Online course design in higher education: A case study of Colorado Community Colleges Online

Margaret Gaddis

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Dr. Bynum

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Abstract

This project addresses the General College Botany course redesign. This document describes the Colorado Community Colleges Online organization, the educational theory with which the design process is cultivated, the design process itself, and the primary assessment developed for the course. Theories of andragogy, backwards design, self-reflection, and assessment are discussed. The design process is described in enough detail for a reader to be able to enact a similar process. Likewise, the assessment is described thoroughly so it could be replicated for another course. As such, this document is both an article of preservation, marking the specifics of the CCCOnline course design process at this time, and a manual of best practices for interested readers.

Keywords: instructional design, backwards design, authentic assessment

Online course design in higher education: A case study of Colorado Community Colleges Online Colorado

Community Colleges Online (CCCOnline) is an award-winning service organization associated with the Colorado Community College System (CCCS). The CCCS is the largest system of higher education in Colorado, serving 144,000 students annually at 13 colleges. CCCOnline uses a master course development program to design and redesign its course offerings. The design process described in this document is relevant to any CCCOnline course and could be applied to the design process at another institution with similar demographics and service goals. In addition to the design process, the document presents the specific learning activities and assessments relevant to a contemporary online course offered at a community college. The purpose of this publication is to describe the systems used by CCCOnline to provide a best management practices perspective for readers interested in pursuing online course development at their institutions.

The Organizational Characteristics of CCCOnline

The CCCS is governed by the State Board for Community Colleges and Occupational Education (SBCCOE). The CCCS vision is “that Colorado community colleges are unsurpassed at providing quality educational opportunities for all who aspire to enrich their lives.” ("About CCCS," 2016).” CCCOnline was created in 1998 to serve students with online education opportunities. In 2012, annual enrollment was 50,000 in 230 courses ("CCCO Strategic Plan," 2013/2014). Courses taken through CCCOnline are transcripted by the student’s home college within the CCCS. Each home college within the CCCS is independently accredited by the Higher Learning Commission.

In the fall of 2014, CCCS served 40% of all resident undergraduates and 48% of all undergraduate students of color in Colorado. 35% of CCCS students are students of color, 55% are female, and 56% are under 25 years old. On average, student wage potential increases by 17% after attending CCCS even without degree attainment. The largest wage gains are seen in the health science sector where graduating students increase their wage potential by 97% and in the dental hygiene sector where graduating students increase their wage potential by 230%. 40% of all degrees and certificates awarded by CCCS are related to health science majors and careers. Tuition costs are approximately $3,900 per year. The CCCS's total economic impact is $3.01 billion annually, or equivalent to 55,800 jobs created ("CCCS Fact Sheet," 2016).

The Course Development Process

The overarching goal for the CCCOnline's course development is to have 100% of the courses offered by CCCOnline Quality Matters certified. Quality Matters (QM) is an international organization that provides guidance to higher education and K-12 institutions to ensure quality in online education. QM is a faculty-centered, peer-review process for course design. With 900 subscribers, QM is recognized as the leading quality assurance organization ("Quality Matters," 2016). All CCCOnline administrative leaders and many faculty members have participated in Quality Matters training and some are certified peer-reviewers. Numerous courses developed by CCCOnline have won national merit awards ("CCCO Strategic Plan," 2013/2014).

The QM organization provides course review in addition to professional development training. Graduates of the professional training programs can become reviewers, an accolade that confers professional respect within the realm of online education. As such, the organization increases quality through faculty and course development. QM is similar to the Higher Learning

Commission's Academic Quality Improvement Program (AQIP), which is described as an accreditation program in which reviewers "act more like consultants than gatekeepers" (Cullen, Harris, & Hill, 2012, p. 86). The rubrics employed in the QM process provide important scaffolding for the CCCOnline master course template.

CCCOnline does not add new courses frequently because the course offerings are based on demand in the CCCS. Most of the courses CCCOnline offers are Guaranteed Transfer (GT) courses. GT courses are described in the Colorado Common Course Numbering System (CCNS). The CCNS listing provides a title for a course, the credit hours, the learning outcomes and a topical outline ("CCCNS," 2016). GT courses are guaranteed to transfer to any institution of higher education in Colorado. The design process subsequently described is a process for redesigning courses as they become antiquated. Courses can become antiquated in pedagogy, technology, or due to master course template revisions. Courses are identified for redevelopment by the Dean, Chair, or faculty. The whole design cycle takes approximately one year from course identification to course launch.

CCCOnline uses an integrated team approach for course design. The team consists of a Subject Matter Expert (SME), an Instructional Designer (ID), and the Program Chair (PC). Puzziferro & Shelton (2014) emphasize the importance of a team-based approach due to the myriad skills required to enact quality course design. The SME and ID have different terminal degrees, the former emphasizing discipline-related knowledge and the latter emphasizing the technological skills required to build an online course. The Program Chair brings leadership skills and a specific knowledge of the administrative culture of the institution.

The SME is selected from the faculty who currently teach in the department. Faculty interested in participating in course design have to complete a self-scheduled, asynchronous

SME training, which describes the course development process and defines the roles for each of the team members. There are several IDs who work for the organization and they all design courses for every discipline so there is continuity in learning experience across disciplines when a student takes a CCCOnline course. The ID selected for a particular course design is a matter of availability, not one of differentiated skill. All IDs are trained to build courses according to the master course template, which is based on the quality criteria outlined by QM.

Once the team is selected, a first meeting occurs. This first meeting is an important equalizer as it defined the roles for each team member. It also shapes the vision for the course and establishes a timeline for the project. The team discusses the student demographic and the degree requirements that bring students to the course. The team reviews the CCNS learning outcomes and drafts course outcomes. The SME has personal knowledge of the existing course and shares this experience at the first meeting. However, the SME does not have any design control and must operate within the framework developed by the Instructional Design Department. Therefore, the meeting initiates the leadership of the ID who is responsible for driving the scheduled process according to the organization-wide policies and master course template. The PC does not play an active role in the design process, but is present throughout to monitor compliance with the organizational policies and to provide mediation for the SME and ID if needed.

CCCOnline enacts backwards design, a course design process in which the outcomes of the course are developed first, then the assessments, and finally the learning activities (Wiggins & Mctighe, 2005). The concept of backwards design is important to the standardization and accountability within the CCCS and within the Colorado higher education system as a whole. It guarantees that the learning activities promote knowledge attainment in the CCNS-specified

course competencies. This ensures that the educational product offered provides a specific learning experience that can be sequenced into a degree, career, or technical education program.

After the first meeting, the SME sets to work developing the course map. The course map is an essential component of backwards design. The course map identifies the structure of the course according to the CCNS course competencies. The modules each address specific CCNS course competencies, rather than follow the sequence of learning objectives presented in a textbook or other primary text for a course. Once the course competencies are mapped to each module, the SME develops learning outcomes that relate to the specific activities within the course. The course map is developed in a spreadsheet program so that seat time can be calculated for each course event, whether it is instructional time, reading time, learning activities, or assessments. Seat time is a concept that is waning in popularity (Cullen et al., 2012), however it still plays an important role in the CCCS as it equates to the credit hours assigned to each course. Seat time calculations provide another layer of accountability for the CCCS and standardization for students who are planning their academic time.

The SME must produce the course map according to time schedule specified by the ID. Once the map is submitted, the SME, ID, and PC have another meeting, which is called the kick-off meeting. In the kick-off meeting, the course vision and outcomes are finalized and the course map is discussed and reviewed. In many ways, the kick-off meeting is a formative assessment for the SME. The development of the course map is the first proof that the SME is capable of conceptualizing the course design. If the course map does not meet the standards of the ID and PC, additional mentoring ensues. The finalized course map is a contract for process from which the SME and ID cannot deviate once it is approved by the team. This consensus-building step in the backwards design process is very important to the success of the course design because once

accepted, the course must be designed according to those specifications and therefore the intention to adhere to the course competencies is guaranteed.

After the course map is approved by the team, the SME sets on a scheduled plan of development, producing the entire contents of each module in sequence according to deadlines set by the ID. The PC oversees this process, is available as a mentor for the SME, and mitigates any communication issues that might arise. The SME designs the assessments first, then the instructional materials, and finally the learning activities for each module. The documents associated with each module's content are stored and shared via cloud-based document curation. After each deadline, the team communicates via email. The ID and PC review the work of the SME to ensure that it follows the course map and the master course templates.

The whole course is developed in word documents before the ID commences the course build. In other words, the technical design process is subsequent to the content build. This ensures that the content is well-vetted in advance of technical application. This is important because word processing documents are flat, whereas the Learning Management System (LMS) has a three-dimensional structure; when a correction needs to be made in the LMS, it involves more work to ensure mistakes and contradictions do not appear in the published course. Just as the SME has a schedule timeline, the work of the ID has deadlines. After each module is built in the LMS, the SME and PC review the work of the ID to ensure that it follows the course map, contains no content errors, and adheres to QM standards.

Once the entire course is built, the SME conducts a final review of the course in the LMS. Upon acceptance of the final review, the master course is launched in the subsequent semester. Faculty teaching the course are not permitted to change the contents of the course in any way other than to add their own announcements and personal contact information. Faculty

presence and autonomy in communication comes through their participatory efforts in discussions, student communications, and grading comments. Master course updates, corrections, and additions are handled by the ID team through a process in which the faculty who teach the course request ID assistance to make changes to the master course template.

Case Study: General College Botany (BIO221)

This project plan addresses the redesign of General College Botany (BIO221), a Guaranteed Transfer (GT) course already offered at CCCOnline. GT courses are guaranteed to transfer to any of the state's four-year institutions of higher education. The course is also offered at some of the home colleges and similar courses are offered at the four-year institutions within the state. The majority of students enrolled in this course attend Colorado State University, a four-year state institution that has several natural resources degree programs. Students report that they are taking the course at CCCOnline because they cannot enroll in the course offered at CSU due to upper classmen and/or major discipline priority enrollment. Despite this continued issue, CSU does not apparently offer more sections to accommodate these students. As such, the redesign of BIO221 is particularly important with respect to the articulation agreements between the two-year and four-year institutions in the state of Colorado.

After several years of requests, the course has finally been accepted into the course development process at CCCOnline. The SME for the redesign is the author of this benchmark project. She has previous experience teaching this course, a terminal degree in biology and research experience in the field of restoration ecology. The ID has an instructional design degree and is trained to manage and enact the master course template for CCCOnline. The program chair has a terminal degree in biology and acts as a liaison between the faculty and the administration. She brings a strong command of organization policy and biological knowledge to

the team. The interdisciplinary nature of this team facilitates effective course design through collaboration and the application of their specific skill sets (Puzziferro & Shelton, 2014).

BIO221 will be developed following the principles of backwards design (Wiggins & Mctighe, 2005). The leading principle of backwards design is that the learning outcomes for a course are identified in advance of course development. Courses offered at community colleges in Colorado are designed according to the Common Course Numbering System ("CCCNS," 2016). The CCNS is a database that describes courses across all disciplines. Each listing contains the approved name and course number, the number of credits, the learning outcomes, and a topical outline for each course.

BIO221 will be designed to the CCCOnline master course template. All CCCOnline courses are developed using the team approach described above. When possible, the SME for the team is a seasoned instructor who teaches the course for CCCOnline. Once the course is developed, all CCCOnline instructors who teach the course must use the master course template and they are not permitted to change its content. They may add personal components including an instructor biography, news items, and self-authored discussion posts, but they may not add or remove assignment or assessments. They are also not permitted to add extra credit or alter the point schema in any way.

The first task for the SME the production of the course map. After this guiding document is drafted, the same process for development will unfold for each module of the course. The master course template dictates that there are five modules per course. The first step in the design process is to align each module to the CCNS course competencies. Each learning outcome must appear once and can be repeated in subsequent modules. Cullen, Harris, and Hill (2012) suggest that the learning outcomes should be revisited throughout the course, a principle they call *recursion*.

The basic premise of the master course template is that the course could be used with any textbook hence the focus is on the CCNS learning outcomes rather than a focus on text-specific learning outcomes. That being said, the chapters of the textbook must be aligned to the CCNS learning outcomes. Therefore, the second step in the course design process is to align the textbook chapters to the module learning outcomes. This defines the reading sequence for the course. The learning outcomes for the BIO221 course are noted in the Course Map, which can be found in Appendix A.

The third step is to build the summative assessments for the course. By designing the assessments first followed by the learning activities, the SME can ensure that the learning activities reinforce the concepts on which students will be assessed. Repetition and reinforcement within the course design are tenets of cognitivism that promote learning through intentional mental preparation (Martinez, 2010). The summative assessments for this course will include multiple choice questions and authentic components like short answer questions within the test.

Authentic assessment is important in online courses as it validates student identity by providing an authoring opportunity in an otherwise Internet-available assessment schema. Virtually any test question written by a textbook publisher can be found on the Internet in instructors' webpages, offered as practice quizzes and on websites like Quizlet ("Quizlet," 2016). Student-authored questions can be validated by plagiarism tools like TurnItIn, which is used by CCCOnline ("TurnItIn," 2016). Authentic assessment is also important to learner-centered curricula in that it provides opportunities for students to be self-directed, which activates their intrinsic motivation and stimulates their prior knowledge. These are tenets of constructivist learning theories.

The fourth step in the course design process is to develop the exploration content. The exploration content is the SME-authored component of the course. The exploration introduces the module and connects the module's learning outcomes to real-world, contemporary issues. The exploration content may also reinforce knowledge necessary for success in the module. For example,

if the module includes a lab that has specific mathematical applications, the exploration content might include tutorials for these math skills, which are not part of this course's learning outcomes, but are nonetheless required for success in this course.

The fifth through eighth steps include developing the learning activity content. The labs for this course are designed and prepared by a third party vendor, Hands On Labs ("Hands On Labs," 2016). The fifth step is to align the labs in the botany lab kit with each module. The sixth step is to choose the CONNECT study assignment. CONNECT is the digital learning resource that accompanies the McGraw-Hill textbook that will be used in this course ("CONNECT," 2016). The seventh step is to design the discussion topics in alignment with the module learning outcomes. The eighth and final step is to develop the semester project's checkpoint assignments. This semester-long research paper is supported by module scaffolding that guide the student through the process of topic selection, research, peer-review and collaboration.

Authentic Assessment

In light of the fact that this is a biology course for biology majors, the final research project is designed to hone students' professional skills. It also provides an opportunity for students to explore a specific topic of interest that they cultivate within the parameters of the course learning outcomes. The entire process is similar to the process one undergoes to write a thesis or a dissertation. It is assumed that most biology students will engage in research in their academic careers, producing a thesis in their undergraduate career to graduate with honors, then producing a thesis or dissertation if they pursue an advanced degree in biology, and finally publishing peer-reviewed articles if they become a practicing scientist and scholar. By modeling this process while also addressing the knowledge base of the course, students will grow their understanding of plant biology and their professional confidence. This is a significant opportunity to explore the rigor required to pursue a degree and career in the sciences. Modeling

the real-world context is a central tenet of authentic assessment (Herrington, Reeves, & Oliver, 2014).

The "rigor" of biology is often illustrated to potential biology students via a pre-course, for example, for nursing majors. These pre-courses, however, are designed to drill and test students before they enter a nursing track. Nothing about this assessment schema is true to the professional reality of becoming a nurse. In contrast to the pre-course phenomenon, the final research project described here is authentic and student-directed. It not only requires rigorous study; it allows students an opportunity to engage their intrinsic motivations to pursue biology.

Adult learners need to be intrinsically motivated. They have many tasks to pursue in life and have limited time to enact learning experiences. Therefore, these learning experiences have to be meaningful and reflect the life goals of the student (Knowles, Holton, & Swanson, 2011). As such, students may be attracted to the course for a variety of reasons. If they are not afforded the opportunity to maintain their focus on their individual learning needs, their learning goals may not be realized.

The final research project has several checkpoint assignments throughout the semester to facilitate growth in research and writing. These checkpoint assignments are described in Table 1. They include collaborative discussion assignments in which students practice their research and writing skills and share them with their peers to solicit feedback. Collaboration enhances learning by engaging social contexts. Research indicates that learning involves social, cognitive and emotional development (Bangert, 2008). The checkpoint assignments also include content-related written assignments submitted through a dropbox to the instructor who gives substantial feedback for improvement. This collaborative framework develops a community of inquiry in

which critical thinking is fostered through self-reflection and interactive dialogue (Garrison, Cleveland-Innes, & Fung, 2010).

Table 1

Final Research Paper Assignments

Assignment Type	Brief description of the assignment	Estimated Time (hours)	Outcomes
Module 1- Discussion Question #2 Concept (F or S)	o Scientific method and experimental design - F	3	2, 3, 6
Module 1- Project(s) (F or S)	o Intro to final research paper -F o Identify topic, provide three reference citations for possible use - F	2	
Module 2- Discussion Question #2 Concept (F or S)	o Introduction to peer-reviewed literature: Submit one reference and annotation for final paper - F	3	6
Module 2- Project(s) (F or S)	o Annotated bibliography (3 references) o Citation list of 2 other potential references	3	6
Module 3- Project(s) (F or S)	o Research paper outline (with second revision deadline after instructor feedback)	3	
Module 4- Project(s) (F or S)	o First draft of research paper	10	
Module 5- Discussion Question #2 Concept (F or S)	o Present your final paper topic in summary: Post the abstract, the reference list, and at least one relevant image for the final research topic. - S	3	
Module 5- Project(s) (F or S)	o Final draft of research paper	4	

Note. This is an excerpt from the course map that details the assignments that scaffold the final assessment tool for the course. "F" denotes "formative assessment" and "S" denotes "summative assessment."

In some modules, the discussion facilitates the written assignments. For example, in module 2, students share one citation and annotation in discussion. Then, by the end of the week, they submit three annotations to the instructor as their written assignment for the module. The

feedback they receive in discussion will help them to achieve full credit in the written assignment. In other modules, students work directly with the instructor to achieve continuous improvement. They submit first a research topic, and then an outline. The instructor provides feedback and the student submits revisions to the outline. The student submits a first draft and then a final draft. Along the way, the instructor and the student have a dialogue about the project, which facilitates both academic growth and their interpersonal relationship.

The instructor's commitment to each individual student enhances the students' motivation as well as their skills because this commitment demonstrates to the student that the instructor is invested in helping the student grow intellectually and professionally. The instructor develops the community of inquiry through this relationship by communicating clear and reasonable expectations, by clarifying thinking, and by establishing professional and respectful parameters for communication (Garrison et al., 2010). The end result is a refined and exceptional work product, suitable for use as an application artifact, for example, to gain acceptance to an advanced degree program or to an employment opportunity.

Students preview the learning outcomes for each module in the course and then design the research project around their personal interests. They may choose any topic within the parameters of the learning outcomes. In this way, the project is both aligned to the course's intended knowledge gain and to students' learning needs. When the instructor reviews the submitted outline, the primary objective of this feedback component is to assess the topic's congruence with the course learning outcomes. Students must revise the outline according to the feedback provided by the instructor if their topic does not adhere to the academic purpose of the course.

The dialogue that ensues between the student and the instructor is authentic and professional. This, in itself, is another way in which the course models real-world context. Students must engage with the instructor in the way they would communicate with their professional team members and superiors. This might involve compromise to reconcile the students' chosen path and the acceptable path as determined by the instructor. This is a scenario that plays out in a professional context in myriad ways. Most people don't come to work and make up their own work projects, but they also don't stay with an organization for long if they have no autonomy and self-direction. These are basic principles of adult learning applied to the professional environment. By balancing student autonomy with course learning outcomes, and by establishing productive and collaborative communication, the final research paper as designed for BIO221 is an exceptional assessment tool.

Other Assessments, the Exploration, and Other Learning Activities

In addition to the final research paper, there are several other recurring activities in the course. The online discussion is largely favored as the primary surrogate for attending class in a traditional sense (Palloff & Pratt, 2013). Online discussions are typically one to two weeks in length. They are built within the LMS and contain a discussion prompt, which is guidance students must follow when initiating their *original post*, ie their authentic contribution to the conversation. Students can participate in discussion 24 hours per day, but typically the discussion opens and closes on specified dates. The exceptions to this are open forums in which students can ask questions and/or share social messages.

There are two discussions associated with each module. It is typical for the first discussion in the first module of an online course to be a student introduction discussion, which is the case in BIO221. Introductory discussions build community among the students and the

instructor of the course. This first initiation creates a bridge to facilitate social and cognitive development. The online classroom can leave students feeling lonely if there is not an intentional effort by the instructor to encourage social interaction (Palloff & Pratt, 2013). Therefore, it is important that the instructor imparts a sense of caring and open communication that can then be modeled by the students in the community.

The second discussion of module 1 is associated with the authentic assessment, ie the final research paper, described above. This discussion gets student oriented to the course learning outcomes and working on their final research papers in the first week of the course. Students must review the learning outcomes and identify a potential topic for their final paper. By sharing their thoughts on final paper topics, they continue to get to know each other and can find allies in the course who are pursuing similar degrees and/or interests. This fosters professional networking and social interaction. Later in the semester, students with similar paper topics may choose to review each other's work since they are both budding experts in the subtopic. Alternatively, students might choose to review the work of students pursuing different topics to expand their own knowledge of botany.

After the community-forming discussions of the first module, the subsequent modules have one collaborative wiki-building discussion crafted around the learning outcomes, and one discussion that addresses a component of the final paper. The development of wikis is an emerging concept in education built upon constructivist principles of learning. A wiki resource is a knowledge base to which all community members contribute. "Knowledge is no longer acquired in a linear manner. We can no longer personally experience and acquire all the learning that we need in order to act. We must derive our competence from forming connections with other people. Blogs and wikis are ideal tools for this and what we see in these tools are examples

of networks of growing knowledge and understanding" (Rennie & Morrison, 2008, p. 11). The second discussion of each module provides scaffolding for the final research paper. The details of these discussions are noted in Table 1. They incrementally develop research and writing skills in students while also providing a model for successful project management.

The course uses an electronic textbook with a digital, adaptive study program. This adaptive study program called CONNECT helps students assess their own understanding and offers additional tutorials on the learning outcomes that they need to work on more. McGraw-Hill partnered with faculty from across the nation to study the impact CONNECT has on student success. Student pass rate, average grade point average and retention rates are higher using CONNECT than without CONNECT (McGraw-Hill, 2016). Adaptive study tools keep students engaged in their own learning process. Their personal motivation and drive to succeed is the single most important factor that impacts student success.

In BIO221, there are two assignments derived from the McGraw-Hill CONNECT resources. The first is the reading assignment. When students read the textbook using the LearnSmart tool, they are given self-check activities periodically. When they do not respond to the self-check questions with the appropriate answer, sections of the text where those concepts are discussed are highlighted. Students can then study the highlighted sections in more detail. The second assignment is a homework assignment derived from the publisher test bank. The questions chosen are matching and ordinal questions. These types of questions do not appear in the quizzes, but they allow students to synthesize a larger concept from the module in the safe space of formative assessment.

BIO221 has one lab credit. Students perform at-home laboratory experiments using a third party lab kit produced by Hands On Lab (HOL) ("Hands On Labs," 2016). The product

development team at HOL uses QM and current scholarly literature to produce labs that address common learning outcomes in common lower division college science courses. Their labs follow inquiry-based learning principles and include self-assessments throughout the learning process. While HOL produces a student submission document called a *lab report assistant*, the SME for BIO221 has modified these documents so they include standard CCCOnline requirements like photo authentication and additional instructional resources where needed.

Each module ends with a module quiz and there is a cumulative midterm and final exam in BIO221. These are summative assessments. Summative assessments evaluate students' command of the learning outcomes and are not generally used as learning tools (Aboulsoud, 2011). In contrast, the assignments described above are formative assessments design to both indicate a students' understanding and provide them with opportunities to learn, study, and self-assess. Both the module quizzes and the cumulative exams are derived from the publisher test banks. Each student receives a random draw of multiple choice questions from the test banks of the accompanying chapters. In this way, each student takes a different exam, which limits their ability to share test resources. The quizzes and exams are timed. Each question receives one minute of time. Time limits for summative assessments restrict students' ability to search for the answers on the Internet. Although not an infallible measure, it encourages students to enter the quiz or exam in a prepared state of mind.

Conclusion

This document describes the CCCS and CCCOnline, the statewide community college system in Colorado. The demographics of the student population are considered in light of the guiding mission for the organization. The master course development process for CCCOnline follows QM principles and involves a team-based approach. The case study of BIO221 provides

detail for the steps involved in the course development process and the kinds of assessments and assignments used in CCCOnline courses. Authentic assessment, andragogy, self-assessment and backwards design are guiding theoretical frameworks for the CCCOnline course design process. CCCOnline is an award-winning institution and therefore readers can take these guidelines as best management practices and apply them to their own similar institutions.

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Appendix A

The Course Map- Module 1

Element	**Module 1: 2 course weeks**
Deliverable Dates	
Course Competencies	list corresponding letters from Course Details Sheet A, B, E
Module Outcomes	write outcomes & map to corresponding competency (in parentheses) 1. Recognize that plants play a central role in global biological processes as primary producers. A 2. Recall the steps of the scientific method. E 3. Design a botanical experiment according to the principles of the scientific method. E 4. Label all of the common structures of a plant. A 5. List commonalities among all living organisms. B 6. Demonstrate a working knowledge of the academic integrity and experimental design.
Topics	o the general biology of plants o the nature of life
Reading Assignments	list reading assignment by Chapter #1-2
Exploration Concepts (Outline based on main topics)	o Explore the scientific process o Review the attributes of living organisms o Introduce the world of plant biology
Lab Concepts - F	o a review of botanical structures and experimental design (MG created lab)
Assignment #1 Concepts (F or S)	o CONNECT assignment - F
Assignment #2 Concepts (if applicable) (F or S)	o list concept(s) covered o list concept(s) covered
Discussion Question #1 Concept (F or S)	o Student Introductions - F o Academic Integrity - F
Discussion Question #2 Concept (F or S)	o Scientific method and experimental design - F
Project(s) (F or S)	o Intro to final research paper -F o Identify topic, provide three reference citations for possible use - F
Exam/Quiz (Yes or No) -all S	Yes- CONNECT quiz