

Implementation of Teaching Methods to Develop Plant Identification Mastery among College Students

Sarah Striegel and Erik Christian
Iowa State University

INTRODUCTION

Individuals in the field of agronomy work with a vast number of diverse plant species during their career. Whether that plant might be a cultivated crop, a forage grass or legume, or a weed, being able to identify what plant one is working with is a key skill for all agronomists. Plant identification is a common component of the Agronomy Core Coursework at Iowa State University. Some courses even focus primarily on plant identification, such as Weed Science Identification or the course that was my particular area of focus, Crop and Seed Identification Laboratory. Completion of this course is often precludes the Intercollegiate Crops Team course, hereafter referred to as Agron. 331, but is not a requirement.

The Crop and Seed Identification Laboratory, hereafter referred to as Agron. 330, is a two credit course that is offered during the fall semester, where it meets once a week for three hours. The Iowa State University Course Catalog provides the following course description: "Identification, agronomic, and binomial classification of crops, weeds, and diseases. Analysis of crop seed samples for contaminants of weed and other crop seeds" (Agron 330.) Identification of the plant species consists of vegetative, reproductive, and seed stages. This course had 19 students enrolled in the Fall 2017 semester. Each week, students took a quiz over species they had learned. They also learned about 7-12 new species from student presentations. Students also worked in groups to create a dichotomous key for a plant family, such as the Poaceae family.

I previously served as the teaching assistant for Agron. 330 in Fall 2016 and returned for the Fall 2017 semester. During my time in this role, Dr. Erik Christian and I implemented new teaching methods and course organization to help further develop the plant identification skills of the students and foster mastery in the field. I had also learned about mastery techniques in some Curriculum & Instruction courses. This is important as identification is an essential skill for Agronomy students in their future careers and could lead to the students' success in Agron. 331 and potential selection to compete on Iowa State's Intercollegiate Crops Team.

OBJECTIVES

New teaching methods and course organization were implemented for Agron. 330 in the Fall 2017 semester to aid in developing plant identification mastery among the enrolled students. These changes were fulfilled with the following objectives in mind:

- To develop a species list that emphasizes the appropriate vegetative, reproductive, and seed identification skills for an individual working in the field of Agronomy.
- To establish similarities and differences between species through grouping according to taxonomic family and identifying similar morphological characteristics.
- To determine the relative effectiveness of a mastery requirement in students' identification performance in comparison to traditional methods.

METHODS

Prior to the beginning of the Fall 2017, changes were made in alignment with the objectives to promote plant identification mastery among enrolled students. These changes were reflected on the course syllabus, species list, and any subsequent materials developed for the course.

- The species list was edited to better represent general expectations of students working in agronomy industry roles upon graduation. This included adding species and adjusting the required identification at the vegetative, reproductive, and/or seed stages. A greater emphasis was shifted to vegetative identification, especially of weeds. The species list and syllabus were adjusted to reflect the changes.
- The species list was changed from past formatting by use (cultivated crop, etc.) to a list organized by taxonomic family (i.e. Fabaceae, or bean family, etc.). The syllabus was adjusted as well to reflect the new list and the new order in which students learned the species. This allowed students to learn the species within a family with similar morphological characteristics at the same time, therefore immediately identifying differences between species which are easily confused rather than learning these differences throughout the course. In-class worksheets were developed to facilitate connections amongst species belonging to the same taxonomic family. See Figure 1.
- A requirement for unit mastery prior to course continuation was implemented. This required students to fully understand the material before moving onto new plant species. It was hypothesized this requirement would lead to a better overall performance in the course in comparison to traditional methods. Mastery of the unit was demonstrated by an expected performance level of 27/30 (90%) on the weekly in-class quiz. If a student failed to meet the mastery requirement on the first quiz, a supplemental quiz was offered each week to replace the previous quiz score. If a student failed to meet the mastery requirement on the supplemental quiz, a supplemental learning session with personalized study materials would be offered to augment their score and understanding of the material. The syllabus expressed each of these requirements and was presented in entirety to students on the first day of class.

Agronomy 330: Plant and Seed Identification List					
p = flowering to mature stage		v = vegetative stage		s = seed	
Fabaceae			Poaceae (cont.)		
001	alfalfa	v s	052	grain sorghum	p v s
002	alsike clover	v s	053	green foxtail	v
003	arrowleaf clover	v s	054	indiangrass	p s
004	birdsfoot trefoil	v s	055	johnsongrass	p
005	common vetch	v s	056	painted gnatgrass	p
006	cowpea	p v	057	Kentucky bluegrass	p v s
007	purplehull cowpea	s	058	large crabgrass	v
008	blackeye cowpea	s	059	little bluestem	p s
009	crimson clover	v s	060	oat	p v s
010	crownvetch	v s	061	orchardgrass	p v s
011	fieldbean	p v	062	pearl millet	p s
012	black turtle fieldbean	s	063	perennial ryegrass	p v s
013	navy fieldbean	s	064	proso millet	p s
014	great northern fieldbean	s	065	quackgrass	v
015	red kidney fieldbean	s	066	reed canarygrass	p v s
016	pinto fieldbean	s	067	rescuegrass	p v s
017	fieldpea	p v	068	rice	p v s
018	Australian winter fieldpea	s	069	rye	p v s
019	green mungbean	p v s	070	smooth bromegrass	p v s
020	garf	p v s	071	sideoats grama	p
021	hairy vetch	v s	072	sudangrass	s
022	Korean lespedeza	v s	073	switchgrass	p s
023	lentil	p v s	074	tall fescue	p v s
024	peanut	p v s	075	teff	p s
025	red clover	v s	076	timothy	p v s
026	sericea lespedeza	v	077	triticale	p s
027	sicklepod	v	078	wheat	p v
028	soybean	p v s	079	hard red spring wheat	s
029	sunn hemp	v	080	hard red winter wheat	s
030	sweetclover	v s	081	hard white wheat	s
031	white clover	v s	082	soft red winter wheat	s

Figure 1: A portion of the updated species list, organized by taxonomic family.

RESULTS

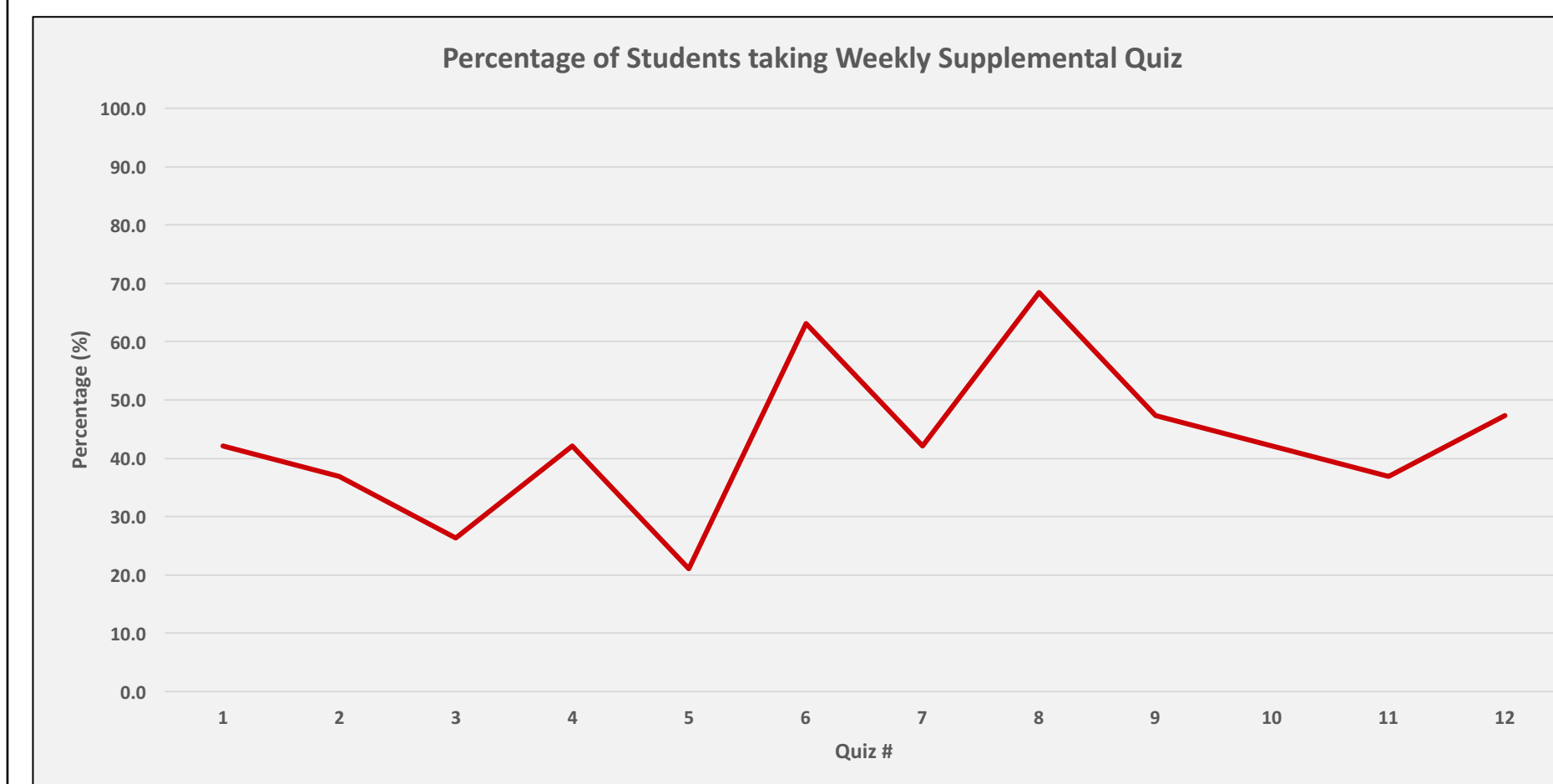


Figure 2: Percentage of students required to take the supplemental quiz after failing to meet the expected performance level.

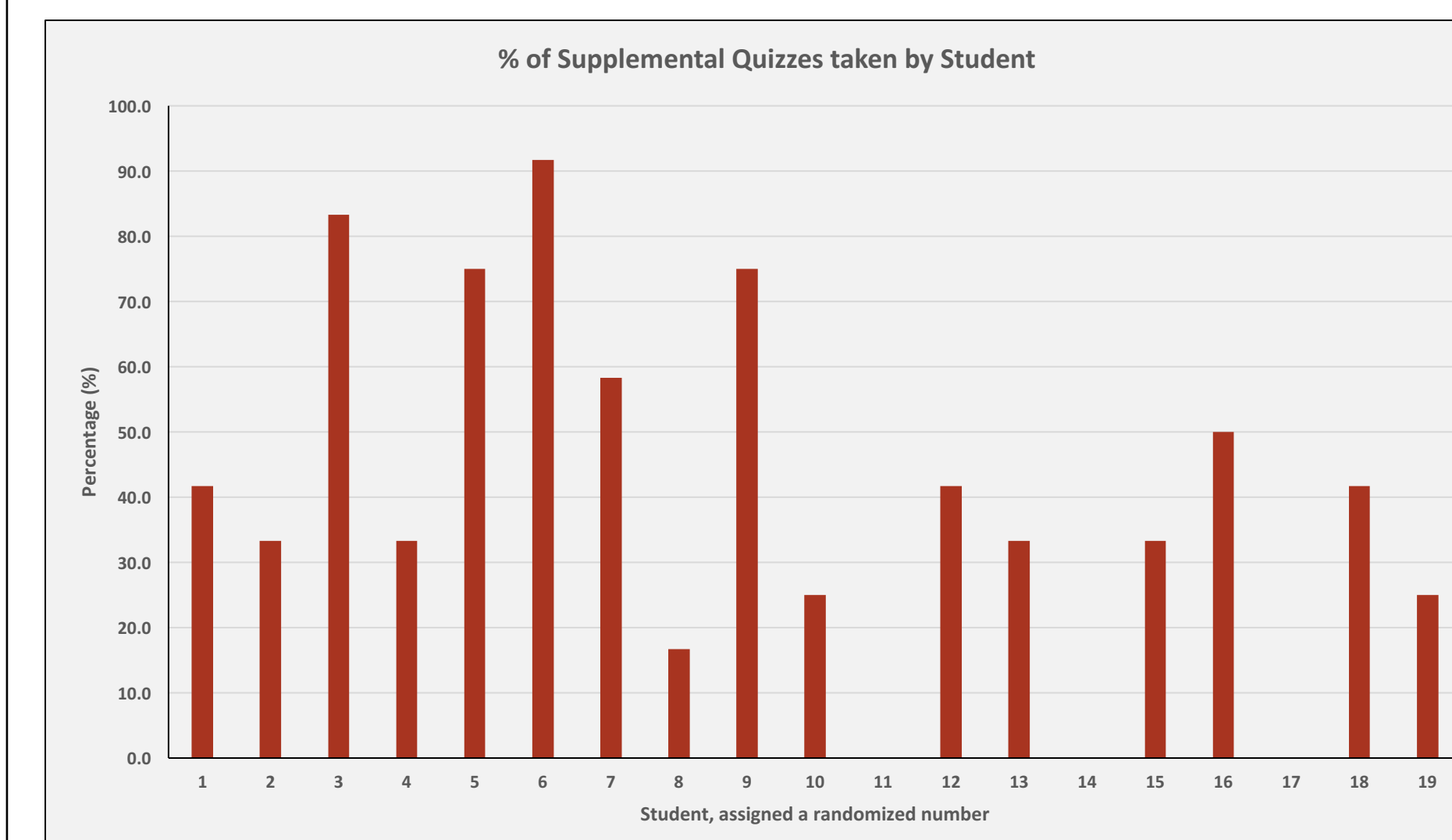


Figure 3: Percentage of supplemental quizzes students were required to take to meet the expected performance level.

Relevant Identification:

Greater emphasis on vegetative identification led to some new challenges. Namely, it was challenging to supply plants at different vegetative stages for students to study as some were more difficult to start from seed. In past semesters, these plants were not available at all and their vegetative identification were not required. Mounts (pressed, preserved plants) were often used for vegetative identification even if they displayed the reproductive stage, which some students found confusing and/or challenging. Vegetative seedling identification was not extensively implemented due to the combined challenges of the delicateness of the seedling plants and failed germination resulting in a shortage of samples. Despite the challenges faced, students expressed the list modifications allowed for an emphasis on relevant identification.

Most Missed Species:

Trends in which species at which stages were missed most remained fairly consistent with past semesters. Students were recently asked to state which three things they were struggling with most in the class. Top responses included: wheat seeds, *Poaceae* vegetative and seeds, and *Fabaceae* vegetative. In Fall 2016, the top responses were the same.

Meeting the Expected Performance Level:

Each student met the expected performance level on the initial, in-class quiz at least once, while some students met the expected performance level initially every time. An average of 43% of students were required to take the supplemental quiz each week, with a range of 20-70% of students taking a supplemental quiz. See Figure 2. Student improvement in regards to meeting the expected performance level was also monitored. See Figure 3. Students consistently failing to reach the expected performance level were offered additional help and advice in regards to studying for the course.

CONCLUSION

- The revised list better represented the identification skills necessary to work in the field of Agronomy, as expressed in student responses regarding the course changes.
- In comparison to past semesters, students still struggled with similar species and taxonomic families according to student responses. However, students also expressed the course schedule and learning the species by family helped with their dichotomous key assignment and identification performance. **It was determined the organization by taxonomic family aided in identification.**
- Student grades can serve as an indicator of performance in any given course, but the nature of mastery requirements inherently improves all grades. The goal was not to improve grades but to increase student understanding. **It was determined the new teaching method resulted in a greater percentage of students to reach a level of understanding indicative of mastery.**

REFERENCES

Iowa State University. Courses and Programs. Course Catalog. Agron. 330. Accessed 20 February 2017.
<<http://catalog.iastate.edu/azcourses/agron/>>

RELEVANT MATERIALS

- Fall 2017 Course Syllabus
- Fall 2017 Species List
- In-Class Worksheets
- Class Assignments
- Supplemental Quiz Sign-up Sheets