Analysis of a Professional Development Event on Cannabis Education for Cannabis Educators

Blake C. Colclasure[1], Robert Mejia[2], Koral Fritz[3], Ekaterina G. Sedia[2], and Mariah Duffey[2]

[1]Doane University
[2]Stockton University
[3]Lake Superior State University

Abstract

Cannabis is one of the fastest-growing industries in the United States. The unprecedented expansion of the industry has been influenced by the changing regulatory landscape on industrial hemp, medical cannabis, and adult-use cannabis. The wide variety of cannabis- and hemp-related jobs, from agricultural production to product sales, require a skilled workforce. Post-secondary institutions have recognized the gap in workforce training and have begun to offer educational credentials in cannabis ranging from certificates to graduate degrees. As the cannabis education sector is built, professional development on cannabis education for post-secondary educators can assist in the creation and teaching of high-quality academic programs. A survey was used to evaluate the inaugural Cannabis Curriculum Convening, a pioneering professional development event on cannabis education. Our findings show that professional development positively impacted educators' knowledge and confidence toward integrating cannabis curriculum. Educators' future needs for professional development (curriculum/program development and pedagogical content knowledge) were assessed. Findings show that educators desire professional development on forming cannabis industry partnerships and providing non-formal cannabis education. The most in-demand pedagogical content knowledge topics were medical cannabis, cannabis history, and cannabis regulation, testing, and compliance. We hope our recommendations will inform current and future

professional development in cannabis education.

The cannabis industry in the United States has experienced unprecedented growth in the last decade due to advancements in federal and state legalization. Industrial hemp, classified as cannabis containing 0.3% or less of the psychotropic compound tetrahydrocannabinol (THC), was removed as a Schedule 1 drug under the 2018 Farm Bill (USDA, 2019). Soon after, many states legalized hemp production at the state level, and as of 2021, hemp production was legal in every U.S. state (Moseley-Morris, 2022). Hemp products range from hemp fiber to biofuels, and from hemp protein to cannabidiol (CBD) for health and wellness markets. Cherney and Small (2016) described optimism that hemp could revitalize the U.S. agricultural economy. In 2021, there were more than 54,000 acres of hemp under production in the United States (USDA, 2022).

Marijuana, defined as cannabis containing more than 0.3% THC, remains illegal at the federal level in the United States. However, as of June 2022, the use of medical cannabis is legal in a majority of states, and only 11 states continue to outlaw cannabis completely (Mayorquin, 2022). Although there is a need for additional clinical trials, emerging research shows opportunities for cannabis to be beneficial for a wide variety of medical conditions (Karst, 2018). Regulations on adult-use (i.e., recreational) cannabis also continue to evolve. As of 2022, adult use has been legalized in 18 states (Mayorquin, 2022) and was federally legalized in Canada in 2018 (Turna et al., 2021). In total, approximately 70% of the U.S. population live in areas where adult-use or medical marijuana is allowed (Merz & Riepe, 2021).

The changing regulatory landscape of cannabis catalyzed the growth of the industry. Annual industrial hemp value in the United States alone surpassed $820 million in 2021 (USDA, 2022). In 2019, the U.S. marijuana industry produced $14 billion in sales (Marijuana Business Daily, 2019). The cannabis industry now supports more than 428,000 full-time jobs and has been reported as the fastest-growing job market in the United States (Barcott & Whitney, 2022). The rapid expansion of the industry has led to significant gaps in cannabis consumer education and workforce training. A prominent need for formal and non-formal cannabis education exists, including consumer education (Clobes et al., 2022; Putnam et al., 2019), university Extension programming for farmers (Dingha et al., 2019), and credentialed workforce development and training programs (Black, 2020; Haug et al., 2016; Reid et al., 2022; Uwakonye, 2020).

The need for credentialed cannabis education and workforce training has led to the creation of cannabis courses and programs in higher education (Campanile, 2021; McDonald, 2020; Reid et al. 2022; Kelly, 2019; Uwakonye, 2020). Institutions are aiming to serve the wide variety of cannabis-related careers and are creating programs ranging from 6-month certificate programs (e.g., Northern Michigan University's Cannabis Agriculture and Horticulture Certificate) to graduate degrees (e.g., University of Maryland's Master of Science in Medical Cannabis Science and Therapeutics). There are multiple offerings in both credit-bearing and continuing and adult education spaces. As of 2022, over 75 cannabis-related degrees and courses in higher education have been reported from institutions across the United States (Cornwell, 2022). As new academic courses and programs are developed, Black (2020) described the critical importance of collaborations between the cannabis industry and higher education.

Prior research on formal and non-formal cannabis education is extremely limited. Multiple studies have focused on public health education and cannabis use (Clobes et al., 2021; Reid et al. 2022; Kruger et al., 2020). Clobes et al. (2021) found that health education can be effective in reducing the stigma associated with medical cannabis use. In a study on non-formal hemp education, Colclasure et al. (2021) examined the impact of an educational campaign on a college campus. The researchers found the campaign to be effective, increasing students' knowledge and favorable attitudes toward agricultural hemp.

Published needs assessment research to inform the development of cannabis education has been heavily positioned in the medical community (Klein & Bindler, 2021; St. Pierre et al. 2020; Takakuwa et al., 2021; Zolotov et al., 2021). As public interest in medical cannabis expands (Torgerson et al., 2020), healthcare providers must have the knowledge to make informed recommendations to their patients regarding cannabis. In a review of the literature, Zolotov et al. (2021) found there to be insufficient training in medical and healthcare education programs on medical cannabis. The authors reported a need for competency-based curricula on medical cannabis. Medical practitioners and practitioners in training also desired more training on therapeutic cannabis (Balneaves et al., 2018; St. Pierre et al., 2020). Klein and Bindler (2021) examined the impact of a 2-hour continuing education module on medical cannabis for nurse practitioners. The researchers found the professional development improved nurse practitioners' knowledge and willingness to communicate about cannabis with their patients.

Professional Development for Cannabis Education

Professional development for educators involved in adult, continuing, and higher education has been identified as a valuable tool to promote effective teaching (DiBenedetto & Whitewell, 2019). Professional development programs have the capacity to enrich faculty's skills, knowledge, and confidence in specific teaching contexts, and have been identified as essential to foster quality instruction in post-secondary education (Myers & Roberts, 2004; Rocca, 2010). In an evaluation of a professional development workshop on sustainable agriculture, Walsh and Irving (2021) found the workshop improved teachers' knowledge of sustainable agriculture and confidence in teaching sustainable

agriculture topics. Similarly, Honeyman et al. (2022) found a professional development program on bioenergy improved teacher participants' pedagogical content knowledge on bioenergy. Garza et al. (2022) reported a growing interest in post-secondary educators' desire to attend teaching workshops or conferences on agricultural topics in online formats. In an evaluation of professional development for swine science distance educators, Wiers and Miller (2017) reported that instructors preferred webinars for professional development over other modalities due to the convenience and ability to interact with peers remotely.

As cannabis education programs are created, and new faculty enter the teaching profession, professional development opportunities on cannabis education can be particularly valuable. Black (2020) suggested that cannabis education must be nimble in order to navigate the rapidly changing needs of the industry - an industry where changing regulations, advancements in technology, and new knowledge and discovery are consistently evolving. Professional development can ensure cannabis educators remain up-to-date with industry advancement and can foster collaborations and networking between cannabis educators across institutions, and between educators and industry experts.

This study provides an overview and evaluation of the Cannabis Curriculum Convening (CCC), a two-day professional development event designed for post-secondary educators across the United States who were involved in or who had interest teaching/developing cannabis-related education. The inaugural event was held in the spring of 2021 in a virtual, webinar-style format due to COVID-19. The event was hosted by Stockton University, and participation was free of charge for registrants. Participants were recruited through social media outlets (e.g., Linked-in), listservs, and personal networks of those involved in cannabis education. A total of 146 individuals registered for the conference. Prior to the event, registrants were emailed Zoom links to attend. The first day of the event included eight one-hour sessions and the second day contained three one-hour sessions. Table 1 illustrates topic sessions of the CCC.

Methods

Purpose

The purpose of this study was to determine the impact of professional development in cannabis education. The study sought to determine the impact of the Cannabis Curriculum Convening on participants' self-perceptions of their knowledge, confidence, and interest in incorporating cannabis education. The study also sought to gather information to inform future professional development in cannabis education. Research in cannabis education and professional development is novel; therefore, this study provides valuable information for educators, instructional designers, administrators, and industry stakeholders involved in cannabis education. The objectives that guided this study were:

1. Determine participants' satisfaction with CCC workshop sessions.
2. Identify changes in participants' perceived knowledge, importance, and confidence in incorporating cannabis education.
3. Identify professional development needs related to developing cannabis curriculum and increasing pedagogical content knowledge.
4. Identify the resources currently used by cannabis educators for personal development.

Survey Instrument

An online survey was developed in Qualtrics to obtain quantitative data for this study. The survey included the sections described below in order.

1. Informed Consent and Screening Questions: Participants were required to provide their informed consent on the first page of the survey. Following informed consent, screening questions were used to identify the sessions attended by each respondent. Respondents needed to have attended at least one session to complete the survey.
2. Satisfaction of Sessions Attended: For each session attended, respondents were asked to indicate their level of satisfaction of the session through a 5-point, Likert-type scale (1 = *extremely dissatisfied* to 5 = *extremely satisfied*). Display logic was used to collect satisfaction levels for each session only from attendees of that session.
3. Changes in Participants' Perceptions of Cannabis Instruction in Higher Education: Each respondent answered questions relating to changes in their perceived level of knowledge, confidence, and belief of importance to incorporate cannabis instruction in higher education. To assess changes in respondents' perceptions as a result of the CCC, a post + retrospective pre-test method (Cantrell, 2010) was used (e.g., before attending this event…, after attending this event…). The retrospective method has been shown to provide improved accuracy compared to pretest and posttest research designs (Little et al. 2019; Moore & Tananis, 2009), and can be effective in assessing the impact of professional development events (Ahmad et al., 2018). Six questions measured changes in participants' perceived knowledge level on cannabis curriculum in higher education, confidence in incorporating cannabis instruction in higher education, and perceived importance of cannabis education in higher education. Statements were measured through 5-item, Likert scales (e.g., 1 = *not knowledgeable* at all to 5 = *extremely knowledgeable*).
4. Professional Development Needs: Two ranking questions were used to determine future professional development needs. The ranking questions were designed to indicate the relative priority of professional development areas, thus enforcing a ranking of the items to produce a ranked-order list. The first question included 10 topic areas related to

Table 1.

Cannabis Curriculum Convening workshop session topics

Time	Session Topics[a]
Day 1	
2:00-2:50 PM	Opening Session: "Why Cannabis Curriculum"
3:00-3:50 PM	Session A: Science-Focused Cannabis Curriculum (including Bachelor's Degrees) Session B: Cultivation-Focused Cannabis Curriculum Session C: Community College Cannabis Curriculum
4:00-4:50 PM	Session A: Law-Focused Cannabis Courses/Curriculum Session B: Medical-Focused Cannabis Courses/Curriculum Session C: Hemp-Focused Cannabis Courses/Curriculum Session D: The Importance of Social Justice in Cannabis Curriculum: Spotlight on Engaging with and Training in a Post-Prison Population
Day 2	
2:00-2:50 PM	Opening Session: "The Role of Continuing Ed/Adult Ed in Cannabis Education"
3:00-4:15 PM	Discipline Assemblage and Summary
4:20-5:00 PM	Inter-Institutional Panel

Note. [a] All session topics were held in a virtual, webinar-style format on Zoom. Each session was led by a presenter or moderator. There were a total of 7 presenters or moderators, each having recognized expertise and experience in the cannabis topic being discussed. A majority of the presenters were faculty members, coordinators, or directors of cannabis studies programs in post-secondary education. Several sessions included a panel of experts on the given topic. In total, faculty from over 10 different universities and several individuals from the cannabis industry presented material.

cannabis curriculum development and pedagogy. Respondents were asked to rank items from 1, most needed, to 10, least needed. The second question followed the same format and asked respondents to rank the need for professional development of 10 cannabis content knowledge areas.

5. Prior Cannabis Education Resources Used: Respondents were asked to identify which resources they have used in the past to learn about cannabis and cannabis education. Participants were asked to select all that apply given a list of 11 resources (e.g., published journal articles, formal education, etc.). An open-ended text box was also included for the option of "other."

6. Demographic Information: The last section of the survey contained questions related to respondent demographics and characteristics. Data on respondents' primary occupation, institution type, education level, gender, race, age, and state of residence were collected.

Survey Distribution and Data Analysis

A total of 146 individuals registered for the CCC and provided an email address during their registration. These email addresses were used to send an email invitation to complete the survey one day after the conclusion of the professional development event. The Tailored Design Method (Dillman et al., 2014) was used and included personalized emails and follow-up reminders to non-respondents. Individuals who registered for the CCC, but did not attend the event, were asked not to complete the survey, and screening questions were used to make sure only CCC participants (n = 90) completed the survey. Means and standard deviations were used to answer objective one. Means, standard deviations, and paired samples t-tests were used to answer objective two. Objective three was assessed through frequencies, means, and standard deviations, and objective 4 was assessed through frequencies. SPSS version 26 was used for data analyses. This study was reviewed by the Doane Univeristy Institutional Review Board and was deemed exempt (S21 EX01 DC 1RB HS).

Results

A total of 90 individuals attended all or a portion of the CCC and were sent a link to complete the survey after the event. A total of 36 survey responses were received for a 40% response rate. Thirty-three participants completed the entire survey, a completion rate of 91.6%. Nearly half of respondents identified as female (f = 16, 48.5%) and a majority of respondents held a terminal degree (e.g., Ph.D., J.D.) (f = 19, 57.5%). Approximately half of respondents (f = 16, 48.5%) identified as a faculty member in higher education, while five respondents (15.2%) indicated having a non-faculty association with higher education (e.g., administrator, instructional designer). Nine respondents (27.3%) were professionals in the cannabis industry. Of

identified faculty members, a majority (f = 10) were tenured (professor, associate professor) and most faculty (f = 14) were actively teaching one or more courses related to cannabis. Eight faculty members were employed at a community or junior college.

Objective 1: Participant Satisfaction

Given the format of the workshop, some sessions were attended more than others. Overall, participants were more satisfied than dissatisfied with the sessions. The average response mean for each session was within .5 of being somewhat satisfied (4). Six sessions achieved an average satisfaction rating at or above a 4.0. Respondents were most satisfied with the science-focused cannabis curriculum session (*M* = 4.33, *SD* = 1.01), importance of social justice in cannabis curriculum (M = 4.20, SD = 1.17), and community college cannabis curriculum (*M* = 4.18, *SD* = 1.11). Table 2 illustrates respondents' satisfaction level for sessions attended.

Objective 2: Changes to Participants' Perceived Knowledge, Confidence, and Importance

Prior to participating in the CCC, participants indicated being somewhat knowledgeable (*M* = 3.41, *SD* = 1.10) on cannabis curricula in higher education. After attending the workshop, participants indicated an increase in knowledge (*M* = 3.79, *SD* = 0.98). Through a paired-samples t-test, the mean increase of 0.38 was shown to be statistically significant (p < .01). Participants' confidence toward integrating cannabis curriculum increased from a mean of 3.68 (*SD* = 1.22) to 4.12 (*SD* = 1.17) and this change was also statistically significant (*p* < .05). Participants initially held a high level of importance toward cannabis education (*M* = 4.12, *SD* = 1.07). After the event, the mean level of perceived importance increased (*M* = 4.35, *SD* = 1.04); however, the change was not significant (*p* = .20). Table 3 illustrates participants' perceived knowledge, confidence, and importance of incorporating cannabis education before and after attending the CCC.

Objectives 3 and 4: Professional Development Needs and Resources Used

Respondents ranked 10 areas of professional development needs related to cannabis curriculum from one, *most desired*, to ten, *least desired*. Mean scores for items were compared to determine the largest needs of respondents. The item, *forming cannabis industry partnerships* was most desired (*M* = 3.91, *SD* = 2.78), followed by *providing non-formal education* (*M* = 4.13, *SD* = 2.32) and *identifying/assessing cannabis program/course learning outcomes* (*M* = 5.09, SD = 2.43). The least desired area was *working with administrators on cannabis education programs* (*M* = 7.38, *SD* = 2.89). Table 4 illustrates mean scores and rank for each of the ten items.

Respondents also ranked 10 areas of professional development needs related to cannabis content knowledge and mean scores were compared to determine topic areas

Table 2.

Workshop sessions and participant satisfaction

Session Topics	*f*	*M*[a]	*SD*
Science-focused cannabis curriculum	15	4.33	1.01
Importance of social justice in cannabis curriculum	5	4.20	1.17
Community college cannabis curriculum	11	4.18	1.11
Medical-focused cannabis curriculum	9	4.11	0.87
Opening session: Why cannabis curriculum?	30	4.03	1.28
Discipline assemblage and summary	14	4.00	1.07
Inter-institutional panel	12	3.92	1.26
Hemp-focused cannabis curriculum	11	3.82	1.27
The role of continuing and adult cannabis education	21	3.76	1.27
Law-focused cannabis curriculum	4	3.75	1.09
Cultivation-focused cannabis curriculum	6	3.67	1.60

Note. [a] measured on a Likert scale from 1=extremely dissatisfied to 5=extremely satisfied

Table 3.

Respondents' (n = 34) self-assessment of pre- and post-knowledge of cannabis education, self-confidence toward integrating cannabis curricula in higher education, and perceived importance of cannabis education

	Pre-assessment		Post-assessment		Paired-Samples t-test	
Construct	*M*	*SD*	*M*	*SD*	*t*	*p-value*
Knowledge	3.41	1.10	3.79	0.98	3.419	.002[a]
Confidence	3.68	1.22	4.12	1.17	2.325	.026[a]
Importance	4.12	1.07	4.35	1.04	1.311	.199

Note. [a] significance at p < .05

of most need. Respondents indicated the highest need for medical cannabis (*M* = 4.00, *SD* = 2.34), cannabis history (*M* = 4.63, *SD* = 3.16), and cannabis regulation, testing, and compliance (*M* = 5.07, *SD* = 2.61). The least desired content knowledge areas were environmental sustainability and cannabis (*M* = 6.83, *SD* = 2.37) and cannabis business management (*M* = 6.40, *SD* = 3.32). Table 5 illustrates mean scores and rank for each of the ten content knowledge items.

Respondents' use of resources for their own continuing education on cannabis were determined by frequencies. Twenty-nine (90.6%) respondents indicated using websites as resources to learn more about cannabis. Other commonly used resources were published journal articles (*f* = 23, 71.8%), non-formal education (*f* = 19, 59.4%), and books (*f*

= 18, 56.3%). The least used resources were massive open online courses (f = 4, 12.5%), magazines (f = 11, 34.4%), and TV (news/documentaries) (f = 11, 34.4%). Table 6 illustrates respondents' frequency of resources used for continuing their own education on cannabis.

Discussion

Cannabis education programs are critical to prepare a skilled and professional workforce for a wide variety of industrial hemp and cannabis positions in agriculture, business, chemistry, and medicine, among other areas. The role of professional development for cannabis educators will be central in the creation and teaching of high-quality cannabis programs across the United States. The evaluation of the Cannabis Curriculum Convening provides support that professional development can be used to improve cannabis educators' confidence and knowledge toward integrating cannabis curricula. The positive outcomes seen from the inaugural CCC were similar to outcomes from professional development events for educators on other agriculture-related topics (Honeyman et al., 2022; Wiers & Miller, 2017; Walsh & Irving, 2021).

Black (2020) described collaboration between the cannabis industry and higher education as critical. Participants in our study valued these collaborations, as they ranked forming industry partnerships as the most needed professional development area. The second most needed professional development was providing non-formal

Table 4.

Respondents' (n=32) ranking of PD needs related to cannabis curriculum (1 = most desired to 10 = least desired)

Rank	Item	M	SD
1	Forming cannabis industry partnerships	3.91	2.78
2	Providing non-formal education (e.g., workshops)	4.13	2.32
3	Identifying/assessing cannabis program/course learning outcomes	5.09	2.43
4	Designing cannabis certificates or degrees	5.41	3.00
5	Collaborating with other institutions (e.g., cannabis ed. agreements)	5.41	3.15
6	Creating online/remote cannabis education programs/courses	5.56	2.28
7	Incorporating hands-on learning experiences in cannabis instruction	5.66	2.73
8	Forming interdisciplinary cannabis education programs	5.72	2.45
9	Marketing cannabis education programs	6.75	2.80
10	Working with administrators on cannabis education programs	7.38	2.89

Table 5.

Respondents' (n=30) ranking of PD needs related to cannabis content knowledge (1 = most desired to 10 = least desired)

Rank	Item	M	SD
1	Medical cannabis	4.00	2.34
2	Cannabis history	4.63	3.16
3	Cannabis regulation, testing, and compliance	5.07	2.61
4	Cannabis processing	5.37	2.61
5	Cannabis cultivation in controlled environments (e.g., greenhouse)	5.40	2.40
6	Cannabis biology and genetics	5.40	2.84
7	Cannabis and social justice	5.73	3.32
8	Cannabis cultivation in outdoor environments (e.g., field-based)	6.17	2.38
9	Cannabis business management	6.40	3.32
10	Environmental sustainability and cannabis	6.83	2.37

Table 6.

Respondents' (n = 32) frequency of resources used for continuing education on cannabis

Resource	f	%
Websites	29	90.6
Published Journal Articles	23	71.8
Non-Formal Education (e.g., short courses, workshops, seminars)	19	59.4
Books	18	56.3
Friends and Colleagues	15	46.9
Formal Education (credit or certificate bearing courses)	13	40.6
YouTube or Online Video	13	40.6
Academic Organizations/Societies	12	37.5
TV (e.g., news/documentaries)	11	34.4
Magazines	11	34.4
Massive Open Online Courses (MOOCs)	4	12.5

education. Train-the-trainer professional development for delivering non-formal education may be particularly useful for university Extension, supporting the needed development of hemp-based Extension support for farmers (Dingha et al., 2019). Educators' need for developing non-formal cannabis education also align with prior literature citing the need for consumer and continuing workforce education on cannabis (Balneaves et al., 2018; Clobes et al., 2022; Haug et al., 2016; Rampold et al., 2021).

Cannabis educators will need to continue to advance their own content knowledge on topics within the cannabis industry. Prior literature on the need for cannabis education has overwhelmingly been in the medical research community (Klein & Bindler, 2021; St. Pierre et al. 2020; Takakuwa et al., 2021; Zolotov et al., 2021). When determining their own pedagogical content knowledge needs, our respondents ranked professional development on medical cannabis as the top need, supporting the urgency for medical cannabis education.

The illegal period of all forms of cannabis in the United States created extensive gaps in research, educational resources, and foundational curriculum related to cannabis. Instructors may have limited opportunities and resources to learn about cannabis. Our findings indicate that websites are the most frequently used resource by educators to learn more about cannabis. This finding supports previous work by Kruger et al. (2020) who reported that consumers use the internet as a primary information source for cannabis.

Limitations to this study included a small sample size and a low response rate. The constructs (e.g., knowledge, confidence, and importance) measured in this study were limited to participants' perceptions. To improve response rates in future professional development events, surveys could be administered at the close of each webinar session. Despite this study's limitations, there are tremendous gaps in cannabis education research and this study contributes to novel findings in a rapidly advancing industry. Future studies are recommend to examine cannabis educators' behavior after completion of professional development (e.g., changes to instruction or program development) and studies that examine student outcomes as a result of cannabis education programs.

Summary

This study provided an evaluation of the inaugural Cannabis Curriculum Convening, an online professional development event on cannabis education for cannabis educators. Our findings demonstrate that the CCC had a significant and positive impact on participants' perceived knowledge and confidence to incorporate cannabis curriculum, suggesting that professional development in cannabis education can be useful to improve educators' self-perceptions and efficacy. Future needs for professional development in cannabis education (curriculum/program development, pedagogical content knowledge) were identified. Participants identified forming cannabis industry partnership and providing non-formal education as the most needed curriculum/program development topics. The most needed pedagogical content knowledge topics were medical cannabis, cannabis history, and cannabis regulation, testing, and compliance. Websites, published journal articles, and non-formal education were the most frequently used resources by educators to learn more about cannabis. As the cannabis industry continues to grow, as well as the accompanying demand for a skilled workforce, cannabis education and workforce training will be paramount to the success of the industry. This study provided evidence that professional development on cannabis education for cannabis educators can be effective in the pursuit of professional and high-quality cannabis education.

References

Ahmad, H., Latada, F., Wahab, M. N., Shah, S. R., & Khan, K. (2018). Shaping professional identity through professional development: A retrospective study of TESOL professionals. *International Journal of English Linguistics*, *8*(6), 37-51. https://doi.org/10.5539/ijel.v8n6p37

Balneaves, L. G., Alraja, A., Ziemianski, D., McCuaig, F., & Ware, M. (2018). A national needs assessment of Canadian nurse practitioners regarding cannabis for therapeutic purposes. *Cannabis and Cannabinoid Research*, *3*, 1. https://doi.org/10.1089/can.2018.0002

Barcott, B., & Whitney, B. (2022). *Jobs Report 2022*. Leafly. https://leafly-cms-production.imgix.net/wp-content/uploads/2022/02/22132544/LeaflyJobsReport2022.pdf

Black, B. E. (2020). Creating a qualified cannabis workforce: How higher education can support cannabis career pathways. [Doctoral dissertation, Kansas State University]. https://krex.k-state.edu/dspace/handle/2097/40335

Campanile, C. (2021, May 2). NY colleges increase cannabis courses amid weed legalization. New York Post. https://nypost.com/2021/05/02/ny-colleges-increase-cannabis-courses-amid-weed-legalization/

Cantrell, P. (2010). Traditional vs. retrospective pretests for measuring science teaching efficacy beliefs in preservice teachers. *School Science & Mathematics*, *103*(4), 177-185. https://doi.org/10.1111/j.1949-8594.2003.tb18116.x

Cherney, J. H., & Small, E. (2016). Industrial hemp in North America: Production, politics and potential. *Agronomy*, *6*(4), 1-24. https//doi.org/10.3390/agronomy6040058

Clobes, T. A., Palmier, L. A., Gagnon, M., Klaiman, C., & Arellano, M. (2022). The impact of education on attitudes toward medical cannabis. *PEC Innovation*, *1*, 100009. https://doi.org/10.1016/j.pecinn.2021.100009

Colclasure, B. C., Ruth, T. K., Durham Brooks, T., & Holmes, A. E. (2021). Hemp, hemp, hooray: The impact of a hemp educational campaign on college students' attitudes and knowledge of industrial hemp. *Journal of Agricultural Education*, *62*(1), 246-259. https://doi.org/10.5032/jae.2021.01246

Cornwell, A. M. (2022, June 2). *Ever thought about taking a university course in cannabis? Now you can.* Oracle. https://cbdoracle.com/news/cannabis-education-training-schools/

DiBenedetto, C. A., & Whitwell, T. (2019). Associate deans and academic leaders' perception for promoting teaching excellence in United States colleges of agriculture. *NACTA Journal*, *63*(1), 13-19.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. John Wiley & Sons, Inc.

Dingha, B., Sandler, L., Bhowmik, A., Akotsen-Mensah, C., Jackai, L., Gibson, K., & Turco, R. (2019). Industrial hemp knowledge and interest among North Carolina organic farmers in the United States. *Sustainability*, *11*, 2691. https://doi.org/10.3390/su11092691

Garza, G., Drewery, M. L., & Anderson, R. G. (2022). Online teaching workshop and conferences: A COVID-19 survey on faculty teaching agriculture. *NACTA Journal*, *66*, 19-25.

Haug, N. A., Kieschnick, D., Scottie, J. E., Babson, K. A., Vandrey, R., & Bonn-Miller, M. O. (2016). Training and practices of cannabis dispensary staff. *Cannabis and Cannabinoid Research*, *1*(1), 244-251. https://doi.org/10.1089/can.2016.0024

Honeyman, K., Robinson, J. S., & Haggard, B. (2002). An evaluation of a sustainable bioenergy professional development program. *NACTA Journal*, *66*, 27-36.

Karst, A. (2018). Weighing the benefits and risks of medical marijuana use: a brief review. *Pharmacy*, *6*, 128. https//doi.org/10.3390/pharmacy6040128

Kelly, K. J. (2019, March, 30). *More US colleges adding marijuana to their study programs*. Voice of America. https://learningenglish.voanews.com/a/more-us-colleges-adding-marijuana-to-their-study-programs/4829219.html

Klein, T. A., & Bindler, R. (2021). Ask your provider about cannabis: Increasing nurse practitioner knowledge and confidence. *Cannabis and Cannabinoid Research*. https://doi.org/10.1089/can.2021.0061

Kruger D. J., Kruger, J. S., Collins, R. L. (2020). Frequent cannabis users demonstrate low knowledge of cannabinoid content and dosage. *Drugs*, *28*(1), 97-103. https://doi.org/10.1080/09687637.2020.1752150

Kruger, D. J., Moffet, I. M., Seluk, L. C., & Zammit, L. A. (2020). A content analysis of internet information sources on medical cannabis. *Journal of Cannabis Research*, *2*, 29. https://doi.org/10.1186/s42238-020-00041-1

Little, T. D., Chang, R., Gorrall, B. K., Waggenspack, L., Fukuda, E., Allen, P. J., & Noam, G. G. (2019). The retrospective pretest-posttest design redux: On its validity as an alternative to traditional pretest-posttest measurements. *International Journal of Behavioral Development*, *44*(2), 175-183. https://doi.org/10.1177/0165025419877973

Marijuana Business Daily (2019). Annual Marijuana Business Factbook (7th ed.).

Mayorquin, O. (2022, April 26). *In what states is weed legal? Here is the list*. USA Today. https://www.usatoday.com/story/news/nation/2022/04/20/states-with-legal-weed-recreational/7371071001/

McDonald, R. (2020, February 18). *Courses in cannabis: How American universities are responding to the growing prevalence of marijuana*. DU Clarion. https://duclarion.com/2020/02/courses-in-cannabis-how-american-universities-are-responding-to-the-growing-prevalence-of-marijuana/

Merz, M., & Riepe, J. (2021). SMEs with legally restricted banking access: evidence from the US marijuana industry. *Journal of Business Economics*, *91*, 797-849. https://doi.org/10.1007/s11573-020-01017-6

Moore, D., & Tananis, C. A. (2009). Measuring change in a short-term educational program using a retrospective pretest design. *American Journal of Evaluation*, *30*(2), 189-202. https://doi.org/10.1177/1098214009334506

Moseley-Morris, K. (2022, January 25). *Idaho was the 50th state to legalize industrial hemp. Now eight farmers are ready to produce it*. Idaho Capital Sun. https://idahocapitalsun.com/2022/01/25/idaho-was-the-50th-state-to-legalize-industrial-hemp-now-eight-farmers-are-ready-to-produce-it/

Myers, B. E., & Roberts, T. G. (2004). Conducting and evaluating professional development workshops using experiential learning. *NACTA Journal*, *48*(2), 27-32.

Putnam, J., Doyle, K., Kiger, A., & Riggs, C. J. (2019). Filling the cannabis misuse knowledge gap for college campus health teams. *American Journal of Health Studies*, *34*(3), 147-154. https://doi.org/10.47779/ajhs.2019.43

Rampold, S., Brym, Z., Kandzer, M. S., & Baker, L. M. (2021). Hemp there it is: Examining consumers' attitudes toward the revitalization of hemp as an agricultural commodity. *Journal of Applied Communications*, *105*(2), 2. https://doi.org/10.4148/1051-0834.2385

Reid, A. E., Crump, M. E. S., Clement, V. R., & Rolle, J. D. (2022). Introducing cannabis education on a college campus in 2021: The case of Medgar Evers College. *International Journal of Higher Education Management*, 8(2), 36-53. https://doi.org/10.24052/IJHEM/V08N02/ART-3

Rocca, S. J. (2010). Determining the professional development needs of faculty in a college of agriculture. *NACTA Journal*, *54*(1), 69-75.

St. Pierre, M., Matthews, L., & Walsh, Z. (2020). Cannabis education needs assessment among Canadian physicians in-training. *Complementary Therapies in Medicine*, *49*, 102328. https://doi.org/10.1016/j.ctim.2020.102328

Takakuwa, K. M., Mistretta, A., Pazdernik, V. K., & Sulak, D. (2021). Education, knowledge, and practice characteristics of cannabis physicians: A survey of the society of cannabis clinicians. *Cannabis and Cannabinoid Research*, *6*(1), 58-65. https://doi.org/10.1089/can.2019.0025

Torgerson, T., Roberts, W., Lester, D., Khojasteh, J., & Vassar, M. (2020). Public interest in cannabis during election season: a Google Trends analysis. *Journal of Cannabis Research*, *2*, 31. https://doi.org/10.1186/s42238-020-00039-9

Turna, J., Belisario, K., Balodis, I., Ameringen, M. V., Busse, J., & MacKillop, J. (2021). Cannabis use and misuse in the year following recreational cannabis legalization in Canada: a longitudinal observational cohort study of community adults on Ontario. *Drug and Alcohol Dependence*, *225*(1), 108781. https://doi.org/10.1016/j.drugalcdep.2021.108781

United States Department of Agriculture. (2019, May 28). Executive summary of new hemp authorities [Memorandum]. https://www.ams.usda.gov/sites/default/files/HempExecSumandLegalOpinion.pdf

United States Department of Agriculture, National Agricultural Statistics Service. (2022). National Hemp Report. https://downloads.usda.library.cornell.edu/usda-esmis/files/gf06h2430/xd07hw825/v692v917t/hempan22.pdf

Uwakonye, D. (2020). *Strengthening capacity of youth in support of emerging agricultural industries in Africa: Lesotho's cannabis industry and the role of higher education in its human resources development.* [Thesis, Cornell University]. https://ecommons.cornell.edu/bitstream/handle/1813/72648/DeAndre_Uwakonye_MPS_Capstone.pdf?sequence=1

Walsh, M., & Irving, J. (2020). Promoting sustainable agriculture content in science classes through professional development for teachers. *NACTA Journal*, *65*, 262-267.

Wiers, R., & Miller, G. (2017). Evaluation of professional development resources for swine science distance education instructors. *NACTA Journal*, *61*(1), 73-76.

Zolotov, Y., Metri, S., Calabria, E., & Kogan, M. (2021). Medical cannabis education among healthcare trainees: A scoping review. *Complementary Therapies in Medicine*, *58*, 102675. https://doi.org/10.1016/j.ctim.2021.102675