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# Postsecondary Students' Perceptions of Water Issues and Water-Related Educational Interests

**Abstract**

We conducted a nonexperimental, descriptive study to better understand Oklahoma State University students' perceptions of water issues and relevant learning preferences using a 56-item survey instrument we based on the 2008 Water Issues in Oklahoma survey. In total, 103 agriculture students participated in our survey. Clean drinking water was their top concern, but few understood potential risks to water supplies. Additionally, participants expressed only modest interest in learning more about water issues. They indicated that they preferred learning via digital media and traditional fact sheets and expressed little interest in learning via apps, in-person events, and newspaper articles. Our results have implications for delivering water education programs to younger college-educated adults.

**Keywords:** water, perceptions, postsecondary students

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## Introduction

Determining public perceptions regarding water resource issues and associated learning preferences is essential for developing effective programs to improve protection of this critical natural resource (Adams et al., 2013; Boellstorff et al., 2013; Mahler et al., 2013; Gholson, Boellstorff, Cummings, Wagner, & Dozier, 2018). The National Water Survey Needs Assessment Program (Mahler et al., 2013) was an evaluation of the public's priorities and educational interests related to water in 41 states. In general, most participants in this and other such surveys (Adams et al., 2013; Boellstorff et al., 2013) have been over 50 years old. Likewise, participants in more recent studies (Eck, Wagner, Chapagain, & Joshi, 2019; Gholson et al., 2018; Kopiyawattage & Lamm, 2017) have been predominately over 40 years old. The opinions and preferences of these demographics are important, but the perceptions, attitudes, and interests of the younger

demographic also must be understood and are generally unexplored. Thus we conducted a nonexperimental, descriptive evaluation to understand the perceptions and educational preferences of college students at Oklahoma State University (OSU) regarding water issues. The evaluation's results have implications for Extension professionals working to deliver water education programs to younger college-educated adults.

## Methods

To measure postsecondary students' perceptions of water issues in Oklahoma, we used the 56-item Water Issues in Oklahoma survey from 2008 as a template. The original survey was part of the National Water Needs Assessment Program (Mahler et al., 2013) and included four sections addressing public perceptions regarding the environment, drinking water issues, protecting and preserving water resources, and learning preferences.

We modified the instrument slightly to improve consistency and clarity, removed an irrelevant item from the protecting and preserving water resources section, and added an item addressing climate change. The instrument included items assessing how the postsecondary students perceived the importance of 27 water issues via use of a 5-point scale of agreement, four questions addressing drinking water perceptions, 10 questions addressing the protection and preservation of water resources and concerns related to both groundwater and surface water, and eight questions intended to assess learning preferences of the students. The final seven questions were related to participant sociodemographics.

The survey, which was approved by the OSU Internal Review Board, was administered in the fall 2018 and spring 2019 semesters during two regularly scheduled classes in the Ferguson College of Agriculture—an introduction to agricultural economics course and an upper level agricultural education course. Of the 108 students receiving the survey, 103 voluntarily completed it, resulting in a 95.4% response rate. We analyzed the survey data using IBM SPSS Version 23.

## Results

Of the 103 respondents, 54% were male and 46% were female. Ninety-seven percent of respondents were under 27 years old, with most (88%) being between 18 and 21 years old; three were in the age range of 46 to 51 years. The sample represented students from eight states, with the overwhelming majority, 85%, being from Oklahoma and 58% having lived in Oklahoma for more than 10 years. Sixty-eight percent came from nonagricultural backgrounds, and 32% lived on farms. Ninety-three percent of respondents were working toward a bachelor's degree, and eight individuals were pursuing a master's degree.

Participants were asked to rate the importance of 27 water issues using a scale of 1 (*not important*) to 5 (*extremely important*). For 15 issues, the mean score was greater than 4 (Table 1), indicating that most participants felt that these issues were very important or extremely important. For the remaining 12 items, participants identified the issues as somewhat important or did not have an opinion. There was 100% agreement among participants that clean drinking water was of utmost importance.

**Table 1.**

Importance of Water Issues to Oklahoma State University Agriculture Students

| Identified issue | *M* | *SD* | % Agreement[a] |
|---|---|---|---|
| Clean drinking water | 4.9 | 0.30 | 100.0 |
| Water for agriculture | 4.8 | 0.48 | 98.1 |
| Preserving agricultural land and open space | 4.7 | 0.53 | 98.1 |
| Improving agricultural practices | 4.6 | 0.69 | 95.2 |
| Clean rivers and lakes | 4.4 | 0.79 | 93.2 |
| Water for aquatic habitat | 4.4 | 0.99 | 90.3 |
| Clean groundwater | 4.4 | 0.80 | 93.2 |
| Improving water quality monitoring to detect pollution | 4.4 | 0.80 | 90.3 |
| Improving storm water runoff | 4.4 | 0.76 | 93.2 |
| Educating municipal officials | 4.3 | 0.83 | 86.4 |
| Residential water conservation | 4.3 | 0.89 | 85.5 |
| Preserving & restoring buffer zones and wetlands | 4.3 | 0.89 | 82.4 |
| Making water quality and quantity data available to the public | 4.2 | 0.93 | 81.5 |
| Better management of shoreline access to prevent erosion | 4.0 | 0.93 | 77.7 |
| Improving municipal practices | 4.0 | 1.02 | 73.8 |
| Treating storm water runoff | 3.9 | 0.98 | 72.8 |
| Better management of recreational activities (boating, fishing, ATVs) | 3.9 | 1.04 | 68.9 |
| Building new water storage structures (dams, reservoirs) | 3.9 | 0.98 | 67.0 |
| Hypoxia (Gulf dead zone) | 3.8 | 1.09 | 57.3 |
| Water for commerce/ industry/power | 3.8 | 1.06 | 67.9 |
| Improving home and garden practices | 3.8 | 1.08 | 68.9 |
| Involving citizens in collecting water quality information | 3.8 | 1.15 | 64.1 |
| Water for municipal use | 3.6 | 1.03 | 60.2 |
| Within state transfer/sale of water rights | 3.5 | 1.06 | 50.5 |
| Interstate transfer/sale of water rights | 3.4 | 1.11 | 46.6 |
| Water for household landscapes | 3.3 | 1.22 | 47.6 |
| Water for recreation | 3.2 | 1.27 | 49.5 |

*Note. n* = 103. Scale: 1 = *Not Important*, 2 = *Somewhat Important*, 3 = *No Opinion*, 4 = *Very Important*, 5 = *Extremely Important*.

aItems marked with either a 4 or a 5.

Sixty-two percent of participants used either municipal or rural public water supplies for their home source of drinking water. Eighty-one percent felt their tap water was safe to drink, although only 16 respondents

had had their water tested. Sixteen respondents purchased bottled water as their primary source of drinking water, but a majority (55 respondents) indicated that they used bottled water for drinking often. Fifty-two percent reported being satisfied with their home drinking water, yet 74% used either a water treatment system or water filter at home.

Of the students who responded, 62% and 54% believed groundwater quality and surface water quality, respectively, to be normal, good, or excellent. Thirty-three of the 103 participants identified surface water quality as poor or unacceptable. The majority of students perceived that water quantity was not a problem, although 27% did not know whether it was or not. Forty percent of participants did not know whether climate change would affect the amount of water available in their areas. When asked about what pollutants affected groundwater and surface water quality, the majority of students did not know, resulting in mean scores of approximately 3 for all pollutants on a 5-point Likert-type scale (Table 2).

**Table 2.**

Oklahoma State University Agriculture Student Perceptions Regarding Pollutants Affecting Groundwater and Surface Water Quality

| **Identified pollutant** | ***M*** | ***SD*** |
|---|---|---|
| Sediment | 3.3 | 0.84 |
| Turbidity (muddy water) | 3.3 | 1.01 |
| Algae | 3.3 | 0.90 |
| Minerals (iron. manganese, calcium) | 3.2 | 0.91 |
| Fertilizer/Nitrates | 3.2 | 0.91 |
| Heavy metals (lead, arsenic, mercury) | 3.2 | 0.92 |
| Pathogens (bacteria. viruses, germs) | 3.1 | 0.86 |
| Fertilizer/Phosphates | 3.1 | 0.88 |
| Pesticides | 3.1 | 0.84 |
| Petroleum products/bi-products | 2.9 | 0.74 |
| Salinity (water too salty) | 2.8 | 0.94 |
| Pharmaceuticals (antibiotics, personal care products) | 2.8 | 0.79 |

*Note. n* = 103. Scale: 1 = *Know it is NOT a Problem*, 2 = *Suspect it is NOT a Problem*, 3 = *Don't Know*, 4 = *Suspect it IS a Problem*, 5 = *Know it IS a Problem*.

Seventy-one percent of participants supported the treatment and reuse of produced water (i.e., wastewater byproduct from oil and gas production being considered for treatment and reuse) for nonfood agricultural production (i.e., agricultural products not directly consumed by humans). Many students were willing to adopt new technologies such as low-flow showerheads and high-efficiency washing machines and dishwashers (44%) or to change how their landscape was watered (41%) to safeguard water supplies; however, few expressed willingness to alter their landscapes (16%), chemical use (21%), or septic system maintenance pratices (16%).

Students were equally influenced to change their minds about water-related issues as a result of personal

conversations (41%), class presentations (41%), and financial considerations (41%). When asked where they normally obtained their news, being allowed to select multiple answers, 71% of students indicated the Internet, 65% said social media, 46% indicated television, and 30% said radio. Print resources (e.g., newspapers, magazines, newsletters) were used by less than 17% of the participating college students.

Seventy percent of students self-identified as having the viewpoint that resource use should be equally balanced with resource protection relative to environmental issues. Although 76% of respondents had not participated in any water resource–related activity (e.g., master gardener participation, volunteer water quality monitoring, water protection group activities, water meetings, Extension water programs, water planning sessions), they showed modest interest in water programming related to agricultural management practices (i.e., animal waste management, grazing management, irrigation management) and wildlife (i.e., fish and wildlife water needs, restoring fish and aquatic habitat) (Table 3).

**Table 3.**

Oklahoma State University Agriculture Student Learning Interests Related to Water Issues

| Identified issue | No. | % |
|---|---|---|
| Animal waste management | 48 | 46.6 |
| Fish and wildlife water needs | 38 | 36.9 |
| Restoring fish and aquatic habitat | 36 | 35.0 |
| Grazing management | 32 | 31.0 |
| Irrigation management | 30 | 29.1 |
| Forest management and water issues | 27 | 26.2 |
| Nutrient and pesticide management | 27 | 26.2 |
| Watershed management | 24 | 23.3 |
| Stream restoration | 24 | 23.3 |
| Private well protection | 21 | 20.4 |
| Protecting public drinking water supplies | 21 | 20.4 |
| Home and garden landscaping | 21 | 20.4 |
| Beach/shoreline clean-up | 21 | 20.4 |
| Landscape buffers | 17 | 16.5 |
| Produced water from oil production | 12 | 11.7 |
| Septic system management | 11 | 10.7 |
| Community actions concerning water issues | 11 | 10.7 |
| Water policy and economics | 10 | 9.7 |

*Note.* $n$ = 103. Participants could select all issues of interest.

Determining preferred learning methods for target audiences is key for developing effective Extension

programs. Table 4 shows the percentages of students interested in 12 potential learning methods. Digital media play a key role in participants' preferred methods, as using social media, watching informational videos, and accessing websites were some of the most preferred.

**Table 4.**

Preferred Learning Methods of Oklahoma State University Agriculture Students

| Identified method | No. | % |
|---|---|---|
| Use social media | 56 | 54.4 |
| Watch a video of information | 38 | 36.9 |
| Watch TV coverage | 35 | 33.9 |
| Read printed fact sheets, bulletins, or brochures | 32 | 31.0 |
| Visit a web site for information and tips | 27 | 26.2 |
| Take a course for certification or credit | 21 | 20.4 |
| Take part in a onetime volunteer activity | 20 | 19.4 |
| Look at a demonstration or display | 19 | 18.4 |
| Download an app | 17 | 16.5 |
| Attend a short course | 14 | 13.6 |
| Read a newspaper article or series | 9 | 8.7 |
| Attend a fair or festival | 8 | 7.8 |

*Note.* $n$ = 103. Participants could select all methods of interest.

# Discussion

Results indicate that a wide range of water issues are important to the agriculture students surveyed, particularly clean drinking water, water for agriculture, preserving agricultural land and open space, and improving agricultural practices. Similarly, Mahler, Simmons, Sorenson, and Miner (2004) and Chapagain, Wagner, Joshi, and Eck (2020) found that clean drinking water and water for agriculture were extremely important to the public in the Pacific Northwest and Oklahoma (average age of 60 years old), respectively. Kopiyawattage and Lamm (2017) also found that clean water was an important public issue for Florida residents over 18 years of age. Taken together, these findings suggest broad interest in clean drinking water and water for agriculture regardless of demographic or locale, and this broad interest likely has resulted in these being important topics for Extension programming for many years (Tyndall & Roesch, 2014).

Surprisingly, recreation was rated as the least important water issue to OSU agriculture students. Recreation, particularly fishing, is a multi-billion-dollar industry in Oklahoma (American Sportfishing Association, 2019). Not surprisingly, water for household landscapes and the sale/transfer of water rights also were rated as not important by the OSU agriculture students, likely because most students rent and do not own water rights. These findings are intuitive and consistent with previous findings from nine southern

states (Adams et al., 2013) that clean drinking water is more important to water users than water for recreation and landscapes.

Although most students perceived surface water and groundwater to be of normal quality or better, most did not know what pollutants may be affecting their quality. This lack of knowledge indicates a potential educational need among respondents. In contrast, water users in nine southern states, including Oklahoma, identified nitrate and phosphate fertilizers as equally affecting water quality (Borisova et al., 2013). Swistock and Clark (2015) highlighted the importance of Extension programming on influencing use of water testing and understanding of water quality factors among the public. Boellstorff et al. (2013) found that water users were interested in learning more about protecting public drinking water supplies, watershed management, and nutrient and pesticide management, whereas we found that OSU agriculture students were only modestly interested in learning about water resources topics related to agricultural and wildlife management and less interested in others.

Evans et al. (2015) found that local drought significantly affected public opinion on water supply and climate change issues. This does not appear to be the case in our survey. Despite Oklahoma suffering severe drought in 2010–2015, most students felt water quantity was not a problem or did not know whether it was. Although prior studies (e.g., Huang & Lamm, 2015) showed that participants prioritized conservation efforts, only 40% of our participants were willing to adopt new water conservation technologies. It is likely that average rainfall the year prior to the survey (Mesonet, n.d.) had a greater influence on the students' responses than the drought a half decade prior.

Whereas the option of learning via social media was not included in previous studies (e.g., Adams et al., 2013; Chapagain et al., 2020; Mahler et al., 2010), our results showed that it was the most preferred learning method among the students we surveyed. In fact, four of the top five preferred learning methods required digital delivery, indicating the importance of developing electronic media for reaching this demographic. It was surprising though that almost a third of students expressed interest in reading printed brochures or fact sheets, indicating the continued need for producing these along with adoption of digital delivery methods. However, others (Gholson et al., 2018) have also found the importance of both digital (websites and TV) and printed delivery. It also was somewhat surprising that less than 20% of our respondents were interested in downloading an app, possibly indicating the declining importance of this delivery method. Other less desirable learning methods for students included reading newspaper articles and attending workshops, fairs, or festivals. In contrast, the public in the Pacific Northwest most preferred learning from reading newspaper articles (Mahler et al., 2010). Age most certainly affected our finding that social media and video were the preferred learning methods as our survey included only young and educated respondents whereas prior studies (e.g., Boellstorff et al., 2013; Chapagain et al., 2020; Mahler et al., 2010) were dominated by older respondents who most preferred learning about water issues via newspaper articles and/or TV.

## Conclusions and Future Implications for Extension Professionals

A wide range of water issues were important to the agriculture students we surveyed. This is not surprising, as 70% felt that resource use and resource protection should be balanced. Clean drinking water, in particular, was a top priority. Despite the importance of clean drinking water, few understood what pollutants may be affecting their water supplies, suggesting that education on this topic is needed.

 

A major challenge in delivering such education will be reaching this demographic. With only modest interest (~40% at best) expressed by students in learning about water resource topics or implementing conservation measures, successful delivery of needed programs will be a challenge. Effective use of digital media (social media, video, TV, and websites) will be key, as will focusing on water topics of highest interest (agricultural and wildlife management practices), to reaching and educating this group. However, continued use of traditional delivery via printed fact sheets and brochures is still needed. Little interest was expressed in learning via downloading apps, reading newspaper articles and attending fairs, festivals, short courses, or volunteer activities. Thus, in meeting growing digital delivery needs, it may be possible to reduce time and effort devoted to these other delivery mechanisms without affecting program impact.

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