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Flipping the adult natural resources classroom to build community and learn in nature

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Abstract

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Abstract

Adult-focused natural resources education is critical amid widespread challenges related to water quality, biodiversity declines, and climate change. Extension educators are poised to make impactful advances in natural resource education among adult learners when equipped with educational tools that improve knowledge and build connections among peers. The Mater Conservationist Program in Iowa sought to address this educational need through a flipped-classroom learning model evaluated in this report. Participants (n = 174) enrolled in 11 offerings of the program completed a multi-week educational curriculum that combined online instruction by university educators with in-person instruction led by local natural resources professionals and extension educators in a flipped classroom model. The approach ensured a standardized educational experience across the state but allowed for tailored, locally-focused education through in-person instruction on topics most important or relevant to local natural resource issues. Participants completing a post-course evaluation indicated widespread satisfaction (91% extremely or somewhat satisfied) in all three program elements – online instruction, in-person instruction, and networking opportunities. Participant self-assessed knowledge increased in each module topic between 2.8 and 3.8 points on a 10-point scale ($P < .001$). Participants declared an intent to apply lessons from the class on over 30,000 acres of land they owned or had influence over across a diversity of land use contexts found in the state. The flipped classroom model facilitated deep learning but also important experiences in nature and networking among peer learners and professionals that should translate to improved community engagement in critical areas of natural resources stewardship.

1 | INTRODUCTION

Extension educators have a critical role to play in engaging the public in meaningful dialog on large-scale socio-ecological challenges related to land stewardship like forest health, water quality, biodiversity conservation, and climate change (Goerlich et al., 2019; Krasny & Tidball, 2010). In the midwestern United States, where land stewardship challenges are met with a highly diffuse land ownership and decision-making context (Burger et al., 2019), extension is poised to play an especially important and central role in messaging public-good information to private actors and

Abbreviation: MCP, Master Conservationist Program

compelling participation in interventions aimed at improving water quality, biodiversity conservation, or climate change (Bates & Arbuckle Jr, 2017; Grudens-Schuck et al., 2017; Prokopy et al., 2015). For example, in Iowa around 97% of the land area is held in private ownership and 81% of all land is in some sort of agricultural production (USDA, 2020). Thus, to impact high priority issues like wildlife conservation or water quality in this landscape, planners have recognized the critical role of mobilizing a broad swath of the public in voluntary conservation for the public good.

A trend towards specialization in extension education however presents unique challenges for program areas that fall through the cracks (Ahmed & Morse, 2010). In Iowa, regionalization and specialization among extension educators in agriculture and natural resources has focused exclusively on commodity production that treat natural resource stewardship challenges only tangentially to the production enterprise. Thus, although extension could have positive impacts on resource stewardship in communities across the state (Mandal & Lawrence, 2017) that potential has gone largely unrealized without dedicated programming or educators in natural resources program areas.

Despite limited educational capacity for natural resources education in extension, there remains a strong regional capacity for conducting standardized educational curricula in Iowa (Holz-Clause et al., 2012) along with an assortment of natural resource professionals in other public institutions such as the state Department of Natural Resources or locally-funded County Conservation Boards. These latter groups however have limited adult educational capacity or mandates. Thus, an opportunity exists in the state for formal, standardized curriculum that blends the institutional capacity for education held in extension with the technical expertise of natural resource professionals living in communities across the state. It was this context, along with the demonstrated societal importance of resource stewardship in a landscape held almost entirely in private ownership, that Iowa State University Extension and Outreach redesigned a signature land-stewardship educational curriculum called the Master Conservationist Program (MCP) to meet the educational needs related to land stewardship within the constraints of the institution and partner public entities (Janke, 2020). The stated goal of the MCP is, "to create a community of passionate conservationists that are engaged in local communities advocating for conservation practices and policies to ensure a sustainable future for Iowa's landscape." The program envisions "a community of trained Iowans that are knowledgeable about conservation challenges and opportunities, equipped with resources to communicate about conservation in Iowa, and connected to a local network of passionate conservationists and educators" (Janke, 2020). The MCP was focused on educational curricula and delivery, comparable to curricula in other 'master' programs across the country in topics ranging from horticulture to livestock (e.g., Schrock et al., 2000; Strong et al., 2010). This article describes the approach to the development and delivery of the educational curriculum and accounts for recent success in program implementation and evaluation that may find application in comparable institutional or environmental contexts.

Core Ideas

- Adult natural resources education is a critical societal need.
- Flipped classroom promoted learning, experiences in nature, and networking.
- Learners demonstrated high satisfaction and knowledge change in each program element.
- Course graduates declared an intent to impact over 30,000 acres of land.

2 | METHODS

2.1 | Instructional approach

The curriculum for the MCP was designed with two critical priorities in mind; the importance of facilitating peer-to-peer learning and the importance of experiences in nature to learn about environmental challenges and opportunities. The community-centric peer-to-peer learning priority has been shown to be advantageous in adult educational curricula and lead to lasting behavioral change and support networks, beyond the traditional knowledge-deficit model of education (Kueper et al., 2013; Strong et al., 2015). Feeling of connections to community also impact behaviors toward resource stewardship and may make private actors more inclined to act altruistically or in cooperation with expert guidance (Landon et al., 2020). The second pillar of the revised MCP was to focus on experiences in nature. Experiences in nature are increasingly recognized in youth education as having formative impacts on child development and positive environmental actions (e.g., Jacobi-Vessels, 2013). Among adult learners, Lutter et al. (2018) found that direct interactions between natural resource professionals and landowners outdoors had a positive impact on trust in conservation agencies and program outcomes, illustrating the positive impacts of adult experiences in nature on environmental stewardship actions.

The flipped classroom model (e.g., Herreid & Schiller, 2013) is ideally suited andragogy – or instructional technique tailored to adult learners (Knowles et al., 2011)– to address these two educational priorities because it allows for self-directed learning on technical material germane to resource

stewardship while also facilitating community building and learning in nature. This approach allows for technical material to be presented in a uniform way and consumed at the learners' own pace before attending an in-person instructional session. In-person instruction can then focus on building community and immersing learners in nature where principles introduced online are reinforced and applied. This andragogical technique has seen past successes in short natural resources curricula (e.g., Larkin et al., 2018) and seems well suited for multi-session educational programs in the discipline.

To implement a flipped classroom approach in our program, we developed a web interface for course participants to access online learning modules that featured original recorded lectures and curated supplemental resources. After an initial in-person introduction to the online materials, participants were asked to review required and supplemental online materials before returning to a scheduled in-person meeting of the class led by local natural resource professionals and educators. Online learning modules were designed to take about two hours for completion, with one hour dedicated to recorded lectures and one hour for reading and reviewing written resources or a variety of supplemental resources germane to each topic. To reinforce lessons from online materials, local instructors reviewed the materials in advance of planning their in-person session to build on lessons presented online through class discussions and hands-on experiences. In-person instruction emphasized locally important components or areas of emphasis under the module topic. For example, learners in the aquatic ecosystems module (Module 2c) would learn about aquatic ecosystem ecology and diversity across the state in the online materials while in-person sessions would be tailored to feature major aquatic ecosystems found in the host region, such as prairie wetlands in north-central Iowa or large river systems in the southeast portion of the state (Bishop, 1981).

Many 'master' curricula across the country led by extension or comparable educational entities often require volunteer hours or time after course completion and before some formal certification is achieved (e.g., Schrock et al., 2000; Wolford et al., 2001). The MCP previously had this mandate, but in association with the curriculum revision described here and in light of institutional barriers for staffing and program support, the revised program focused only on educational curricula over the ~7-week course with no explicit volunteer mandate. Course participants were encouraged to apply lessons learned in the program in communities they reached and evaluations sought to quantify this potential impact. In this way, the curriculum was similar to other intensive educational curricula delivered by extension that focused on educational instruction and networking during instruction, such as that described by Strong et al. (2010).

2.2 | Learning modules

The course material was structured into a series of four modules that built upon one another through the program. The first module was called "Setting the Stage" and focused on two complimentary topics: learning the language of conservation and land stewardship and learning about landforms and geologic factors influencing past and modern land use throughout the state. In-person instruction for Module 1 highlighted local landforms and unique geological features in the community. The second module was split between three different sub-modules and associated in-person sessions, each one focusing on the three major ecosystems found in the state: prairies, forests, and aquatic environments. The third module was titled "Putting it Together" and featured lessons on a range of conservation practices used throughout the state in agricultural and urban landscapes to address land stewardship challenges introduced in Modules 1 and 2. In-person instruction featured local conservation practitioners and priority conservation practices. The final module was called "Communicating Conservation" and discussed the approach to crafting compelling messages about conservation and environmental stewardship from an anthropological and sociological lens. The in-person session paired with the final module facilitated discussions within the class and celebrated successful completion of the curricula.

2.3 | Implementation and evaluation

Online materials were developed and curated by the program leader, state specialists, and university faculty, thus taking the university educators to the learners throughout the state virtually, a model unfeasible with in-person instructional models. In-person sessions were organized and led by extension educators in one or more of Iowa's 100 county extension offices in collaboration with natural resource professionals in agencies such as U.S. Department of Agriculture, Iowa Department of Natural Resources, or county entities that serve as local experts on the topics covered in each module. The curriculum was initially piloted through four offerings completed between October 2017 and August 2018. Following a series of adjustments and improved guidance resulting from this pilot phase, the program was made available for instruction statewide in 2019 and 2020 and these offerings are the basis of the evaluations presented here.

There were 11 offerings of the MCP during 2019 and 2020. Most of these offerings ($n = 9$) were completed during 2019 because restrictions related to gatherings due to the Covid-19 pandemic of 2020 appreciably reduced the capacity for the program to be delivered in that year. Twenty different county extension offices were involved in MCP

instruction across the 11 offerings, including 6 counties that offered courses only in their county and 5 mostly rural counties that collaborated with 1–4 others for the offering. For each offering, local conservation educators, namely those associated with County Conservation Boards or local nature centers, were involved in course design and in-person instruction.

Each participant was asked to complete two assessments, one at the start of the course and one after completion of the course. These assessments were delivered through Qualtrics and completed with an option for anonymity (though most respondents provided their name). The pre-course assessment asked primarily demographic details including race, age, gender, and occupational status. The post course assessment asked questions regarding satisfaction with the course and associated elements (online materials, in-person instruction, and networking opportunities), self-assessed knowledge changes before and after the course on each module topic, planned behavior relative to implementing lessons from the course on land they influenced, and for general narrative feedback.

Here, I report the basic demographics of course participants and summarize results of the post-course assessments to gauge participant learning and planned behavior change. I summarized responses by percentages in each of the satisfaction questions and report those results. I conducted a paired *t*-test on each self-assessed knowledge change and reported differences in mean scores and associated test statistics ($\alpha = 0.05$). Finally, I reported results on the assessment of planned behavior change from a question asking whether participants planned to apply lessons from the course on land they own or have influence over, so as to gauge the overall potential impact of the curriculum on land-use and land stewardship priorities that underly the motivation for the course. Participants that declared an intent to apply lessons from the class on land they owned or had influence over were then asked to provide estimates of the area (in acres) of land they intended to impact. I summarized these values and reported the proportion of respondents impacting each land use category, the range of areas impacted, and the total area with potential impacts from the program.

3 | RESULTS

There were 174 people to enroll and complete the 11 offerings of the MCP during 2019 and 2020. The pre-course assessment was part of the online materials in Module 1 and therefore had high participation with 171 (98%) respondents. The post-course assessment was sent by course organizers over email after completion of the course and had less participation with 89 respondents (51%). Course participants were 58% female and 42% male. Ages of participants were reported in categories, and spanned from 18–24 to ≥75. The category with the most participants was 55–64 (27%). Of those participating, 23% were older than 65 while 50% were less than 55. Most participants were employed for wages (56%), followed by retirees (27%), and then self-employed (10%). Additional employment categories included homemakers (2%), military (0.6%), unemployed (1%), and students (2%). Employed participants were asked to check which fields or industries they were employed in and the top five responses included agriculture (22%), natural resources or the environment (20%), education (15%), public service (13%), and technology (10%).

In the post-course assessment, participants indicated widespread satisfaction with the three primary course elements: in-person instruction (91% extremely or somewhat satisfied), online materials (91% extremely or somewhat satisfied), and networking opportunities associated with the in-person sessions (91% extremely or somewhat satisfied; Figure 1). Of those responding, 92% indicated they would recommend enrolling in the course to family or friends, 7% replied "maybe" to this question, and only 1% said "no." In the 2020 assessment, we added a question that asked participants specifically if the online materials and supplemental resources impacted their learning experience. Twelve of 14 respondents (86%) to this question indicated the online materials "improved their learning experiences in the program" while 2 (14%) indicated they had no impact.

Self-assessed changes in subject matter knowledge in each of the modules and submodules showed significant positive improvement ranging from 2.8 to 3.8 on a 10-point scale ($P < .001$, Table 1, Figure 2). Every respondent to the post survey that answered the question whether they planned to apply lessons from the class on land they owned or had influence over indicated they did plan to do so ($n = 85$; 100%). In inspection of areas of planned impact, two respondents provided implausible land areas (≥1 million acres impacted) and were thus excluded from the analysis. Among the remaining respondents, most declared an intent to impact land in yards or farmsteads and over 50% of respondents declared an intent to impact each of the major land cover categories included in the assessment (Table 2). Overall, a total of 31,168 acres were reported to be likely impacted by program graduates.

4 | DISCUSSION

The implementation of a flipped classroom for natural resources education among adult learners in the MCP was successful in improving self-assessed knowledge, providing networking opportunities for learners to build community, and in providing outdoor education opportunities without sacrificing technical education. Although no case-control was available to compare the flipped model with a traditional classroom

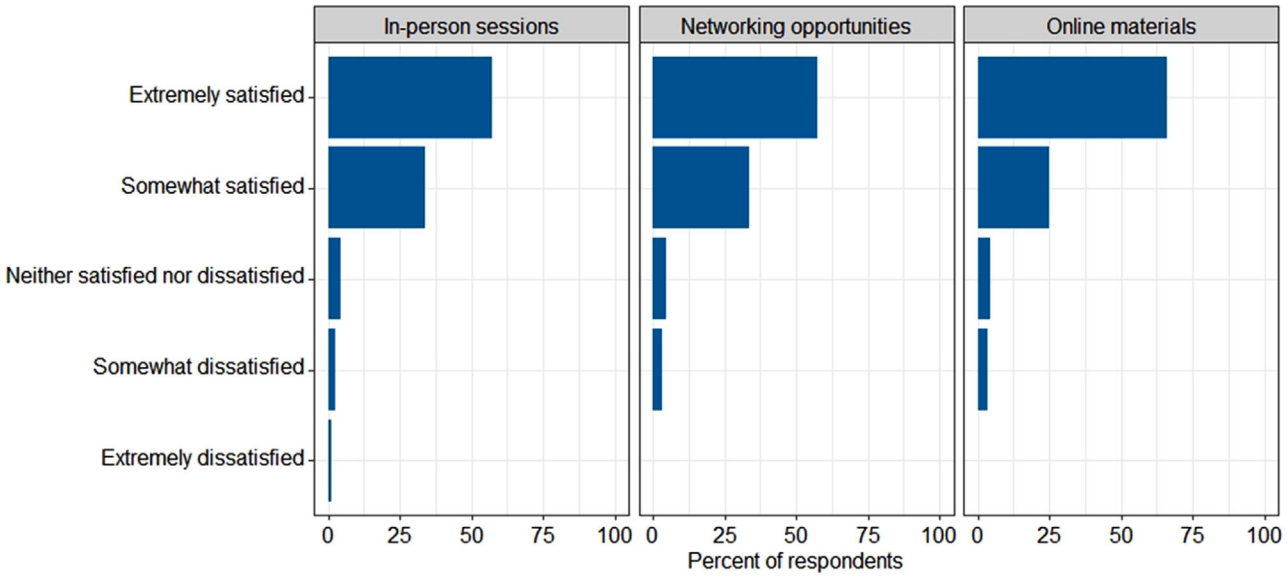

FIGURE 1 Participant satisfaction ratings from post-course assessment of the Master Conservationist Program implemented in a flipped classroom format in Iowa

TABLE 1 Self-assessed knowledge change in each module subject area before and after taking the Master Conservationist Program in a flipped-classroom instructional model

		Mean score (0 low, 10 high)				
Module	***n*** [a]	**Pre-course**	**Post-course**	**Improvement**	***P***	***t***
Module 1: Landforms and geology	86	3.4	7.1	3.8 (3.4, 4.1)	<.001	19.404
Module 2a: Prairie ecosystems	86	4.3	7.9	3.6 (3.1, 4.1)	<.001	14.819
Module 2b: Forest ecosystems	82	3.8	7.2	3.4 (3.0, 3.9)	<.001	15.476
Module 2c: Aquatic ecosystems	80	3.5	7.1	3.6 (3.1, 4.1)	<.001	14.378
Module 3: Conservation practices	86	4.9	8.0	3.1 (2.6, 3.5)	<.001	13.065
Module 4: Conservation communication	86	4.1	7.0	2.8 (2.4, 3.3)	<.001	12.196

[a]complete paired comparisons in evaluation data.

model, program evaluations and planned behavior changes reported in the post-course assessment make a compelling case for the efficacy of this andragogical technique that may find application for comparable natural sciences curricula in similar institutional contexts.

The flipped classroom has been applied in a variety of adult and youth education arenas with demonstrated success (e.g., Herreid & Schiller, 2013). In reviewing the literature on adult learners and flipped classrooms in extension and natural resources education, only relatively short-term instructional programs, such as those associated with a conference (Franz et al., 2014) or workshops (Larkin et al., 2018), were available. Thus, successful implementation of the flipped classroom for sustained instruction in a multi-week educational curriculum with adults reported here further demonstrates the utility of the instructional method in extension programming. The approach as implemented in the MCP ensured that learners across the state received the same baseline educational materials on large-scale challenges related to resource stewardship in the state, while simultaneously tailoring in-person instruction to more localized challenges. This model offers advantages in ensuring consistent educational outcomes across a diffuse extension system while also allowing for substantial local control on educational experiences and foci. Such a model may find widespread application within extension educational systems where system-wide uniformity is a priority and regional-

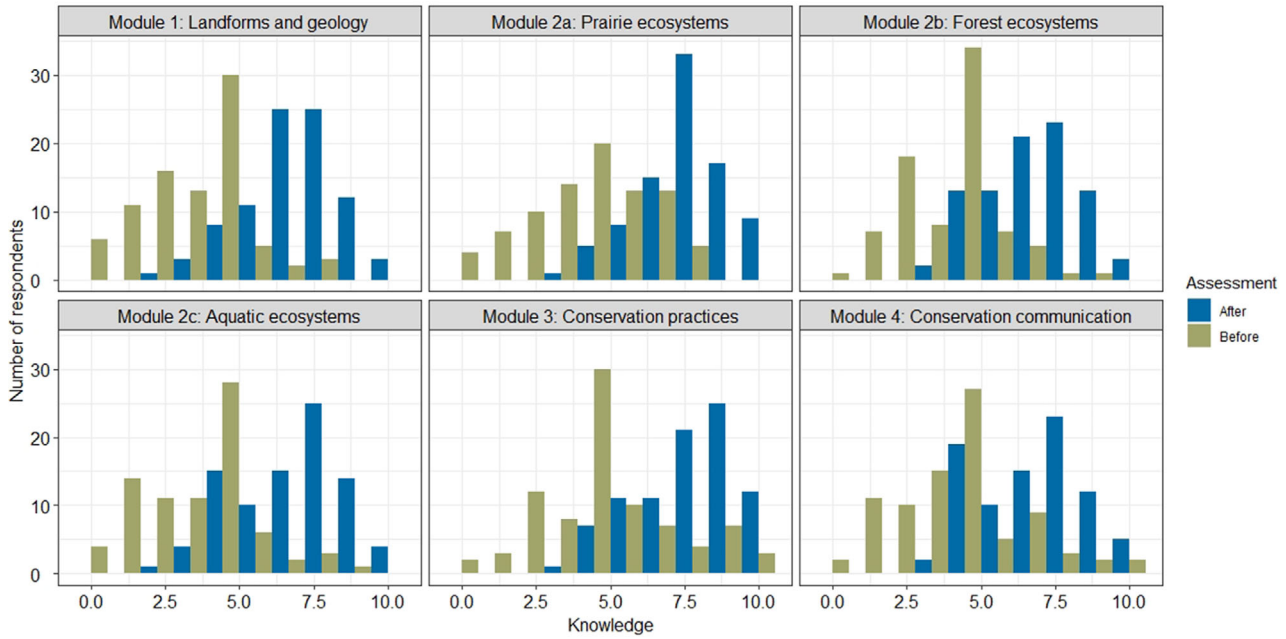

FIGURE 2 Self-assessed knowledge change from post-course assessment of the Master Conservationist Program implemented in a flipped classroom format in Iowa with 89 participants

TABLE 2 Respondent intent to apply lessons from the flipped implementation of the Master Conservationist Program from post-course evaluations. Proportions are the proportion of respondents ($n = 89$) indicating intent to apply lessons from the course for each land use category

		Area with intent to impact (acres)				
Category	**Percent**[a]	**Mean**	**Median**	**Min**	**Max**	**Sum**
Home yard or farmstead	84.3	12.4	1.0	<0.1	180.0	855.0
Forested land	62.7	95.6	19.0	0.5	2,500.0	3,825.5
Row crop	61.4	292.5	100.0	1.0	5,000.0	7,897.0
Prairie or grassland	57.8	171.9	10.0	0.5	5,000.0	5,843.5
Wetland, river, or stream	55.4	64.9	8.0	0.3	1,000.0	1,946.3
City park or public natural area	54.2	313.6	10.0	1.0	3,300.0	10,035.0
Pasture	51.8	32.7	25.0	1.0	100.0	621.0
Other	21.7	24.1	16.5	0.5	80.0	144.5

[a]Percent of respondents indicating intent to impact land in the category.

ization (sensu Holz-Clause et al., 2012) facilitates local adaptation and implementation.

Among a number of possible barriers to successful implementation anticipated in the design of the course was an apprehension among older learners toward web-based instruction and tools (Boellstorff et al., 2013; Gholson et al., 2018). However, we found that despite the tendency for course participants to be in older age categories, we had widespread satisfaction with the online materials used in the course. This finding was further supported by the supplemental question used in 2020 assessments about whether online material enhanced learning, which further supported this assertion with over 85% of responses in the affirmative. Informal discussions with participants during the course and after also suggested they found the material suitably accessible, informative, and an important component of the educational experience in the course.

One component of the success of the online resources for the program may have been the relative ease with which learners could access the materials. Rather than using a formal learning management system with login information or other access hurdles, we developed our online resources as hidden webpages on an otherwise publicly-accessible website (Iowa State University, 2020) . Therefore, learners could

access the materials simply with a link from course organizers without having to worry about login information or having to learn a new user interface. Discussions with participants during instruction suggested they were appreciative of this approach and looked forward to continuing to use online materials after the completion of the course. Our choice to not use a formal learning management system did preclude tracking participant use of online materials or more advanced features like online discussions or assessments, but ease of access and uniform experience across the state was more important in meeting program goals.

Although we could not track individual completion of the online materials before attendance of in-person programs, view counts on online lectures and discussions during course instruction suggested participation in online lessons was high. This is consistent with general theories of adult education that show adult learners are more self-directed and motivated to complete coursework than young learners (Knowles et al., 2011; Ota et al., 2006). Early experiences with the curriculum actually taught course organizers to be judicious in assignment of online materials to avoid confusion over expectations and participants being overburdened with online work before coming to in-person sessions. We structured online resources to clearly convey required and supplemental resources and materials. Required materials generally took ~2 hours to complete and were a combination of recorded lectures from university professors or educators and assigned readings. Supplemental resources were a long list of curated materials from many resources across the state or world relating to the subject of the module. Participants consistently commented on the novelty of having all these disparate resources compiled into one place on the module learning pages as an asset. Online lessons and associated supplements were thus one way to ensure a uniform experience and exposure to priority issues across each offering in the state.

In-person instruction and activities were also highly successful in the revised instructional model. Course organizers were encouraged to spend in-person time (ranging from 1.5 to 3 hours per meeting) outside or in small-group discussions. Most course offerings visited different places for each module, exposing local community members to a diversity of landscapes and natural areas, as well as a diversity of local natural resource educators and experts. Course evaluations consistently indicated high satisfaction with the diversity of sites and speakers used during in-person instruction, indicating that this in-person networking and hands-on aspect of the course was critical, in addition to online materials. A longitudinal study of course graduates would allow us to evaluate whether connections made between educators and course participants during these sessions were sustained for positive impacts, but has not yet been conducted.

The program showed promise for positively impacting conditions on the land based on widespread declared intent to apply lessons from the course to improve a diversity of land types in the state. All participants answering the question whether they planned to impact land indicated an intent to do so, which shows promising potential for direct impacts of the program on environmental outcomes. Documented impacts of actions taken on land following the course would be the most informative metric of course impacts, but unfortunately such an evaluation was beyond the scope of the present study where we only measured intent immediately after course completion. Interestingly, most participants planned to apply lessons in their own back yards (Table 2), which was a promising development in engaging people in recognizing they all have impacts on nature and can improve conditions at any scale (Krasny & Tidball, 2010). Such actions may be small-scale changes taught in the curriculum, such as planting native plants for wildlife or installing rain gardens in local communities. A smaller proportion of course graduates indicated intent to work at larger scales in natural and agricultural areas with lessons learned in the course. Some course participants had disproportionally large impacts on land because they worked for land management companies or public entities like city or county parks departments. Public lands were the single largest category of land with planned impacts in our evaluation, but remaining categories of a variety of private land types comprised over two-thirds the area likely to be impacted. This latter category was the primary stated focus of our curricula, given the diffuse private landownership structure that prevails in the state. Nevertheless, engaging with land managers or public servants could be a future focus of this program or comparable programs with education tailored specifically to applications on large management areas that would increase the total footprint of the program. Additional future directions for the program include efforts to engage with course graduates beyond completion of the curriculum through continued learning, networking opportunities, or formalized volunteer experiences and to assess realized impacts on land beyond stated intent measured in the present study.

5 | CONCLUSIONS

Although many adult natural resources educational curricula successfully use in-person instruction (e.g. Major, 2006), the flipped classroom model of the MCP presented here demonstrates the promise of this blended approach for learning and improving land stewardship. Evaluations demonstrated most participants intended to impact land, collectively summing to over 30,000 acres through just two years of evaluation. The flipped classroom model allowed course organizers to achieve a more standardized experience across the disparate extension system in the state and allowed participants to spend time in conversation and immersed in nature during limited in-person time. Thus, the approach seems like a win-win model for adult

learners to fill knowledge gaps, learn about and in nature, and build community and trust with peers and natural resource educators, ultimately building stronger connections to land and people and hopefully improving environmental outcomes in communities across the state (Tidball & Krasny, 2011). The model also facilitates dissemination of information from campus educators throughout the state in a way infeasible with in-person instructional models over large geographies, thus achieving a central goal for extension in taking the innovations from university researchers out to the people of the state where they can apply it.

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The Master Conservationist Program was successful only because of the dedicated work and leadership of dozens of regional natural resources and extension professionals that organized and led the programs and university educators that assisted in development of online resources. I am grateful to each of these people for their hard work and dedication to implementing the program during 2019 and 2020, as well as dozens more that assisted in pilot phases of the course redesign since 2017. I'm also grateful to the course participants who took the course and provided feedback in person or through the evaluations presented here. Dr. Nancy Franz and two anonymous reviewers provided a valuable review and suggestions for improving an earlier drafts of the manuscript. The survey instrument used for program evaluation was exempt from Institutional Review Board approval at Iowa State University.

AUTHOR CONTRIBUTIONS

Adam Janke: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing-original draft; Writing-review & editing.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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