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### CURRICULAR THREADS: INTEGRATED THEMES FROM INTRODUCTORY TO CAPSTONE COURSES

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ABSTRACT: Effective curricular design in natural resources should concentrate not only on critical technical content, but also on developing important themes in ever-increasing complexity as students proceed from introductory to capstone courses. We propose a set of perspectives/values (e.g., citizenship, respect, curiosity, liflong learning, and the role of science in society) and critical skills (e.g., communication, leadership, critical thinking, problem solving, and team working) that we believe should be used as a set of "curricular threads" uniting individual courses in the curriculum. Students should be exposed to these perspectives early in their student careers, and they should be challenged to identify and continually refine their own set of professional and environmental perspectives and values throughout their academic career. Development of those perspectives could be interwoven with fostering critical-skills development that will increase students' professional effectiveness.

#### **INTRODUCTION**

Instructors will often comment woefully that students are not prepared for material they are covering in their classes. We would argue that, much like biotic succession, where a barren field when left alone will gradually revert to a forest with several seral stages along the way, our students don't come to us as late successional forests, and it is our job to develop to cultivate them through the seral stages. Furthermore, not all students are at the same levels of succession at the same time in their academic careers. When students are faced with assignments and expectations that may be more advanced than they are prepared for, instructors often experience a classroom "revolt," where students become frustrated, and the teachable moments are nonexistent because of resentment held by the students. In this case, we really can't blame them. We don't expect graduate students to

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first defend their thesis and then write it, nor do we expect them to first write their thesis before building a justification and developing the relevancy of their work. A student who writes poorly as a freshman will continue to write poorly if not properly guided early in his or her academic career. Therefore, we propose that an effective curriculum guides students by building on themes from simple to complex through the academic career of the student.

In the book *Courage to Teach*, Palmer (1998) states, "Good teachers possess a capacity for connectedness. They are able to weave a complex web of connections among themselves, their subjects, and their students so that students can learn to weave a world for themselves." While Palmer was referring to the individual teacher's capacity to teach, imagine if this paradigm were transferred to a group of teachers organized as an academic program. The result could be a very powerful program of instruction for students within a curriculum. Yet, many of us teach our courses in a vacuum. Professor X has been teaching his class for 25 years without changing it, yet few people in Professor X's department know the learning objectives for the class. If faculty are unaware of material taught in their own department, then they are certainly clueless with regard to what is taught in other departments.

In the current academic model of higher education, students take a suite of classes that ideally build upon one another; for example, Chemistry II must be taken after Chemistry I. Classes are generally billed as freshman, sophomore, junior, or senior level and content is then supposedly "level specific." However, students will often perceive the matrix of classes (that faculty so carefully choose to produce a balanced curriculum) as a jumble of hoops merely to be jumped through. Relevant material is not automatically transferred between classes in the minds of our students. In many cases teaching practices that employ rote learning, topical surveys, emphasis on factoids, and isolated opportunities to apply learned material actually act as impediments to the transfer of information between classes (Ormrod, 1999).

#### CONCEPT OF CURRICULAR THREADS

In the K-12 education system in Virginia, teachers are required to base their material on prescribed "Standards of Learning" (Board of Education 1995, 2001). For each broad subject (math, science, social studies, etc.) there are specific "strands" that must be incorporated into classroom learning. For example, within the subject of math, there are six strands: number sense, computation, measurement, geometry, statistics, and patterns/algebra. Starting at the kindergarten level, the statistics strand identifies specific objectives for the student: count and tally objects, use picture graphs, read counter dials. The strand then continues through seventh grade, building in complexity along the way. For example, a fourth-grader must be able to determine simple probability and collect and display data using line and bar graphs. By seventh grade, pupils must design an experiment, determine and express probability, calculate mean, median, range, and mode, display data with graphs, interpret data and predict results. While most university faculty would likely balk at a state-mandated, strict structure for higher education, the approach may be a highly valuable tool for maximizing student learning and outcomes within specific academic programs such as forestry, fisheries, or wildlife.

#### **EXAMPLES OF CURRICULAR THREADS**

We propose that effective curricular design is a combination of classes structured around threads within major thematic areas that we have identified as critical theoretical and technical content, critical skills, and values/ perspectives (Table 1). Critical theoretical and technical content gives students a solid technical grounding in the things they need to know. Important technical threads within the themes include species identification, basic statistical concepts, life history and ecology, genetics, and approaches to managing fish and wildlife populations. Critical skills are the second major theme that includes threads of specific technical skills and broader skills (such as communication) that graduates will be required to know to do their jobs effectively. Critical skills threads include problem solving, critical thinking, team working, organizational skills, and technical field skills for sampling fish and wildlife populations. Finally, the third theme, values and perspectives, is one that is not

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taught but rather nurtured or developed as these tend to be individual specific, based on the student's background and experiences. Included in this thread are notions of citizenship, respect, curiosity, a commitment to lifelong learning, and cultural sensitivity.

#### Table 1. Examples of threads within each of three major themes as identified by participants in the facilitated discussion at the Fourth Biennial Conference on University Education in Natural Resources, Raleigh, North Carolina, 2002.

Critical Theoretical and Technical Content

- species identification
- basic statistics
- life history and ecology
- genetics
- management approaches
- spatial information systems
- scale
- information technologies
- quantitative and qualitative analyses
- human dimensions
- policy and institutions
- economics

#### Critical Skills

- communication (written, oral, visual, interpersonal)
- critical thinking
- problem solving
- team working
- organizational
- negotiation and conflict resolution
- administrative/project management
- leadership
- diplomacy
- self-evaluation
- field skills

#### Values and Perspectives

- citizenship
- respect
- curiosity
- lifelong learning
- cultural sensitivity
- ethics
- flexibility
- philosophies
- international perspectives
- passion for resources

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#### APPROACHES FOR IMPLEMENTING CURRICULAR THREADS

In many cases, individual faculty may already incorporate the critical threads within their courses, but a faculty group exercise is important to elucidate and strengthen the in-curricular connections. If faculty are aware of the building blocks in other classes, they can confidently refer students to material learned in prior classes.

One example of a critical thread in our curriculum is the communication (writing) thread. In our freshman class required for all college majors ("Introduction to Renewable Natural Resources") students are required to write several microthemes. A microtheme is a short (less than 250 words), structured (introduction, body, conclusion) paper that helps students develop concise, scientific writing skills appropriate for natural resources. Within the microtheme exercise, we explain the concept of conveying a strong and complete message in few words while posing a reasoned argument for an opinion on an assigned topic. Students submit drafts before the final paper is submitted (we start the first microtheme with a draft outline) and we find that their writing markedly improves through the semester. To follow up on microthemes, the sophomore class ("Principles of Fisheries and Wildlife Management") includes an assignment that requires students to use the microtheme approach to write letters on topics that we cover in class. One example is a letter to the university president in which the student proposes to use a popular piece of property on campus for restoration of an endangered species (their choice of species). Students must justify why the species is important and how the property must be altered to address all of the life history needs required by the species. Again, the assignment is short (less than two pages) and they are to focus on presenting their ideas in a concise, but compelling format. As juniors, the students experience hands-on investigations through the fisheries techniques class and develop concise written presentations of scientific information. Finally, as seniors, students write a management plan based on their own field investigations to collect data and their subsequent analysis of that information. Seniors must fully synthesize their information for this document and employ the writing principles that they learned in earlier classes. We propose to further develop the curricular thread concept in our program by actively *reminding* students of the principles that they have learned previously. Imagine the frustration that would occur if we gave the senior assignment to students in the freshmen or sophomore years before they had the skills and experience to thoroughly engage in this experience. Similar thread examples exist for the critical theoretical and technical content (population assessment), and values/ perspectives (Table 2).

Level	Example 1: Theoretical and and Technical Content (Population Assessment)	Example 2: Values/Perspectives (citizenship)
Freshmen	conduct survey of birds in area with point-transect methods	participate in or organize streamside cleanup
Sophomore	conduct mark-recapture using student population in large class	conduct biomonitoring of local stream
Juniors	actually mark animals/fish and attempt to recapture	participate in project Wet/assist with fish dissections at local middle school
Seniors	prescribe and use best assessment approach for real project	develop pond management plan for veteran's hospital

 Table 2. Examples of curricular threads for critical theoretical and technical content and values/
 perspectives in Natural Resources education.

During the facilitated discussion at the Fourth Biennial Conference on University Education in Natural Re-

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sources in Raleigh, North Carolina, 27 participants were divided into small groups to develop an example of level-specific activities that would support one of the listed curricular threads. The groups volunteered two separate examples (Table 3). Both groups (as well as the authors) noted a difficulty in developing the programs. It was easy to identify the starting point of a thread with a freshman-level activity. But then the groups had more trouble defining sophomore and junior roles and jumped ahead to define the senior task for the thread and then worked backward. So, it seems that those of us participating in this exercise can very quickly define the beginning and endpoints for our students, but the roles that sophomore and junior levels play in academic development are less clear. An additional point is that each of the activities outlined with the curricular threads (Table 3) is just an individual activity and will be viewed by the students as such, unless the faculty use an active approach to help the students recall important principles or building blocks that they learned in earlier exercises.

# Table 3. Examples of activities to support development of a curricular thread throughout an academic program developed by participants in the facilitated discussion at the Fourth Biennial Conference on University Education in Natural Resources, Raleigh, North Carolina, 2002.

Level	Example 1: Critical Skill (teamwork)	Example 2: Critical Skill (public communication)
Freshmen	Camping weekend with assigned roles for food, tents, firewood (etc.)	Attend local public hearing and write reflection paper on observations of communication styles.
Sophomore	Some sort of laboratory exercise.	Write a scientific article for a newspaper.
Juniors	Write an endangered species plan with a working group or team.	Prepare formal testimony on a topic.
Seniors	Interdisciplinary management plan for a real area or client.	Set up a campus public hearing on a controversial issue.

#### CHALLENGES IN DEVELOPING CURRICULUM THREADS

During the facilitated discussion we also heard several concerns relating to the issues of transfer students, full faculty participation in thread development, and the possibility that this approach may overburden faculty teaching introductory courses. Although the last item was a concern over the number of threads that would be implemented by the introductory class, we really are proposing repackaging existing courses, not additions to the curriculum. Students transferring into the curriculum could be required to take the classes on which the threads are based. In the Natural Resources curricula at Virginia Tech, an incoming transfer student would be required to take two classes that would develop the foundation for their final two years at Virginia Tech. If a student comes well prepared with the basic courses, this requirement does not usually overburden their schedules. Finally, faculty cooperation and collaboration may be the greatest challenge if faculty are polarized into academic "domains." However, unlike most contentious discussions that involve curriculum changes (addition or deletion of classes), this approach may involve only a subtle tweaking of material already present in the curriculum or the addition of a few key pieces to tie the threads together between class levels.

#### DESIRED OUTCOMES FROM CURRICULAR THREADS AND ADVANTAGES TO THIS APPROACH

The most obvious desired outcome from this approach would be that our students would learn more from a cohesive format, and this would result in a retention of more of this information. One of the participants in the facilitated discussion pointed out that this could be a real mechanism for retention. If students are shown the linkages Natural Resources and Environmental Issues

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of the material between their courses and the relevancy of the material to the real word, they may view their learning as they progress in their academic career as an investment.

From the instructor's perspective, the "threads" approach provides benefits in that we create a connection to other teaching faculty, and we can encourage transference of learned material between levels when we are confident of the materials covered in another class. Furthermore, validation that the threads are important evolves from faculty workgroups that identify important themes. Without this collaboration, students only see common themes where faculty thinking intersects by accident rather than by design. This is not to suggest that Faculty Member A know all of the material, exercises, etc. in Faculty Member C's class. But, this does mean that the faculty work together to identify key threads and appropriate measures of the success of the threads. We believe that one of the best examples that faculty can create for students in our academic programs is to demonstrate our abilities as lifelong learners who are working in a cooperative team capacity to create learning experiences that are in the best interests of our students.

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