
<td>76.8</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>57.4</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>71.8</td>
</tr>
<tr>
<td></td>
<td>Career Yes</td>
<td>63.8</td>
</tr>
<tr>
<td></td>
<td>Career No</td>
<td>69.2</td>
</tr>
<tr>
<td>4. Breeding animals for valuable traits is acceptable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farm</td>
<td>90.6</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>69.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>74.4</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>87.3</td>
</tr>
<tr>
<td></td>
<td>Career Yes</td>
<td>76.9</td>
</tr>
<tr>
<td></td>
<td>Career No</td>
<td>81.0</td>
</tr>
<tr>
<td>5. When possible, I purchase organic animal products.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farm</td>
<td>25.2</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>54.6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>44.4</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>38.4</td>
</tr>
<tr>
<td></td>
<td>Career Yes</td>
<td>43.6</td>
</tr>
<tr>
<td></td>
<td>Career No</td>
<td>39.6</td>
</tr>
<tr>
<td></td>
<td>Farm</td>
<td>60.2</td>
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<tr>
<td></td>
<td>Urban</td>
<td>57.8</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>57.8</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td>Career Yes</td>
<td>58.4</td>
</tr>
<tr>
<td></td>
<td>Career No</td>
<td>61.8</td>
</tr>
<tr>
<td>6. I purchase animal food products based upon price.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farm</td>
<td>30.8</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>51.7</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>46.9</td>
</tr>
<tr>
<td>7. I purchase animal food products based upon environmental and welfare</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8. Animal farm size has grown too large.

9. Farm animals are valuable to society.

<table>
<thead>
<tr>
<th></th>
<th>8. Animal farm size has grown too large.</th>
<th>9. Farm animals are valuable to society.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male 33.0 34.6 0.34 0.11 0.20</td>
<td>Male 95.2 96.3 1.31 0.05 0.15</td>
</tr>
<tr>
<td></td>
<td>Career Yes 47.2 35.2 3.62 Instruction Career Interaction</td>
<td>Urban 85.8 89.4 0.05 0.05 0.15</td>
</tr>
<tr>
<td></td>
<td>Career No 28.2 28.5 0.87 0.14 &lt;0.05</td>
<td>Female 89.4 93.2 1.46 Instruction Sex Interaction</td>
</tr>
<tr>
<td></td>
<td>Farm 49.3 37.5 2.85 Instruction Background Interaction</td>
<td>Male 87.4 93.5 &lt;0.05 0.71 0.58</td>
</tr>
<tr>
<td></td>
<td>Urban 55.2 41.5 &lt;0.05 0.2 0.86</td>
<td>Career Yes 89.1 93.2 1.69 Instruction Career Interaction</td>
</tr>
<tr>
<td></td>
<td>Female 52.8 40.2 3.23 Instruction Sex Interaction</td>
<td>Career No 87.9 93.4 &lt;0.05 0.84 0.78</td>
</tr>
</tbody>
</table>
|               | Male 51.9 39.5 <0.05 0.86 0.99           | aIndicates survey responses before and after instruction.
REFERENCES


