Active Learning Using Smart Phones in a Flipped Classroom: A Case Study on Developing Final Videos in Silviculture

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Abstract

College students, instructors, and the population at large are increasingly connected through smart phones and tablets, shifting how we interact at a personal and professional level. Smart devices allow students to interact with data and science in novel ways; however, these devices can also be distracting and inhibit student learning. Instructors at all levels of education are beginning to develop activities that utilize smart devices to increase learning. In this case study, smart devices were utilized to create videos in an upper division silviculture class at the University of Minnesota. Students created a final video prescription for a forest stand of their choosing, incorporating knowledge gained throughout the semester. Students' videos were assessed on five major components: (1) the location and land-use history; (2) stand composition, structure, and stage of stand development; (3) goals and objectives; (4) silvicultural systems; and (5) correct use of terms. Video editing and video quality were not included in the assessment. The final video assignment was an alternative to a final exam. The final video assignment allowed students to practice their communication skills and think creatively; skills that have been repeatedly rated as important by prospective employers in the natural resource field. The majority of students surveyed ($n = 21$ of 23) responded positively to this project. This assignment can be easily modified for larger class sizes and different disciplines.

Impact Statement Many students have powerful computers sitting in the palms of their hands everyday. These smart phones can and do offer many distractions but they can also be powerful teaching tools. This article demonstrates one example of how a video filmed on a smart phone can replace a final exam. These videos are a win–win: students enjoy producing the videos, and as an instructor they are more enjoyable to grade.

Core Ideas

- The ubiquity of smart devices is changing classroom capabilities in higher education natural resource classes.
- The final video project extends the active learning environment outside the physical classroom into the forest.
- The final video assignment is essentially a cumulative, open-book exam where students practice presentation skills and interact with technology.
- This assignment can be adapted for other subjects and/or larger classes by shifting the focus of the rubric to encompass the goals of the class.

Technology in and outside of the classroom is changing how natural resource educators interact and teach undergraduate college students (Nilson, 2016). Current students are highly connected, with 85% of college students owning a smart phone in 2015 (Harrison Poll, 2015). The ability to connect to the Internet, smart phone applications (apps)—including social media—and texting offer many opportunities and challenges when teaching undergraduate classes. On the positive side, online learning tools, including apps, allow students to interact with data in new ways. For example, students can use smart tablets to enter forestry cruise data, visualize data on Wiki-pages, and easily access GIS/GPS tools such as Google Earth. On the negative side, one survey estimates that 92% of students use their phones to text during class time (Tindell and Bohlander, 2012). It is unlikely that the distractions that smart phones provide will disappear in the future. Instead of simply forbidding the use of these devices by their students, instructors should develop lesson plans that can compete with or utilize these devices to engage students and deliver content.

There has been an increased push for instructors to engage students through active learning techniques (Prince, 2004; Freeman et al., 2014). It is estimated that participatory active learning methods (i.e., in-class group assignments) have higher retention rates than passive teaching methods (i.e., lectures); retention rates for lectures and readings are 5 and 10%, respectively, compared to a 90% retention rate when students are actively teaching others (Nunn and Jones, 1972).

Case studies—an active learning technique when applied pedagogically—are commonly used as teaching tools in several disciplines (Merseth, 1991; Beck, 2007). They facilitate vicarious learning in a "low stakes" environment (Veal and Taylor, 1995) and promote critical thinking about real-world scenarios. Typically, case studies are presented to students in highly detailed, contextual narratives (Levin, 1995, p.63) that then foster discussion. Active learning techniques are not new to many natural resources, agriculture, and ecology instructors. Many instructors in these fields use a combination of field, lab, and class exercises to deliver key content. However, what is changing is the method of communicating this key content. One method, which is becoming increasingly popular among college instructors, is the "flipped classroom" (Bergmann and Sams, 2012, 2014). A flipped classroom or flipped class literally "flips" how content is delivered. In a traditional lecture, the instructor spends the majority of class

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Abbreviations: apps, applications; GLR, Great Lakes Region; UMN, University of Minnesota.

time delivering content and then students are assigned activities or problem sets to be completed outside of class as homework. In a flipped class, the lecture is delivered outside of class, generally through a pre-recorded audio and/or visual format, while the activities or problem sets are done in class. This shifts class time from mostly passive learning to active learning; active learning activities can include experiments, reviewing case studies, or small or large group discussions. Some benefits of flipped classrooms for students include being able to re-watch lectures, the ability to pause and rewind, the ability to watch when most convenient, and additional interaction with instructors and teaching assistants during class activities (Herreid and Schiller, 2013). This also allows for additional time for students to develop and practice networking and communication skills in a group setting.

Natural resource employers continue to rate communication skills as extremely important when evaluating potential hires (Bullard, 2015; Sample et al., 2015). Undergraduate natural resource students are commonly exposed to multiple forms of communicating, including field reports, PowerPoint and poster presentations, and class debates. These methods of communicating offer many benefits, but a large drawback is that most students do not get the chance to visually see themselves present. Video recording gives students that chance. With the widespread ownership of smart phones and tablets, students have powerful computers sitting in the palms of their hands. This tool allows students to record and, most importantly, watch and listen to how they are communicating information. This process is intended to provide valuable self-evaluation to the student and hasten the rate of improvement in their presentation skills.

Using this technology, a final project was developed in which each individual student creates a video describing a silvicultural prescription for a forest stand of his or her choosing. This assignment was designed to meet the following learning objectives: (1) to enhance student engagement with the discipline of silviculture; (2) to refine students' communication skills; (3) to reinforce students' retention of silviculture concepts and theories; and (4) to have students integrate concepts from silviculture and previous classes when developing a silviculture prescription.

General Design of the Class

Managing Forest Ecosystems: Silviculture (henceforth referred to as "Silviculture"; FNRM 3411/5411) is a mixed undergraduate/graduate-level course offered every fall semester at the University of Minnesota (UMN) (online syllabus available at: https://www.forestry.umn.edu/current-students/course-websites/fnrm-3411-5411). At the UMN, the silviculture lecture and lab are two separate classes. The silviculture lecture attracts a wide range of students with various majors and career goals. Enrollment averages 20 to 30 students; the majority of students (>80%) are undergraduates in their junior or senior year. The silviculture lecture is required for two of the three forestry tracks at the UMN, which are accredited by the Society of American Foresters. Additionally, it is a requirement for the forest ecosystem management and conservation minor, as well as an elective course for environmental science, policy and management majors. The silviculture lab is only required for the "traditional forestry" track at the UMN, and enrollment is generally less than

15 students. The lab focuses on additional quantitative silviculture tools, field trips with different land owners, field exercises, and the use of the USDA Forest Service Forest vegetation simulator.

Silviculture is "the art, science, and practice of establishing, tending, and reproducing forest stands of desired characteristics. It is based on knowledge of species' characteristics and environmental requirements" (Helms, 1998). Silviculture builds and incorporates knowledge from numerous natural resource subjects including soils, forest ecology, entomology, economics, and wildlife management, to name a few (Assmann, 1970). Students are asked to draw from previous courses and incorporate prior knowledge when we discuss silvicultural systems and management planning. Core course learning objectives are to facilitate students' to understand individual tree growth and stand development processes; to develop and build a silvicultural toolbox of important definitions, processes, and methods; to clearly define goals and objectives and how to use these to write silvicultural prescriptions; to understand how silvicultural treatments can influence stand structure and composition and how these changes influence timber quantity and quality, forest health, biodiversity, soil, and wildlife habitat; to understand how silviculture is influenced by broader social, economic, and ecological issues; and to think critically and use knowledge to make informed decisions.

Silviculture is a hybrid flipped class. A hybrid flipped classroom shifts some of the lectures outside of class but not all. In silviculture, approximately 75% of the lecture content is delivered as recorded online videos (https://www.youtube.com/channel/UCEUNM4iJoeTfEe_l5CIQ9Eg).

The hybrid flipped classroom model works well for this discipline due to the large amount of terms, foundational theory, and concepts that must be covered. These aspects are covered in general terms in online video lectures. Students then apply these concepts and terms learned in the classroom by working on case studies, developing and presenting PowerPoint presentations, discussing peer-reviewed literature, and field activities. This creates multiple formats and repetition to allow for increased student learning and retention (Singh, 2003). These in-class assignments represent 50% of the students' grade. The other 50% of the student grade is split between two mid-term exams weighted at 10% each, the final video project weighted at 10%, final project weighted at 15%, and professionalism weighted at 5%.

Final Video Project (The Case)

The final video project required students to apply knowledge gained throughout the semester in silviculture and incorporate content from previous courses and summer experiences. This project integrated the six-core course learning objectives (as outlined in the General Design of the Class section). Students were asked to develop a silvicultural prescription for a forest stand of their choosing (Exhibit 1). In the video, students were asked to address four main topics: (1) the location and land-use history; (2) stand composition, structure, and stage of stand development; (3) goals and objectives[1]; and (4) the

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[1] Management goals are broad, often non-quantifiable ideas describing a future forest state. Management objectives are directly related to management goals but are concise statements regarding treatments and outcomes (Helms, 1998).

Exhibit 1. Instructions for the final video assignment given to students.

Big picture logistics	Due Week 11 Worth 10% of your grade 5-minutes maximum video length
Topics to cover	Where are you? What are the current stand conditions? Stand developmental stage(s) Do you have an estimate for age or whether this is an even-, uneven-, or two-aged stand? What are your goals and objectives for the stand? How are you going to meet your goals and objectives? What kind of silviculture system are you planning to use? What type of active management are you prescribing?
Point distribution	Location (5 points) Current stand conditions (15 points) Goals and objectives (10 points) Silvicultural system (15 points) Correct use of terms (15 points) Time—every minute over 5:30 (−5 points)
Recommendations for video production	Before you start filming, walk around your stand Remember to address regeneration, tending, and harvesting Create a script Check course slides, notes, or online resources to ensure you are using terms correctly You may need to do more than one take You will have the majority of the information needed to complete this assignment by Week 6 or 7

silvicultural systems (regeneration, tending, and harvesting) (see rubric [Exhibit 2] for additional information). An additional component was the correct use of terms throughout the video.

The final video project was broadly introduced during the second week of class. Students were informed that they would be creating a final video, the percentage of their grade it constituted (10%), when the videos were due (Week 11 of a 14-week class), and that the videos were to be watched during the last two class periods of the semester. The introduction was used as a teaser to get students thinking about general topics and forest ecosystems that may be of interest to them and to allow for planning if the desired forest ecosystem was outside Minnesota, Wisconsin, or Michigan (Great Lakes Region [GLR]). Logistical considerations will be addressed in the Lessons Learned section of this article.

During the fourth week of class, the formal final video assignment was handed out. Students were to develop a prescription for a forest stand of their choosing. The forest stand had to be a manageable unit (stands ranged from 10 to 100 acres in size). Each individual student needed to develop management goals and objectives for their stand. This could be done in collaboration with landowner (i.e., private non-industrial forest owner), but this was not required. This lack of required interaction between the individual student and the forest landowner did limit some of the "real world application." Students' prescriptions did not have to balance the needs of multiple stakeholders or fit within management targets. Each student managed his or her selected stand based on his or her stated management goals and objectives. Another aspect that was not considered in the assignment was economic consideration of treatments. These two factors, which are extremely important for students within the "traditional forestry" track are not addressed in this assignment, but are addressed in a capstone project.

The assignment also included additional detail regarding the logistics of the final video project. Students were told

the final video should be less than 5 minutes in length, aspects to cover (Exhibit 2), and that each student must turn in a video individually. Recommendations for developing and filming their videos were also shared (Exhibit 1). These included visually surveying your stand, creating a script or notes on what you plan to say, checking that terms are used correctly, and allowing time to film multiple takes. The requirements focused on content, not stylization. Students were not required to be in front of the camera and could provide voice-over during editing. Students could choose to shoot their video in one take or use multiple takes. Some students used video editing software to add additional features like audio. Students have also involved family, friends, and pets in the filming of the videos. An additional detail that will be added next year is that the student must be the one delivering the content. This has not been a problem in the past, but this line will be added to avoid future issues.

By Week 4, we had covered the majority of the background information, some foundational silvicultural theory, and were beginning to transition to learning about silvicultural systems. To introduce the final video project, two videos that received high grades from previous years were shown as examples. These videos covered the four main topic areas, correctly used terms (and humor), and interesting technology or other creative strategies to draw in the viewer. This allowed students to view this assignment as an opportunity to be creative and explore management techniques and forest ecosystems that were of interest to them. These systems were to serve as the de facto case study narratives—though manifested—that the students would discuss in their videos.

Students were consistently reminded of the due date for the final video assignment as the date approached. During one of the in-class activities during Week 7 or 8, the professor chatted with each student for approximately 3 to 5 minutes to see if (s)he had picked a stand, started thinking about management goals and objectives, and if (s)he had any questions. This allowed the

Exhibit 2. Rubric for final video project in FNRM 3411/5411 Managing Forest Ecosystems: Silviculture. The final video assignment is worth 10% of the student's grade. Students are graded on six main components: location, current stand conditions, goals and objectives, silvicultural system, terms, and time.

		5 points	3 points	1 point	0 points
Location (5 points)		Student describes location and ownership clearly and concisely. Uses at least one additional resource (soil survey, habitat type, Google Earth) to set ecological context for the stand	Student describes location and ownership clearly and concisely. Uses no additional resources to set ecological context for the stand	Student provides limited information on location and ownership. Information may be confusing or difficult to understand	Student gives no background information on the stand.
Current stand conditions (15 points)	Composition	Student identifies to species current overstory, saplings, and seedlings species. Student gives examples of these species in video. Silvics information on important species is presented to give context for goals and objective and silvicultural system used.	Student identifies some individuals to species but may group other species by genus. Limited discussion of individuals in seedling and sapling layer.	Student provides limited information on current overstory. No additional information on the silvics is provided.	Student provides no information on species present in the stand.
	Structure	Student describes current structure with reference to expected diameter distribute (reserve-j, unimodal, bimodal, etc.). Describes structure in overstory and regeneration layers.	Student describes current overstory structure but does not provide information on regeneration layer.	Student provides limited information on current stand structure. Information provided is either incorrect or not presented clearly	Student provide no information on current stand structure
	Stand development	Student describes current stage of stand develop based on Oliver and Larson (1996) description. Relates current stage of stand develop with stand composition and structure	Student describes current stage of stand develop based on Oliver and Larson (1996) but provides little context.	Student inaccurately describes current stage of development	Student provides no information on stage of stand development
Goals and objectives (10 points)	Goals	Goals are clearly articled and follow the *Adaptation Workbook* (Janowiak et al., 2012). Student provides at least two goals for the stand.	Goals are less clearly articled and follow the *Adaptation Workbook* (Janowiak et al., 2012). Student provides at least one goal for the stand.	Student may provide a goal but either may be suited as an objective or not a suitable fit for the stand.	Student provides no goals for the stand
	Objectives	Objectives are clearly articled and follow the *Adaptation Workbook* (Janowiak et al., 2012). Student provides at least one objective for each goal. Objectives fit with previously described goals.	Objectives are clearly articled and follow the *Adaptation Workbook* (Janowiak et al., 2012). Student provides at least one objective for each goal. Objectives may not fit with previously described goals.	Objectives are not clearly articulated. Objectives do not fit with previously described goals.	Student provides no objectives for the stand

(continued next page)

Exhibit 2. Continued.

Silvicultural system (15 points)

	5 points	3 points	1 point	0 points
Regeneration	Student clearly describes methods for successfully regenerating the stand. Differentiates between natural and artificial regeneration. Includes sufficient detail, which may include species, density, site preparation methods, browse control, etc. Regeneration methods fit with aforementioned goals and objectives	Student provides some detail on methods for successfully regenerating the stand. Information on species, density, type of regeneration may be missing. Regeneration methods may or may not fit with aforementioned goals and objectives	Student provides little detail on methods for successfully regenerating the stand. No reference to species, density, or type of regeneration is given. Regeneration methods do not fit with aforementioned goals and objectives.	Student does not discuss regeneration methods
Tending	Student clearly describes intermediate treatment methods used or why intermediate treatments methods are not prescribed. Includes sufficient detail on thinning, weeding, or other tending methods. Tending methods fit with aforementioned goals and objectives.	Student provides some detail on intermediate treatment methods used or why they will not be used. Tending methods may or may not fit with aforementioned goals and objectives.	Student provides little detail on intermediate treatment methods used or why they will not be used. Tending methods do not fit with aforementioned goals and objectives	Student does not discuss tending methods
Harvesting	Student clearly describes the type of harvest system and differentiates between even, two, and uneven-aged systems. Student describes what will be harvested which may include species, density to be removed, plans for snags and down dead wood retention, etc. Student will reference at least one management document (manager's guide book, peer reviewed or gray literature, etc.). Harvest system fits with aforementioned goals and objectives.	Student provides some detail on the type of harvest system used but additional information is lacking. No references aided in developing the harvest system. Harvest system may or may not fit with the aforementioned goals and objectives.	Student provides little detail on type of harvest system used and no additional information is provided. No references aided in developing the harvest system. Harvest system does not fit with aforementioned goals and objectives.	Student does not discuss harvest methods

Terminology (15 points)

15 points	11 points	7 points	3 points
Student uses correct terms throughout the video. Terms convey information on the goals and objectives and silvicultural system.	Student uses correct terms the majority of the time. Terms may have been unclear or been used incorrectly less than 3 times.	Student uses correctly terms half of the time. Incorrect use of terms is present in goals and objective and/or silvicultural system.	Students uses terms incorrectly and/or terms are wrong.

Time (5 points)

5 points	3 points	1 point	0 points
Student uses time allocated to cover topics clearly and concisely. Student does not go over time by more than 30 seconds.	Student goes over time by more than 1 minute or student did not use time effectively covering required topics.	Student goes over time by more than 2 minutes or student provides limited information on required topics.	Student use of time management is poor. Student did not follow direction on topics to cover.

professor to have an even better understanding of the students' interests to design future assignments and gave the students an opportunity to ask specific questions.

Prior to the videos being shown in class on the last 2 days of class, the videos were graded based on the rubric. Students received written feedback with their grade. In future years, students will receive a copy of the rubric when the assignment is distributed.

Exhibit

The forested stands students chose to cover ranged geographically and compositionally, as well as in landownership. With case studies highlighting a diversity of locations, students were better able to get a sense of the variety of forest conditions that exist—exposure that is critical for an aspiring land manager.

Students' videos broadly fit into three categories: private forest stands in the GLR, public forest stands in the GLR, and forest stands outside of the GLR (Exhibit 3). To discuss the three categories in more detail, we will use three students' videos as examples.
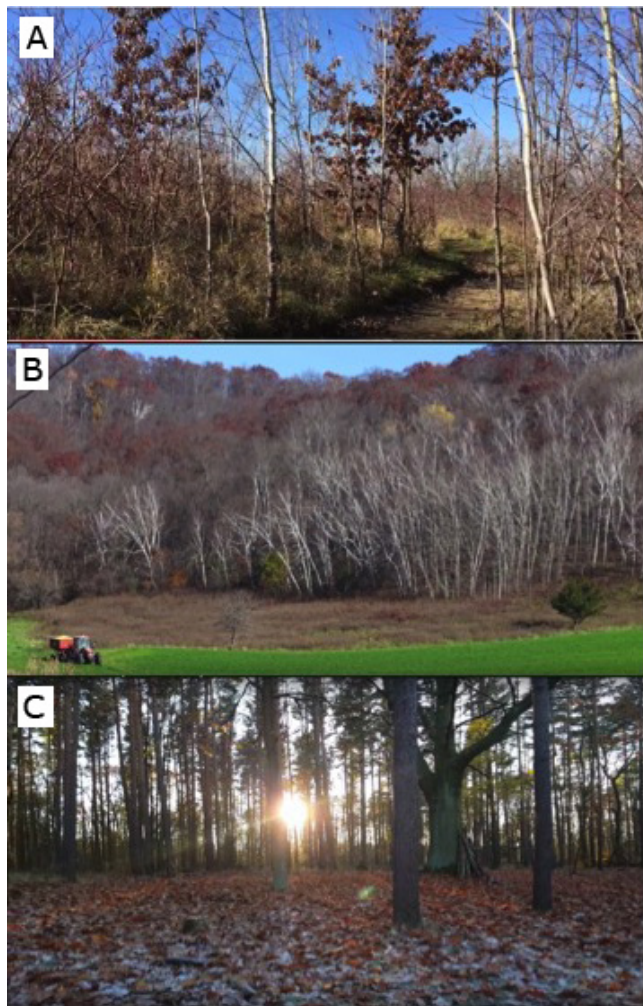

Exhibit 3. Exhibits video image examples from (A) public forest-land (Michael Bahne), (B) private forestland (Marissa Schmitz), and (C) forestland outside of the Great Lakes Region (Daniel Yoder).

Public Forest Stands in the Great Lakes Region

Students who shot videos on public ownerships split relatively evenly between traveling northward in Minnesota, Wisconsin, or the Upper Peninsula of Michigan and staying within 50 miles of the UMN St. Paul campus. One student chose to film his final video at Lake Rebecca. Lake Rebecca is located within 30 miles of the Twin Cities Metropolitan Area and is currently undergoing active forest management to restore hardwood forest plant communities (Exhibit 3A). The student presented current management practices at Lake Rebecca and also included goals and objectives that he developed for the stand.

Private Forest Stands in the Great Lakes Region

Those students who developed silvicultural prescriptions for private lands generally filmed on non-industrial forestland owned by their family or friends. The private forestland students surveyed in this assignment included (1) land that was actively managed for state tax incentives and (2) land for which there was no management plan. In either case, during the process of making the video, the landowners engaged the students, often asking about the implications of ongoing or potential management.

The familiarity students had with the landowners allowed the students to incorporate the landowner in the video-making process and facilitated an active teaching opportunity. In receiving assistance from the landowner in the development and filming of the video, students conveyed information about management practices, silvics, and the correct use of terms. This type of communication is representative of interactions they will likely encounter in their future occupations.

One student chose to film her video on a friend's working farm and forest in southwestern Wisconsin. The friends had recently inherited the farm and had some questions concerning the previous management plan. This was an opportunity for the student to extend the conversation of differing goals and objectives, and the role of active management on her friends' land, given the land's enrollment in Wisconsin's forest tax law. For students in the class, this video demonstrated the often complicated relationships landowners may have with state agencies that generally arise from conflicting management objectives.

Forest Stands Outside of the Great Lakes Region

Students are regularly encouraged to think about choosing a location outside of Minnesota and the GLR for this assignment. While not possible for some, for other students who travel for conferences, field work, or personal reasons, this is an opportunity to highlight a forest type that the class would not otherwise see.

An example that truly highlights this novel experience was a prescription developed for a mixed hardwood–Scotch pine (*Pinus sylvestris* L.) stand in the Grunewald Forest in Berlin, Germany. The student walked the class through a brief history of how past wars have shaped the forest's current structure, the unique goals and objectives for the stand, the prescription that he developed, and terminology differences in silviculture between the United States and Germany. During a few of the early lectures in silviculture, the class discusses how Europe has influenced silviculture

in the United States. Viewing this video on the final day brought the class full circle. After watching the video, we had a brief discussion on similarities (e.g., sandy soils in Germany and the United States both support pines) and differences. It also displayed that the theory and basic understanding of silviculture translates across borders.

Student Feedback

Of the 36 students who participated in this assignment, 23 (or 64%) completed an assessment of how the final video impacted overall learning and retention of silviculture concepts. The online assessment administered through Qualtrics (Qualtrics, Provo, UT) allowed students to submit their responses anonymously and skip any question or parts of the question. This was a voluntary survey that was completed after the end of the semester. Students had already received grades for this assignment and the course. Students had no incentive to select positive responses or comments.

Students were asked a series of 10 questions and their level of agreement or disagreement for each question (Exhibit 4). The vast majority of students responded positively to the assignment with all but one student agreeing or completely agreeing that the final video project increased his or her retention of silviculture terminology and concepts. More than 90% of students responded that the final video project positively impacted their learning in silviculture and that they would keep this assignment in future years. Almost 70% of students shared the final video project with friends and/or family, extending the value of the learning experience outside of the classroom. Students responded more variably to questions concerning the amount of time invested in the video and the ability to evaluate their communication skills. However, students

who did respond neutrally or negatively to these questions did not provide additional comments on their experience or how the project could be improved. Future survey questions may include the amount of time spent making the video, if students reviewed their notes before filming, and a specific question regarding comments to improve the assignment for future years.

Lessons Learned

When originally developing this exercise, the professor had three goals: (1) to encourage students to get outside, (2) to develop an alternative to traditional final exams to evaluate students' proficiencies of the material covered in class, and (3) to provide students an opportunity to practice a different form of communication. Student videos delivered on all three of these goals.

Reflecting on this assignment, there are two areas that stand out: student creativity and logistics. As stated throughout this article and in the rubric, students are graded on video content and not video quality or creativity. That being said, during the past 2 years that this assignment has been implemented in silviculture, students have delivered a high level of craftsmanship and taken ownership in their videos. The willingness to take creative chances with the video could be attributed to the open-endedness of the assignments in terms of video editing, the sense of community that is developed throughout the semester from repeated group assignments, and the reassurance students get on topics and ideas during the individual check-ins. The students' freedom to express themselves creatively allows each student to take a slightly different approach to his or her video. A few examples of this creativity include the addition of outtakes or bloopers, the use of a British accent to mimic the British Broadcasting

Exhibit 4. Results of a 10-question assessment of the silviculture video final project on students' learning and retention of silviculture concepts.

	Completely agree	Agree	Neutral	Disagree	Completely disagree
The final video tested me on similar concepts as a final exam	11	9	1	2	0
The final video project helped tie together concepts learned throughout the course	15	8	0	0	0
The final video project increased my retention of silviculture terminology	14	9	0	0	0
The final video project increased by retention of silviculture concepts	12	10	1	0	0
I invested more time creating my final video than I would have spent studying for a final exam	8	7	5	3	0
The final video project allowed me focus on a topic that was of interest to me	16	6	1	0	0
Overall, the final video positively impacted my learning in silviculture	17	4	2	0	0
I would recommend keeping this project for future students	18	3	1	1	0
Hearing and/or seeing myself speaking allowed me to evaluate my communication skills	10	5	5	3	0
Viewing others' videos demonstrated the diversity of management options and forest types that exist	13	8	2	0	0

Corporation's nature documentaries, and the use of drones to capture a different perspective (looking down instead of up). The use of creativity coupled with the broad interests of those in the class enabled them to focus their management prescriptions on personal areas of interest, such as songbird habitat, morel propagation, and water quality. For example, one student wrote, "I thought it was interesting how each student applied the concepts they learned through the semester to an actual forest setting. It was not exhausting like listening to multiple Power Point presentations from students." This diversity in topics covered not only provides brief, focused case studies of objectives covered in class, but also punctuates the overarching philosophy this course intends to impart: in the face of uncertainty, managers need to manage for complexity (Puettmann et al., 2009).

Although this assignment does provide students with a large amount of freedom, the suggestion to create a script or create a draft of what they plan to say on camera and the development of the rubric ensures that students focus on the four main components. The script is analogous to an open-ended, open-book exam question. The addition of the terminology component motivates students to consider what they are going to say and check notes or the textbook to make sure they are using the terms correctly, which increases retention rates. This is captured in this student's review of the project: "Behind 3–5 minutes of video there are a lot of hours of preparation of the script, which makes you go over all the material again, and tie [in] most of the concepts learned during the class." Finally, creating a viewing "party" with popcorn the last 2 days of class keeps attendance and morale high at the end of the year.

Challenges with this project have been most often related to logistics. The first and most important logistical constraint to consider is access to some kind of video recording device, most often a smart phone. The instructor addresses the technology limitation the first time the assignment is introduced (Week 2). Students who do not have access to a smart phone are encouraged to contact Library Services at the UMN. Here, students and professors can check out video-recording equipment. These reservations do need to be made in advance. The instructor would encourage instructors and professors who consider adopting this assignment to contact your library or technology resource centers to see what kind of equipment is available.

The second most important logistical challenge for this assignment is turning in the assignment. It is most efficient and effective to have students upload their videos to their Google account (UMN email is hosted through Google) or YouTube and then share the videos with the instructor. Privacy settings on YouTube allow for the content to remain private. This is the most frustrating part of the assignment for students. As noted by one student, "Working through technology issues on my own made the video making/editing process very stressful." A potential future option to turn in the video could be on a portable memory device, such as a memory stick.

Modifications for Other Subjects and Larger Class Sizes

A final video project could be modified for numerous natural resources, agriculture, and ecology undergraduate or graduate classes. A very similar assignment was used as a replacement for a traditional midterm exam for a natural resources Measuring and Monitoring course. Students in the Measuring and Monitoring course were asked to create a video in which they demonstrated how to perform a common natural resource field method of their choosing. Similar modifications could be made for other subjects. For larger class sizes, the instructor could modify the assignment in two ways: by selecting a subset of students' videos to be shown during class or by turning the assignment into a group assignment. In the latter modification, the rubric should be modified to allow students to critique group members' participation.

To enhance the project, an instructor could partner with local stakeholders in need of silvicultural prescriptions and use a modified version of this assignment as a service-learning opportunity. *Service learning* is defined as "a structured learning experience that combines community service with explicit learning objectives, preparation, and reflection" (Seifer, 1998, p. 274). Although some of the projects from this case study aligned with the principles of service learning, it was not the intended purpose of this project. It was rare for a student to truly provide the service of a forester to a stakeholder—therefore, the "community service" aspect of this project was too often missing for this assignment to be considered true "service learning." If, however, one were able to pre-empt this assignment with meetings with public or private agencies that could utilize the prescriptions students developed, this assignment could easily expand into a service-learning assignment. This would, however, restrict the number of sites students could assess as an instructor would have to have an agreement from the landholder permitting access and knowledge of the system to validate management recommendations.

Conclusions

Students are increasingly connected, with many owning smart phones and/or tablets. The development of this assignment seeks to use this new technology to practice communication skills. The final video project represents an alternative to a traditional comprehensive final exam. This video assignment facilitated forester-to-landowner interaction—either directly or indirectly—and provided students a self-evaluation of their presentation skills. Slight modifications can be made to transform this assignment for larger classes or different disciplines.

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About the author...

Marcella is an assistant professor of silviculture at the University of Minnesota in the Department of Forest Resources. Her most memorable classes as an undergraduate and graduate student involved multiple ways or activities to interact with the material to gain a greater understanding of the subject. Marcella strives to provide the same opportunity for her undergraduate and graduate silviculture students. One activity that is especially enjoyed by students is swapping a final exam for a video using smart phone technology. This allows students to explore topics that are of interest to them.