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Hemp, Hemp, Hooray: The Impact of a Hemp Educational Campaign on College Students' Attitudes and Knowledge of Industrial Hemp

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Abstract

Through the passage of the 2018 Farm Bill, hemp became a federally legal crop in the United States for the first time in nearly a half century. Farmers from across the country became interested in the potential of the crop and land-grant universities and other institutions of higher education were challenged with the task of closing an expansive knowledge gap through research and outreach. Despite its federally legal status, hemp's association with marijuana and public stigma remain. This study investigated university students' knowledge and attitudes toward hemp before and after an educational campaign that involved hemp plants on campus. Results indicated students initially had low knowledge about hemp. A majority of students did not recognize the crop as being federally legal and were unable to distinguish major differences between hemp and marijuana. Despite low knowledge, students held fairly high attitudes toward hemp. After the educational campaign, students were significantly more knowledgeable and held more favorable attitudes toward hemp.

Keywords: educational campaign; hemp attitudes; hemp knowledge; industrial hemp

Introduction

The 2018 Farm Bill removed hemp from schedule I of the Controlled Substances Act, allowing farmers in the United States to legally grow hemp for the first time in nearly a half century (USDA, 2019). The lifting of the federal ban on growing hemp has prompted many states to legalize hemp cultivation at the state level and to create new hemp regulatory guidelines for farmers and processors (e.g. Nebraska Department of Agriculture, 2020). The re-legalization of hemp cultivation in the United States may allow growers and processors to take advantage of an agricultural commodity that U.S. markets have largely depended upon for imports (Johnson, 2018). In fact, the Hemp Business Journal (2018) estimated that in 2017 there were $820 million in hemp product retail sales in the United States alone. The potential uses of hemp are expansive, ranging from fiber and oilseed to medicinal and recreational markets (Jeliazkov et al., 2019). Recent market reports indicated the gross value of hemp production per acre was approximately $21,000 from seed and $12,500 from stalks (Johnson, 2018). The prospect of a new cash crop in the United States has catalyzed claims that hemp could beneficially transform the United States economy (Cherney & Small, 2016).

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Despite hedged optimism for hemp to radically transform the agricultural economy, and the 2018 Farm Bill's removal of hemp as a federally controlled substance, many challenges remain to make hemp a viable and mainstream crop in the United States. Stevenson (2017) reported that farmers perceive a severe lack of infrastructure that has halted economic growth of the crop. Furthermore, Johnson (2018) described a "need to reestablish agricultural supply chains, breed varieties with modern attributes, upgrade harvesting equipment, modernized processing and manufacturing, and identifying new market opportunities" (p. 6). West Virginia stakeholders appropriately desired more interaction with research institutions to achieve such goals (Stevenson, 2017).

The history of institutional hemp research and cultivation has been limited since hemp was included in the Controlled Substance Act of 1970 (Purdue University, 2015). However, the 2014 Farm Bill provided a step forward for hemp research, permitting certain research institutions and state departments of agriculture to grow hemp under pilot programs (Johnson, 2018). According to the National Conference of State Legislatures (2019), at least 47 states have enacted legislation for hemp cultivation and production programs, including a plethora of research programs within institutions of higher education. The demand for additional research, outreach, and education on hemp cultivation will become even more evident as additional growers seek to implement a new federally and state approved crop. It appears that the United States Department of Agriculture is aiming to address gaps in hemp research, as evident by awarding Purdue University with a $1 million grant related to organic hemp production (Purdue University, 2019).

Despite the clear need for additional hemp research and extension efforts, some claim the most pressing barrier for the successful integration of hemp as a mainstream agricultural crop in the United States is a severe lack of public knowledge and acceptance (Luginbuhl, 2001), mostly due to industrial hemp's historic and close association with marijuana. Cherney and Small (2016) described marijuana's impact on hemp development simply as "catastrophic" (p. 15). Stakeholders of hemp agree and have urged "an increased need and desire of the public to continue being informed and educated" (Morgan, 2014, p. 47). Fortunately for stakeholders, public education on hemp is becoming more abundant, as demonstrated by nation-wide events such as Hemp History Week, an educational initiative of the Hemp Industries Association (2019).

With hemp becoming more visible on university campuses across the United States, agricultural educators, communicators, and extension educators must understand how students perceive the crop, whether or not students associate hemp with marijuana, and provide hemp educational programs to combat existing hemp misconceptions. Therefore, this research sought to understand the role of an educational campaign on students' knowledge and perceptions of industrial hemp in support of the American Association of Agricultural Education Research Priority Area 1: Public and Policy Maker Understanding of Agricultural and Natural Resources (Enns et al., 2016).

Theoretical Framework

Cognitive dissonance theory (Festinger, 1957) was used as the theoretical framework for this study. According to cognitive dissonance theory, individuals seek consistency among their attitudes and behaviors, and when there is inconsistency between the two, internal conflict arises and individuals will likely adjust attitudes or behaviors to reduce the conflict (Festinger, 1957). One paradigm of dissonance processes is belief disconfirmation (Dillard, 2002), which describes the dissonance that occurs when individuals are exposed to new information that is in conflict with their prior beliefs. Educational or media campaigns aimed at persuasion can elicit cognitive dissonance when new information is presented that is in contrast to participants' former beliefs (Thompson & Rhoades-Buck, 2009). To resolve the newly created dissonance, participants either dismiss the new information or form new opinions that align with the purpose of the campaign. According to cognitive dissonance

persuasion theory, participants who form new opinions are likely to exhibit lasting behavior changes and thought-processes (Thompson & Rhoades-Buck, 2009).

While research explicitly looking at cognitive dissonance related to hemp has been limited, the theory has been applied to other educational campaign studies related to agriculture and contentious topics in science. Hidalgo-Baz et al. (2017) researched consumers' attitudes and purchasing behaviors for organic food using cognitive dissonance as their framework. The researchers concluded that increasing knowledge did influence both attitudes and behaviors and helped to decrease dissonance related to purchasing decisions (Hidalgo-Baz et al., 2017). Other researchers have similarly suggested that increasing information about organic food products can lower consumers' uncertainty, which would lead to increased sales (Aertsens et al., 2009). Yim and Vaganov (2003) applied cognitive dissonance to a study exploring risk perceptions of nuclear technology and also found support for the theory. When respondents possessed positive beliefs toward nuclear energy, they became more supportive of the technology with exposure to new knowledge; however, the opposite was true for those with negative attitudes. The researchers concluded cognitive dissonance had a negative effect when the information was too incongruent with the receiver's attitude (Yim & Vaganov, 2003).

There have been some studies that explored consumers' attitude and knowledge about hemp but did not utilize cognitive dissonance theory. In Poland, Borkowska and Bialkowska (2019) concluded people were not knowledgeable about hemp yet held positive attitudes toward the commodity due to its association with marijuana. Knowledge and negative perceptions of hemp have also been determined to be major barriers to consumers' purchasing of hemp products (Hiller Connell, 2010). However, in recent research with Murray State University students, Morgan (2014) determined over 70% of students correctly answered that hemp cannot be smoked to get "high." Furthermore, Morgan (2014) found that nearly 80% of students understood that THC is present in hemp in much smaller levels compared to marijuana. This study from Morgan (2014) may indicate potential differences in knowledge between students and the general public. If cognitive dissonance operates as expected in relation to hemp, increasing knowledge may have a positive impact on attitudes as long as prior attitudes are not extremely negative (Yim & Vaganov, 2003). Additionally, the increase in knowledge could decrease uncertainty, which would lead to positive changes in attitude and behavior.

Purpose and Objectives

With the 2018 federal legalization of hemp, and as the number of states legalizing hemp continues to expand, additional interest among farmers seeking to grow the crop will emerge. Land-grant universities, colleges, and other academic institutions conducting research, education, and outreach efforts on industrial hemp will be needed to fill a void in hemp research and development. Therefore, hemp will become more prevalent on campuses across the nation. Academic institutions must consider how to educate their students about the crop, to disassociate hemp from marijuana, and to understand their student body's baseline knowledge and attitude toward hemp. This study investigated the impact of a hemp educational campaign on a university campus and can serve as a case study for other academic institutions introducing hemp on a college campus. The research objectives that guided this study were:

1. Describe changes in students' knowledge of industrial hemp as a result of a hemp educational campaign
2. Describe changes in students' attitudes toward hemp as a result of a hemp educational campaign

Methods

A research permit to grow hemp was granted to Doane University, a small, private university in Nebraska, by the Nebraska Department of Agriculture during the Fall 2019 semester. Hemp was grown in a lean-to style greenhouse connected to the university's science and mathematics building and was easily seen by students utilizing the building during class attendance. Due to prior research that has indicated members of the public may hold misconceptions and negative attitudes toward hemp (Luginbuhl, 2001), and may associate hemp with marijuana (Morgan, 2014; Stevenson, 2017), an educational campaign was launched serving university students who were expected to visually see and be in close contact with the crop. The purpose of the educational campaign was to increase students' knowledge of hemp, to reduce the spread of misinformation regarding the new crop on campus, to add a layer of security and student safety, and to discuss new and expected student research opportunities involving hemp.

Educational Campaign

The hemp educational campaign began during week 13 of the Fall 2019 semester and coincided with the arrival of hemp plants in the lean-to style greenhouse on Doane's campus. The educational campaign included three components. The first component was a 15-minute hemp informational presentation with a follow-up question and answer session. The informational presentation was delivered to students in seven introductory science courses that were held in the science and mathematics building. The presentations were delivered during the start of each class's first meeting day of week 13 of the Fall 2019 semester. A PowerPoint presentation was used during delivery and included appropriate visuals and talking points. The presentation including the following components: (a) description of hemp as an agricultural commodity; (b) difference between hemp and marijuana; (c) historic and current hemp legalization; (d) uses of hemp and hemp products; (e) potential economic opportunities for hemp in Nebraska; (f) student opportunities to attend additional educational events on hemp; (g) plans for hemp research at Doane University; and, (h) contact information for faculty conducting hemp research and ways for students to become involved in the research. Following the presentation, students were encouraged to ask additional questions.

The second component of the educational campaign was incorporating hemp plants on campus. After the delivery of the hemp informational presentations, students were encouraged to view the hemp crop. Approximately fifteen mature hemp plants were brought to campus during week 13 of the Fall 2019 semester. The mature crops were placed in a locked lean-to style greenhouse that was connected to the science and mathematics building. The greenhouse was located in an area that received a high degree of foot traffic, especially for students enrolled in introductory science courses, and were highly visible to students through glass panels. The main purpose of attaining the plants on campus was for scientific research involving growing conditions and the chemical composition of hemp. None-the-less, we believed that student relevancy (Kember et al., 2008) could be established by having physical hemp plants on campus and demonstrating that science-based research is being conducted. The hemp plants remained visible in the greenhouse during the duration of the campaign.

The third component of the educational campaign was placing educational, poster-sized infographics around the science and mathematics building. Infographics were placed at the entrance of the building and near the greenhouse where hemp crops were present. The infographics included basic illustrations and information pertaining to the differences between hemp and marijuana, the benefits of CBD for health and wellness, and the variety of industrial uses for hemp. Furthermore, the infographics described opportunities for student research.

Participants and Sample

To measure the effectiveness of the educational campaign, only students exposed to all components of the campaign were included in this study. The researchers had limited time and resources to conduct the educational campaign, including the delivery of the informational presentation, and therefore strategically selected courses that would maximize exposure to students within the science and mathematics building. Researchers sought permission from professors teaching introductory biology, introductory chemistry, and introductory meteorology courses. The introductory science courses were designed for freshman students but included some sophomores and upperclassmen. Researchers gained approval from six professors who taught eight introductory science courses, including five introductory biology courses, one introductory chemistry course, and one introductory meteorology course. The total number of students enrolled in the eight courses was 139.

Data Collection and Instrumentation

All data collection and instrumentation was approved by Doane University's Institutional Review Board prior to data collection (IRB#F19015DCIRBHS). Before the educational campaign was delivered, students completed a pretest survey instrument to measure baseline knowledge and attitudes. The pretest survey was administered via paper at the start of the first scheduled class day of week 13 of the Fall 2019 semester, directly prior to the delivery of the informational presentation on hemp. The pretest survey instrument consisted of questions both researcher-developed and adapted from prior literature. This research was part of a larger study on students' knowledge, attitude, perceived trends, and use of hemp and hemp products. The portions of the pretest utilized for this study included the following sections: a) informed consent; b) attitude toward the growing of industrial hemp in the United States; c) knowledge of industrial hemp; and d) demographics.

Brown et al. (2008) suggested that repeating a test between three and six weeks is sufficient to avoid test-retest bias, therefore the posttest survey instrument was delivered three weeks after the pretest survey and informational presentation. The posttest survey followed the same paper format and was administered at the start of the first scheduled class day of week 16 of the Fall 2019 semester. The posttest survey instrument included two sections: attitude toward the growing of industrial hemp in the United States and knowledge of industrial hemp. Each student who participated in the study created a unique identifier using their middle initial and birth date and recorded their personal identifier on the pretest and posttest survey instruments to help match the data.

A bipolar semantic differential scale measuring attitude toward the growing of industrial hemp in the U.S. was modified from a scale used to measure American's attitudes toward genetic modification in science (Ruth et al., 2019). The bipolar semantic differential scale consisted of eight items and each item included five points between two adjectives that were antonyms. Students were instructed to check the box between each set of adjectives that best represented their thoughts about growing industrial hemp in the United States. The following adjectives pairs were used: good/bad, positive/negative, beneficial/not beneficial, acceptable/unacceptable, necessary/unnecessary, important/unimportant, essential/not essential, and crucial/trivial. Negative adjectives were coded as one and positive adjectives were coded as five. A post hoc scale reliability analysis yielded a Cronbach's alpha of .93. Field (2013) reported that scales above .70 are considered reliable and, therefore, the scale used in this study was deemed reliable.

A researcher-developed knowledge test was used to measure students' knowledge of industrial hemp. Previous research has indicated that using true-false testing formats over multiple-choice formats increase internal test reliability (Couch et al., 2018; Kreiter & Frisbie, 1989) and, therefore a true-false testing format was selected for this study. To reduce correct answers from random guessing,

participants were also given the option to select "I don't know" (Burton, 2002). Each student's knowledge of hemp was measured by the total number of statements they answered correctly out of 20.

The 20 statements were made up of seven statements on distinguishing hemp from marijuana, six statements on state and federal legislation pertaining to hemp, four statements on hemp cultivation and production, and three statements on hemp composition. Statements were derived from hemp information in federal and state documents and websites (Congressional Research Service, 2019; Nebraska Department of Agriculture, 2020; United States Department of Agriculture, n.d.) A panel of four experts reviewed the statements for content validity (Kerlinger, 1986). Panel members included a professor of chemistry and co-founder of a hemp processing company, an associate professor of biology with a focus in crop genetics, an assistant professor of environmental science with a focus in agriculture, and an assistant professor of agricultural communications. The same 20 statements were used for both the pretest and posttest, and were randomly ordered in the pretest and again randomly ordered in the posttest to reduce testing effects (Campbell & Stanley, 1963). The Kuder-Richardson formula (Kuder & Richardson, 1937), or commonly known as KR20, was used to calculate the test's inherent reliability. The KR20 reliability is a special case of Cronbach's alpha used to establish reliability of dichotomous data (Huck, 2008), including true-false and multiple-choice content knowledge tests (Burton, 2004). A post hoc KR20 test indicated a Cronbach's alpha of .835, indicating reliability of the knowledge instrument.

Participant demographics were collected in the last section of the pretest survey instrument. The demographics collected were gender, race, political belief, year in school, primary family income (farm or non-farm), description of hometown (urban, suburban, rural), and origin of home (Nebraska, state other than Nebraska, country outside of U.S).

Data Analysis

Each participant's paper copy response was entered digitally to a replicated Qualtrics survey and data were transferred to SPSS version 25 for analyses. Frequencies were used to report demographic variables. Each participant's pretest and posttest were matched via recorded unique personal identifiers. Paired samples *t* tests were used to determine if significant differences existed between participants' knowledge and attitude before and after participating in the hemp educational campaign. An a priori significance of $p < .05$ was established to identify if significant differences existed.

Results

All components of the hemp educational campaign were successfully delivered to approximately 139 students ($N = 139$) enrolled in introductory science courses targeted by the campaign. However, due to student absences during either pretest or posttest administration, and students opting out of the study, the response rate was 80.5% ($n = 112$). More females ($n = 63$, 56.3%) participated in the study compared to males ($n = 49$, 43.8%) and students were predominately white ($n = 95$, 84.8%). A majority of students considered their political belief to be moderate ($n = 54$, 48.2%), followed by conservative or very conservative ($n = 39$, 34.9%), and liberal or very liberal ($n = 15$, 13.4%). Most of the students indicated being freshman ($n = 87$, 77.7%) or sophomore status ($n = 15$, 13.4%), however a few students indicated being upperclassmen ($n = 10$, 8.9%). Despite only sixteen students (14.3%) describing themselves to be from a farming household, a majority of students ($n = 47$, 42.0%) still described their hometown as rural, followed by urban ($n = 37$, 33.0%), and suburban ($n = 28$, 25%). Lastly, most students ($n = 67$, 59.8%) reported being from Nebraska, while 40 (35.7%) students reported coming from a U.S. state other than Nebraska, and five students (4.5%) indicated they were international students.

Change in Knowledge

Students' knowledge levels were assessed via 20 true-false statements regarding industrial hemp. Although the ordering of statements was randomized in both the pretest and posttest instruments, the statements are presented according to categorical themes for ease of viewership.

Seven statements pertained to distinguishing the difference between hemp and marijuana. On average, students answered approximately half or less of these questions correctly on the pretest. Notably, over half of students indicated they were not sure or answered incorrectly that hemp can be smoked to get a "high" or "buzz." Similarly, only half of students knew that hemp and marijuana contained different levels of THC. Students were most unfamiliar with distinguishing the difference in processing and products between hemp and marijuana, indicated by only 25.0% (n = 28) and 30.4% (n = 34) of students answering these statements correctly. Furthermore, between approximately 30% and 50% of students indicated they didn't know the answer to statements regarding the differences between hemp and marijuana.

Posttest scores indicated an increase in student knowledge on all but one statement, *hemp and marijuana are both classified as Cannabis*. One-hundred and ten (98.2%) students correctly answered false to the statement hemp can be smoked to get "high," and 105 (93.8%) students correctly answered false to the statement that the level of THC is the same in marijuana and hemp. Table 1 illustrates students' pretest and posttest responses to statements that required participants to distinguish the difference between hemp and marijuana.

Table 1
Knowledge Responses to Distinguishing Between Hemp and Marijuana (n = 112)

		Pretest			Posttest		
Statement	A[a]	C[b]	I[c]	DK[d]	C[b]	I[c]	DK[d]
Cannabis processing is the same for both hemp and marijuana.	F	28 (25.0)	24 (21.4)	60 (53.6)	61 (54.5)	28 (25.0)	23 (20.5)
Similar to marijuana, hemp can be smoked to get a "high" or "buzz."	F	54 (48.2)	25 (22.3)	33 (29.5)	110 (98.2)	1 (0.9)	1 (0.9)
The level of THC in hemp is similar to the level of THC in marijuana.	F	58 (51.8)	8 (7.1)	46 (41.1)	105 (93.8)	3 (2.7)	4 (3.6)
Hemp is significantly different from marijuana at a genome-wide level.	T	39 (34.8)	11 (9.8)	62 (55.8)	66 (58.9)	22 (19.6)	24 (21.4)
Hemp and marijuana are both classified as Cannabis.	T	58 (51.8)	21 (18.8)	33 (29.5)	57 (50.9)	40 (35.7)	15 (13.4)
The products from hemp and marijuana crops are used similarly.	F	34 (30.4)	40 (35.7)	38 (33.9)	81 (72.3)	18 (16.1)	13 (11.6)
There are no genetic differences between hemp and marijuana.	F	62 (55.4)	9 (8.0)	41 (36.6)	92 (82.1)	11 (9.8)	9 (8.0)

Note. [a]A = answer. [b]C = correct. [c]I = incorrect. [d]DK = don't know

Six statements pertained to federal and state legislation of hemp, including historic and current laws on hemp production (Congressional Research Service, 2019; Nebraska Department of Agriculture,

2020; United States Department of Agriculture, n.d.). Before the educational campaign, only 54 (48.2%) students identified hemp as being a federally legal crop, compared to 95 students (84.8%) after the campaign. Similarly, only 38 (33.9%) of students identified hemp as a legal crop in Nebraska, compared to 93 (83.0%) of students after the campaign. Students struggled understanding the current regulatory agencies associated with hemp on both the pretest (n = 3, 2.7%, correct) and posttest (n = 20, 17.9%, correct). Table 2 illustrates students' pretest and posttest knowledge responses for statements on federal and state hemp laws.

Table 2
Knowledge Responses to Federal and State Hemp Laws (n = 112)

		Pretest			Posttest		
Statement	A[a]	C[b]	I[c]	DK[d]	C[b]	I[c]	DK[d]
Hemp is a federally illegal crop in the United States.	F	54 (48.2)	19 (17.0)	39 (34.8)	95 (84.8)	11 (9.8)	6 (5.4)
Current federal law classifies hemp as a scheduled I controlled substance.	F	22 (19.6)	36 (32.1)	54 (48.2)	59 (52.7)	39 (34.8)	14 (12.5)
CBD from hemp is federally legal.	T	51 (45.5)	17 (15.2)	44 (39.3)	82 (73.2)	14 (12.5)	16 (14.3)
The U.S. Drug Enforcement Administration (DEA) currently has regulatory oversight over hemp.	F	3 (2.7)	52 (46.4)	57 (50.9)	20 (17.9)	71 (63.4)	21 (18.8)
Hemp is a legal crop in Nebraska.	T	38 (33.9)	29 (25.9)	45 (40.2)	93 (83.0)	10 (8.9)	9 (8.0)
Prior to the late 1950s, hemp in the United States was considered an agricultural commodity.	F	32 (28.6)	11 (9.8)	69 (61.6)	74 (66.1)	11 (9.8)	27 (24.1)

Note. [a]A = answer. [b]C = correct. [c]I = incorrect. [d]DK = don't know

Four statements were presented on hemp cultivation and products. Before the educational campaign, a majority of students (n = 87, 77.7%) correctly marked true that cannabinoids found in hemp can have medical benefits, similarly, most students (n = 93, 83.0%) correctly identified that hemp is harvested for both oils and fiber. Few students (n = 6, 5.4%) understood that hemp does not have to be cultivated in carefully controlled conditions. Posttest scores were improved for all statements regarding hemp cultivation and products. However, most students (n = 63, 56.3%) still incorrectly identified that hemp must be grown in carefully controlled conditions. Table 3 illustrates student responses to statements pertaining to hemp cultivation and products.

Table 3
Knowledge Responses to Hemp Cultivation and Products Statements (n = 112)

		Pretest			Posttest		
Statement	A[a]	C[b]	I[c]	DK[d]	C[b]	I[c]	DK[d]
Cannabinoids found in hemp can have medical benefits.	T	87 (77.7)	0 (0.0)	25 (22.3)	99 (88.4)	5 (4.5)	8 (7.1)
The plant parts used in hemp production include fiber, grain, seed, and flower.	T	61 (54.5)	3 (2.7)	48 (42.9)	99 (88.4)	4 (3.6)	9 (8.0)
Hemp crops can be harvested for oils and fiber.	T	93 (83.0)	0 (0.0)	19 (17.0)	108 (96.4)	1 (0.9)	3 (2.7)
Hemp must be grown in carefully controlled, warm, and humid conditions.	F	6 (5.4)	59 (52.7)	47 (42.0)	36 (32.1)	63 (56.3)	13 (11.6)

Note. [a]A = answer. [b]C = correct. [c]I = incorrect. [d]DK = don't know

Lastly, three statements were presented on hemp composition. Pretest scores indicated that most students (n = 72, 64.3%) knew that hemp contains CBD; however, most students (n = 70, 62.5%; n =76, 67.9%) indicated that they did not know about the degree of THC found in hemp. After the educational campaign, knowledge on hemp composition increased. A majority of students (n = 98, 87.5%) correctly marked true to the statement that hemp contains 0.3% or less THC and marked false (n = 65, 58.0%) to the statement that hemp is characterized by high levels of THC. Table 4 illustrates responses to statements regarding hemp composition.

Table 4
Knowledge Responses to Hemp Composition (n = 112)

		Pretest			Posttest		
Statement	A[a]	C[b]	I[c]	DK[d]	C[b]	I[c]	DK[d]
Hemp contains cannabinoids, such as CBD.	T	72 (64.3)	5 (4.5)	35 (31.3)	79 (70.5)	22 (19.6)	11 (9.8)
Hemp contains 0.3% or less THC.	T	41 (36.6)	1 (0.9)	70 (62.5)	98 (87.5)	2 (1.8)	12 (10.7)
Hemp is characterized by plants that are high in delta-9 THC, the dominant psychotropic compound in *Cannabis sativa*.	F	17 (15.2)	19 (17.0)	76 (67.9)	65 (58.0)	21 (18.8)	26 (23.2)

Note. [a]A = answer. [b]C = correct. [c]I = incorrect. [d]DK = don't know

The total number of correct answers out of 20 were calculated to determine each student's knowledge level. Students scored an average of 8.13 (SD = 4.38; 40.7%) correct answers on the knowledge pretest and 14.10 (SD = 2.71; 70.5%) on the posttest. Therefore, students scored an average of approximately 30% higher on the posttest compared to the pretest. To determine if this change was significant, a paired samples t test was conducted and a significant difference was detected (t = 14.837, $p < .001$).

Change in Attitude

Students' attitudes toward growing industrial hemp was assessed prior to and after the educational campaign through an eight-item, five-point, bipolar semantic differential scale. A total of

110 students completed the attitude scale for both the pretest and posttest. Before the educational campaign, students held a slightly favorable (M = 3.59; SD = 0.78) attitude toward the growing of industrial hemp. Overall, students perceived hemp to be more *beneficial* than *not beneficial* (M = 4.06; SD = 0.86) and more *good* than *bad* (M = 3.90; SD = 1.03). The item on the pretest with the lowest mean was *crucial/trivial* (M = 3.02; SD = 0.78). After the educational campaign, students held a more favorable attitude toward the growing of industrial hemp (M = 3.96; SD = 0.69). Furthermore, the mean for each of the eight items increased, with the largest increase reported for the *good/bad* item (M = 4.36; SD = 0.83) and the smallest increase reported for the *crucial*/*trivial* item (M = 3.28, SD = 0.96). Standard deviations decreased for all item responses in the posttest, with the exception of *necessary/unnecessary*, indicating less variability between student responses. Table 5 shows student response means for items on the hemp attitude scale.

Table 5
Pretest and Posttest Attitude Scale Item Means (n = 110)

	Pretest		Posttest	
Item	*M*	*SD*	*M*	*SD*
Good/bad	3.90	1.03	4.36	0.83
Positive/negative	3.93	0.99	4.38	0.76
Beneficial/not beneficial	4.06	0.86	4.34	0.82
Acceptable/unacceptable	3.84	1.03	4.21	0.92
Necessary/unnecessary	3.26	1.00	3.68	1.00
Important/unimportant	3.47	0.95	3.90	0.90
Essential/not essential	3.23	1.02	3.53	0.98
Crucial/trivial	3.02	0.75	3.28	0.96
Scale Average	3.59	0.78	3.96	0.69

Although students' attitudes toward the growing of industrial hemp were positive (M = 3.59; SD = 0.78) before the educational campaign, students appeared to view growing hemp even more positively (M = 3.96; SD = 0.69) after the campaign. A paired samples t test indicated that the .37 increase was significant (t = 5.795, p <.001).

Conclusions and Implications

The purpose of this research was to describe the effect of an educational campaign on students' knowledge of and attitude toward hemp. Overall, the study did support that both knowledge and attitudes improved after an educational campaign. Contrary to prior research (Morgan, 2014), respondents were unable to distinguish the difference between hemp and marijuana prior to the educational campaign. The pretest knowledge scores further indicated that students in this study generally held limited knowledge on laws, cultivation practices, and composition of hemp. An average of 40.7% of statements were answered correctly on the pretest, but a similar percentage of students admitted they didn't know the answer (42.0%) over answering incorrectly (17.4%). This uncertainty or lack of knowledge supports prior research concluding industrial hemp knowledge is low (Borkowska & Bialkowska, 2019).

The positive impact the educational campaign had on students' knowledge was clear, and in many ways justified the successfulness of the campaign. Students' hemp knowledge increased by an additional 30%. Due to student safety and greenhouse security, the knowledge item of most interest was the distinction that hemp cannot be smoked to get "high." After the campaign, 110 of 113 students correctly identified this fact. Furthermore, students scored higher in the posttest for every item but one, *hemp and marijuana are both classified as Cannabis*. Posttest knowledge results indicated students

were receptive to information presented during the educational campaign, even if information was contradictory to a prior held belief.

Previous literature has cited the public may hold skeptical attitudes toward hemp (Borkowska & Bialkowska, 2019; Hiller Connel, 2010; Luginbuhl, 2001), or may associate hemp with marijuana (Stevenson, 2017). While the general public has had mixed feelings toward marijuana legalization (Caulkins et al., 2012; Cruz et al., 2016), young people tend to be more accepting of marijuana and a majority are in favor of legalization (Fisher, 2018; Schmidt et al., 2016; Pew Research Center, 2014). Our findings indicate that before the campaign a majority of students had limited knowledge on hemp and were not able to distinguish major differences between hemp and marijuana. Despite low knowledge and confusion between hemp and marijuana, students held a favorable, preexisting attitude toward hemp. Perhaps students held these preexisting attitudes due to them associating hemp with marijuana. These findings confirm previous reports that college students generally perceive hemp to be beneficial (Morgan, 2014).

After exposure to our hemp educational campaign, students demonstrated more favorable attitudes toward hemp. This change in attitude supported prior research concluding new information could lead to more positive attitudes and decreased uncertainty or dissonance when prior attitudes were already supportive (Yim & Vaganov, 2003). The positive increase in attitude could be linked to students' improved understanding of hemp as a legal crop in the U.S. and in Nebraska, and being able to distinguish the difference between hemp and marijuana. This research indicates that campaigns can be used to influence attitudes, especially when cognitive dissonance may be a factor (Thompson & Rhoades-Buck, 2009).

Recommendations

As more institutions of higher education adopt hemp on their campuses for research and development, faculty and administrators must recognize the potential confusion or perhaps conflict that may arise as the result of a "marijuana-like" crop on campus. Despite the major differences in composition, cultivation, processing, and uses between hemp and marijuana (Congressional Research Service, 2019), the degree to which the general population understands and recognizes these differences is still widely unknown. Our hemp educational campaign, although limited to a concentrated student sample at a private university, shed light on students' limited knowledge about hemp and common misconceptions. Furthermore, this study demonstrated that through our educational campaign, students were receptive to new information and retained the newly found knowledge. Although students' attitudes toward hemp were already slightly positive, students' attitudes became more positive as a result of the campaign.

We recommend other institutions of higher education that are planning to incorporate hemp on campus to consider conducting a similar educational campaign to educate students about the crop. We acknowledge that characteristics of each institution can best determine appropriate procedures to educate students, and there is not a one-size fits all approach to conduct such a campaign. It is apparent that regional and cultural differences may garner more or less support for cannabis cultivation (Caulkins et al., 2012), and these factors should be considered. Yet, the future of hemp looks promising, as young people generally hold positive views toward all types of cannabis (Fisher, 2018; Morgan, 2014; Schmidt et al., 2016).

The successful integration of hemp as a mainstream agricultural crop in the United States may depend upon the public's understanding and support. The history of hemp in the United States is a fascinating study in itself, riddled with legislative drawbacks and public stigma. Agricultural educators and communicators will play an integral role in shaping the future of hemp, and perhaps hemp can

achieve similar significance as it once had in Colonial America. A historic gap in all hemp research exists, especially prior to the 2014 and 2018 Farm Bills. Future research on hemp education and public acceptance is widely needed. Understanding regional differences on the public's knowledge and attitude is a start. We also must consider the implications of hemp education within the public school system.

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