

MountainRise

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The Mountain of Scholarship: A Pedagogical Journey

Assistant Editor's Introduction by Kristina Hargett, Western Carolina University

Many people may wonder about the name of our journal, *MountainRise*. The title alone does not speak directly to the purpose or scope of the journal. At first glance, many people may think that it is a publication concerning geography or travel. Allow me to clarify. For starters, The Coulter Faculty Commons, the center that publishes *MountainRise*, is located at Western Carolina University, which is nestled in the Appalachian mountains of western North Carolina. But also think about this, if you have ever been lucky enough to enjoy a scenic overlook from the top of a mountain, it's like you can see the rest of the world. *MountainRise* aims to rise like a mountain, to overlook a wide span of world and to share the pedagogical knowledge of scholars in their educational travels.

The most recognizable attribute of the Carolinian mountains would have to be the Appalachian Trail. The "AT" runs from Maine to Georgia and many people enjoy the harrowing task of hiking the challenging 2,175 miles. Trekking this trail may seem daunting, but the only requirements are a little preparation and patience (and a good sense of wilderness survival skills would not hurt either). In terms of scholarship, it seems appropriate to compare the act of traveling the AT to the Scholarship of Teaching and Learning (SoTL), which may be just as daunting but just as, if not more, rewarding. In scholarship the trail along the way is much more beneficial than the view from the precipice. Instead of beautiful vistas, scholarship offers the beauty of a continuous education, for scholars and students alike.

Before we begin our hypothetical venture, let us pack our bags with some sustenance: Dr. Craig Seal's review of Becker and Andrew's *The Scholarship of Teaching and Learning in Higher Education: Contributions of Research Universities* will satisfy our appetite for the integration of disciplines, teaching and scholarship from the perspective of research universities. The book is a compilation, a trail mix of sorts, mixing together different authors' critical insights, personal stories, and potential frameworks to contribute to the SoTL. Though, Seal does not agree with the "tonal superiority" of the book, he still recommends it as an "excellent, thought-provoking resource for educators and SoTL scholars."

Leah Hampton's review of Sherry Lee Linkon's *Literary Learning: Teaching the English Major* provides a clear synopsis of Linkon's work. Linkon skips over theory in order to pass on her four interrelated points: common sense of purpose, transparency in teaching, going beyond content

knowledge, and options for research. Hampton agrees that the book, though named specifically for the English major, is appropriate reading for instructors in any discipline. For anyone seeking a more learning-centered teaching approach, the book offers useful questions and instruments while it encourages thoughtfulness towards students who are struggling academically.

Now that our bags are packed with some provisions, let us make our way to the valley of deeper learning with Dr. Bary Fleet's reflective essay entitled "Confessions of a Teacher: Why Am I Doing it the Way I Am?" Dr. Fleet uses the creativity-rich soil found here to grow students that connect more fully to the material and deepen their level of learning. By nixing his class's "traditional" final exam in favor of a small-group project that promoted creativity and tangible interaction with the material, the students and professor share a positive learning experience. He writes about his former teaching style, what changed his mind mid-semester and the positive and negative outcomes of trying a new way to evaluate his students' performance in his Child and Adolescent Development psychology class. After creating a "Parenting Guide" for two young women, Dr. Fleet surveys his students to learn what they thought about the experience, teaching him what to do in future class situations.

You cannot expect to hike a mountain trail without running into a few streams and it just so happens that Dr. Cindy Bennington and Dr. Terry Farrell's article "Common Ground for Three Cultures: Concordance Among Students, Non-Science Faculty, and Science Faculty on Perceptions of Science Course Goals" is more of a three-branched river. In their article, Drs. Bennington and Farrell seek to determine if non-science faculty and students agree with science faculty about the science discipline's educational goals and their importance. They survey science faculty, non-science faculty and students in order to determine how and if science faculty teaching non-major courses embrace a series of previously adopted goals for those courses, the agreement between the importance science faculty and non-science faculty and students place on the stated goals for non-major science courses, and the extent to which both science faculty and students perceive the goals to have been met in their non-science courses. Drs. Bennington and Farrell successfully establish that the gap between the three is not as wide as originally thought and provide other academics with a successful survey method to bridge gaps between disciplinary fields.

Dr. Farshad Tamari, Dr. Mohamed Lakrim and Dr. Loretta Brancaccio-Taras have joined us on our adventure with their article “Facilitating Learning in a Human Anatomy and Physiology Course through Microtheme Writing Assignments” as they investigate the advantages of writing in a human anatomy and physiology class by using “microthemes”. The assignment allowed the students to focus on a particular concept and work with it more closely. By completing the microtheme assignments before class, the students were more prepared for classroom discussion because they sought information from sources outside of the classroom text in order to prepare their writing assignment. In the end, the end-of-the-semester exam results indicated that students who completed the microtheme assignments throughout the semester, benefitted from that direct interaction with the material.

Drs. Alisha Francis and Abraham Flanigan lead us the rest of the way with their article, “Self-directed Learning and Higher Education Practices: Implications for Student Performance and Engagement”. Self-Directed Learning is a 21st-century concept in which students make their own decisions, learning only what they think will be valuable resources to their education. Drs. Francis and Flanigan began their research because of the ambiguity surrounding SDL as an appropriate means of learning in higher education. Some findings claimed that SDL was a positive educational attribute, while other studies showed less definitive benefits and disadvantages. For their study, Drs. Francis and Flanigan took into consideration the relationship between SDL and learning activities, academic motivation, and academic performance. Students completed surveys that corresponded with the three facets of the learning experience and the results of their research prove that a SDL approach in the classroom could be a rocky slope because many students learn differently. In order to successfully make their way up the trail, each instructor must adjust the class accordingly, taking different, sometimes less traveled paths whenever a tree has fallen across their tried and true one.

Now, I know there is no way to truly compare hiking the Appalachian Trail to reading *MountainRise* and please do not attempt to travel the 2,000 miles with only this issue in your backpack, but if you do choose the route of scholarship, this issue will certainly be enough to sustain you in your adventure. You may notice that we did not finish our excursion with a lovely view from the top because I hope that whatever mountain you decide to climb, the view from the top does not become the goal, but the hike itself. In SoTL, the goal isn't to reach the top but to continue learning, to ask questions, and to

make yourself a better scholar in hopes that you will one day inspire a student to traipse the same trails that you once did.

Book Review

Becker, W.E., & Andrews M.L. (Eds.). (2011), *The Scholarship of Teaching and Learning in Higher Education: Contributions of Research Universities*. Bloomington and Indianapolis, IN: Indiana University Press. \$24.95

Overall, William E. Becker and Moya L. Andrews (editors) organized a collection of important, insightful contributions from the perspective of research universities toward the scholarship of teaching and learning (SoTL). The book starts from an institutional perspective, considering several alternatives to facilitate the integration of discipline-based research and scholarship of teaching and learning. The next set of chapters focuses on specific course adoptions of discipline-based methodologies. The focus then shifts toward integration of broader assessment goals. The book ends with a discussion of an innovative program, across campus and department boundaries, that helped integrate disciplines, teaching and research. The text provides some critical insights, provocative personal stories, and potential frameworks to contribute to the SoTL. However, I felt the tone of the book, and the presumed superiority of comprehensive doctoral granting institutions to other members of the academy, undermined the potential universal appeal of the various chapters. In fairness to the contributing authors, the central question of the editors was to consider the “contributions that research universities make to pedagogical advances” (p. 1). Of concern, as a reviewer, is that the tonal superiority became a distraction and moved the contributing authors from providing a set of broad comprehensive guidelines, to a narrow (and at times unjustified) defense of the centrality of research universities, all of which diminished the potential contributions of the collection of insights. Regardless, the book is still an excellent, thought-provoking resource for educators and SoTL scholars.

Shulman starts the book by proposing four teaching academy frameworks (interdisciplinary center, graduate education, technology, and distributed) that may be adopted at an institutional level to assist in the integration of teaching and research. Shulman’s primer (along with the general introduction by Becker and Andrews) helps to provide the context for the remaining chapters.

The next set of authors discusses the integration of research and teaching. Cookman provides the base for the main point of the book, that is, to teach students not just content but methodology, in this

case the examination of historical photographic records. Sept discusses the development of several technological tools to assist students in shifting the focus from passive learner to active researcher, examining anthropological records, albeit with mixed results and significant resources. Andrews applies the lessons learned from the context of one-on-one clinical instructions, in particular, the adaptation of the clinical model to help develop perspective faculty members during their doctoral programs. Becker and Greene discuss the application of quantitative methods to classroom instruction in this case, a computer classroom. The chapter provides an excellent primer on basic statistics to consider in undergraduate instruction. Nelson provides a different perspective, discussing how a focus on instructional effectiveness, particularly the development of critical thinking, may actually inform and re-direct research. Pescosolido and associates considers the approach that many institutions follow, which is some type of freshman seminar or orientation program to help develop intellectual curiosity, and address student success concerns. Although the results were limited and the resources extensive, one take away was the learning not only of undergraduate students, but the graduate teaching assistants (in terms of better perspective teachers and researchers). While each chapter provides value in establishing the link of research universities to SoTL, proving potential frameworks for integrating discipline-based research and classroom instructions, it was the personal journeys of discovery, particularly those of Cookman and Nelson, which were the exemplary contributions for the section.

The book then moves from the application of discipline-based scholarship toward the integration of assessment and teaching effectiveness. Kuh provides a fascinating history of assessment, student development and engagement, and the parallels of assessment to SoTL that is the highlight for this section. McCabe and Powell address head on the assumptions of faculty in terms of grade inflation. Although it would have helped to provide some additional quantitative analysis (to help contextualize the findings), the purpose was to explore the underlying assumptions of faculty and our self-serving bias in relation to grades and grade inflation. Bao and Redish reinforce the complexity of student learning and the need for refined instruments and analysis that better account for the interactions between students, the material, and the environment to assess actual learning. Becker ends the section on assessment by focusing on the various limitations found in current SoTL research. The critiques are not only applicable to SoTL, but also to empirical research in general.

Finally, the last chapter provides an overview of an ambitious, integrative approach to teaching that focuses on a collaborative, interdisciplinary approach (in this case the teaching of mathematics) that provides creative ideas for other institutions to potentially consider.

Although the accounts clearly demonstrate each author's value to SoTL, it is important to note that these are individual contributions, rather than a systemic focus of research universities toward teaching. While it is clear that the resources and level of sophistication possible at research universities is potentially higher than that at non-research institutions, the distinction is less valuable than the overall question of how to integrate our scholarship (regardless of level) with our teaching (regardless of institution), toward assisting our own development and the learning of our students. Finally, the book continues the misguided (and unsubstantiated) assumption that excellent scholarship leads to excellent teaching. Although I concur that integrating teaching and scholarship produces a positive impact on student learning, particularly at the graduate level, the reality is they are distinct skill sets and that teaching excellence (as well as teaching insights) occurs at all levels of the academy.

Craig R. Seal, Assistant Professor, California State University
San Bernardino, California

Book Review

Linkon, S.L. (2012). *Literary Learning: Teaching the English Major*. Bloomington, IN: Indiana University Press. \$24.95

During a recent conversation with a colleague from the applied sciences, I found myself at a cordial but all too familiar impasse. After comparing course loads and learning outcomes, we admitted sheepishly that neither of us had any idea what the other one does all day. My colleague puzzled over my assertion that I could spend half a semester on one Wallace Stevens poem, while I questioned his habit of leaving students to wade through difficult experiments, unaided, for weeks on end. What is it exactly, we both asked, that you *teach*?

I would have been wise to consult Sherry Linkon's *Literary Learning: Teaching the English Major* before attempting to explain myself, for it provides the kind of grounding, accessible definitions of philosophy and purpose that instructors of English desperately need—particularly now, when pressure to prove the worth of humanities courses is at an all-time high.

Literary Learning begins by reminding us of the complexities inherent in teaching and assessing the study of literature. The author describes in detail two essential types of literary learning students must acquire and utilize in any course: Content Knowledge (literary history, theory, form, and so forth) and Strategic Knowledge (analysis, argument, inquiry). Such a distinction may seem obvious, but Linkon's purpose here is partly to show how intuitive understandings may hinder one's practice; instructors of literature rarely make explicit those tactics for dealing with a text which come so naturally to them, but frequently elude or befuddle outsiders. Literary learners find it difficult to explain their habits of mind to themselves, let alone to others. Many instructors assume students will develop certain research and argumentation skills through practice alone, offering "too little overt instruction" on acquiring these skills (29)—a conspicuous irony given the energy most English departments put towards rhetoric and composition pedagogies.

Literature complicates thinking; there are no "answers" for test questions, save the basics of form and context, no tidy packages of confirmed truths about a given text or author. Successful students should leave class with more questions than they had when they came in, but confident about their own strategies for forming interpretations. The study of literature is thus unique and unrivaled in its potential to

beget truly liberal minds. Literary learning helps students feel comfortable with the unresolved; they review and interpret what is *not* said more often than what is. In short, as Linkon puts it, literature courses teach students to take a step back and “read the world,” thereby helping them to navigate it wisely. No small task, and one not easily accomplished in three credits’ worth of sonnet explications.

If the teaching of literature is indeed so essential and inscrutable, then Linkon is ambitious in seeking to refine its methods with one thin volume. Mightier scholars have attempted such a feat, often with deeply confusing results, but the explanations here are clear and precise and will help readers accomplish a great deal. Linkon draws from a well-rounded bibliography and yet forgoes some of the usual discussions of post-structuralism and assorted theories of knowledge. (This seems an altogether conscious and refreshing choice, and one which makes the book easy to follow. Linkon does not reject such scholarship, but clearly wants instructors to do that reading for themselves.)

Literary Learning conveys its four interrelated points quite efficiently. First, Linkon argues convincingly that teachers of literature at any institution must define their discourse and unpack the exact ingredients of literary thinking to achieve a common sense of purpose. Linkon helps start that conversation with a deconstruction of the literary mind and how it reads and argues. There are few surprises here, and again, little theoretical hobnobbing, but readers may nonetheless feel jealous that Linkon has said precisely what they have been trying to articulate to deans or administrators for years.

Second, and perhaps best, Linkon advocates for transparency in practice. Chapters One and Two make a compelling argument for rethinking fundamentally literature’s signature pedagogies of lecture and discussion, which rarely teach Strategic Knowledge, or only do so indirectly. Once we determine how expert literary minds work, it is incumbent upon us to tell students precisely how to build and use such a mind. “Many of our students don’t ‘get it’ because we keep ‘it’ hidden,” Linkon argues (32). Modeling, scaffolding, and methods such as *cognitive apprenticeship* can illuminate our analytical processes for students, so that they can not only explain a given period or work, but also demonstrate how such explanations are generated—and challenged.

Chapter Three explains how to restructure courses that go beyond, or beneath, Content Knowledge. Linkon suggests designing syllabi “backwards,” facilitating ways for students to make and follow a map (i.e., a line of inquiry) to effective interpretation. While this tactic may sound convoluted or

arcane, this section is straightforward and specific, interrogating common assignments like research papers and midterm exams and suggesting challenging alternatives. Sample assignments and discussion plans are included.

Lastly, *Literary Learning* explores options for research. Linkon confesses to being a “geek” for the scholarship of teaching and learning, so Chapter Four delineates several potential literary SoTL projects. Linkon suggests “we can study the texts of learning . . . much as we do literary texts” (109) and details qualitative methods that may interest literature geeks who fear the cold opacity of mathematical assessment. Linkon also demonstrates the added benefit of such research—relevance. Not only can a SoTL study make our classrooms better, but it can also increase awareness of the unique, vital connections between literary learning and student success. Dissecting our discipline and its discourse and achieving transparency in our practice help us succeed in our work and guarantee that others can continue that work in the future.

Thus, teachers in other fields would do well to take a page from *Literary Learning*; any program can benefit from such dissection. All educators suffer occasionally from Hogarth’s *curse of knowledge*, or from a bias in our memory of how we acquired our own scholarly toolkits. What habits of mind did you intuit as a budding scholar that you secretly wish you had figured out years prior? You did not always think in the ways you think now; at some point lights came on, or were switched on by mentors as you slowly made sense of your research and other professional tasks. Linkon’s points can help any instructor to be truly thoughtful towards students who struggle as we once did. For anyone seeking new learning-centered pedagogies, *Literary Learning* offers useful questions and instruments.

During my conversation with my scientist colleague, we found, of course, that while we ask our students to read the world through very different lenses, both approaches have value. But unless we each delve deeply in the ways *Literary Learning* advocates, neither of us can expect to *teach* much of anything. The more we both engage in open, constructive examination of our practice, the stronger our institution will be.

Leah Hampton, Western Carolina University
Cullowhee, North Carolina

Confessions of a teacher: Why am I doing it the way I am?

Dr. Bary Fleet
Bryant University

Abstract

I have been teaching in higher education for most of the past twenty years, long enough to do it without much thought or reflection, doing pretty much the same thing semester after semester. This is the story of how I was challenged to think about what I was doing and how I was doing it, and to experiment with new ways of effectively engaging my students in the process of learning. It meant changing almost everything in the midst of the semester. It was both challenging and exciting.

Background

Historically, my most significant assessment tool was a comprehensive final exam – ostensibly to measure my students' learning. For the most part, it was a multiple-choice exam with a few matching questions thrown in, to be sure that they knew the main characters and their particular contribution to the field. I would also typically offer a series of essay questions for those who complained that they didn't do well on multiple-choice exams. The essay questions would be optional, allowing those who were satisfied with their odds of doing well enough on the multiple-choice questions to let it be, but for those who wanted an opportunity to dilute the consequences of their anticipated poor performance, they could submit answers to a series of variously weighted discussion questions. Honestly, my hope was that very few would choose that option, because we all know that running an answer sheet through a Scantron machine takes much less time and effort than reading and grading a series of essay questions.

As efficient as the multiple-choice tests were, I knew that there was something lacking in the overall picture of learning, particularly with a cumulative final exam. I was concerned that I was encouraging my students to take what the Urban Dictionary refers to as the bulimic approach to learning: take it in, puke it up and move on relatively unaffected by the contents of the course. Bain quotes Robert de Beaugrande: "Bulimic education' force-feeds the learner with a feast of 'facts' which are to be memorized and used for certain narrowly defined tasks, each leading to a single 'right answer' already decided by teacher or textbook. After this use, the facts are 'purged' to make room for the next feeding."

For the students, after taking the final exam, they were done with the course. For me as the instructor, after running the Scantron sheets through and assigning a final grade to them, I was done. Oh yes, I had to actually record and submit the final grade before I was completely done ... free to forget about what was past and go on to my courses for next semester.

In the back of my mind, there were nagging questions: Did I truly measure what the students learned, or was the final exam an indicator of who was best at gazing into the crystal ball and guessing what questions might be included on the exam ... and who was better at memorizing data? Is there a place for creativity in the Social Sciences ... and, if so, to what extent?

That question was raised as I thought of my own two children, both very bright and each with their own learning style. One functioned (and continues to function) very well in the traditional academic setting. The other was always frustrated in that environment and, as a parent, I knew that his grades did not reflect his learning. His grades reflected his teachers' frustration with his attempts at creativity within traditional testing formats.

Stimulus for change

On a whim, I accepted an open invitation by Bryant's Center for Teaching and Learning to be a part of a book discussion group reading What the Best College Teachers Do by Ken Bain (2004). I wanted to be a better teacher and this seemed like an opportunity to think collaboratively about the whole process. I wanted my students to leave my class better people and more prepared to function in the real world. I had reservations about whether that was happening, or whether I had fallen into an academic routine of convenience: present the material, give a series of tests, have the students write some sort of research paper, give a final exam, give a grade ... and be done for the semester.

Being a part of the discussion group opened me up to another way of thinking about what I was doing and why. It also introduced me to the field of the Scholarship of Teaching and Learning: "systematic reflection on teaching and learning made public" (McKinney, 2012) and the work of CASTL (Hutchings, 2002). "Critically reflective teaching happens when we identify and scrutinize the assumptions that undergird how we work." (Brookfield, 1995). This is what I wanted to do: not only identify the assumptions I have been using throughout my career, but to think critically about them and share my journey. While my path differed from that of Randy Bass, I identified with him when he came to "the realization that he didn't really know much about student learning, and that he needed to be more 'intentional' about designing his courses and teaching to the learning (1999).

At the time, I was teaching a psychology course in Child and Adolescent Development. During the conversations about Bain's book, two of his ideas in particular caught my attention: 1) Real "learning" is more likely to take place when people actually work with material, rather than simply trying to memorize it, and 2) Several people working together produce a better product than one person working alone. Both ideas suggested ways for more learning, and learning on a deeper level, to take place. A colleague in the book group suggested that I consider having my class compile a "Parenting Guide" for her, given that she

was five months pregnant, and would be in her last trimester by the end of the semester. Rather than using a traditional final exam to assess my students' learning, I involved them in a final project which was to create and present a Parenting Guide for, and to, a real person.

Moreover, my colleague had a mentoring relationship with a woman who was also expecting a baby about the same time. We thought it could be interesting to have half of the class put together a Parenting Guide for the mentee and her baby's father, while the other half put together a guide for my colleague. We wondered how the students might think differently when considering the social context: an unmarried woman of color, living in a low socioeconomic situation having her first child, as opposed to a married, white, middle-class professional woman who has a ten-year-old stepchild.

I saw this project as allowing the students to be much more creative in demonstrating the learning that had taken place during the course. It also would incorporate the two contentions of Bain that initially caught my attention

Methodology

Based on my new ideas, at mid-semester I changed the two major components of the course evaluation. We agreed as a class that instead of having each student write a major research paper and take a traditional multiple-choice final exam, as the original syllabus called for, the students would create Parenting Guides for the two mothers as their new final exam. The class was divided into small groups and three of the groups would focus on my colleague and three would focus on her mentee. Of the three focusing on my colleague, each group was assigned one specific aspect of development: physical, cognitive and language, or personality and social. The same was true for the three groups focusing on the mentee. All six groups were also instructed to include the importance and influence of family, peers, media and school as they relate to each particular area of development. All of the groups would present their written guides to my colleague and summarize them with an oral presentation as their comprehensive final exam. The groups were self-selected (my compromise with the students for changing the syllabus mid-semester); my preference was to randomly assign the students to their respective groups in order to minimize the possibility of having groups made of those students with whom other students didn't want to work. Following the oral presentation, my colleague was to keep the three guides

that focused on her situation and pass along, as she deemed fit, the set of three guides that focused on her mentee.

As part of their preparation for these real-life case studies, my colleague agreed to meet with the class prior to their presentations, giving the students an opportunity to connect with her and to ask for any additional information about her particular situation and circumstances, as well as that of her mentee. She continued to make herself available to my students as questions arose during their process of developing the Parenting Guides.

I replaced the course-evaluative major research paper with a reflective paper assignment, in which they summarized what they learned. I wanted the students to think about what course material was useful for them as they envisioned themselves being parents, aunts, uncles and members of the community where public policy makes a difference in the development of children and adolescents. This reflection provided the students an opportunity to both review the entire semester and to think of the material in terms of the usefulness and applicability in their own lives. The reflective paper served as another way of personalizing the course content and engaging the students on a level other than purely academic.

Finally, after the course ended, I asked some of our staff from the Center for Teaching and Learning to help administer a questionnaire for my students, soliciting feedback on the whole process. Their responses were submitted through Google Docs, allowing complete anonymity on the part of the students. The responses were given to me by the Director of Faculty Development, who administered the questionnaire. Of thirty-two students, ten responded, and I received a combined narrative of responses to each of the questions.

Results

The first noticeable result to this new way of trying to give students incentives to learn was that they seemed to get excited about the project and there was a lot of energy surrounding the opportunity to work with the material and present what they thought were the important aspects. The task felt much more enjoyable, more meaningful, more engaging and less formidable than trying to memorize a semester's worth of information. (I've never noticed students being excited about a final before!) The students

appeared to like the challenge of doing something practical with the information, as opposed to the feeling of needing to cram for a final exam.

Of the responses from the questionnaire, there was complete unanimity regarding the issue of this process being an adequate assessment of their learning. The students also deemed the practical application to be a real asset. One student commented, “the Parenting Handbook was very helpful in understanding what we had learned throughout the course ... it is something we can take away for our own futures, making this class special and not just simply a requirement.” Another said, “It allowed us to express our creativity and apply what we’d learned to a real life situation ... better than a test.”

Not all of the students were pleased with the change of course requirements mid-semester. While some students were vocal about the sudden alteration of the syllabus, most of the students who responded to the questionnaire simply acknowledged that it would have been helpful to have the assignment at the beginning so they could be thinking about the project throughout the semester. My impression was that those who were focused on their grade were more reluctant. From the very beginning, those students wanted to know what they were going to have to do to get the grade they wanted. My bias suggests they were less interested in actually learning the material, i.e. they were happy with a “bulimic final,” as long as they got a good grade for the semester.

As for the written Parenting Guides themselves, there was a degree of unevenness in terms of the overall quality of the work. My suspicion is that the self-selected groups were not as heterogeneous, and thus were deprived of a richer level of collaboration. Some guides were complete with a cover page and an index of chapter headings, while others literally divided their guide with references to the chapter numbering from the text. In retrospect, I suspect that in leaving room for creativity, I left the project too open-ended and could have given more specific guidelines.

Another limitation was that the students had a difficult time knowing what to do with the aspect of the mentee being both a person of color and of low socioeconomic status. The class members were almost exclusively white and from middle and upper socioeconomic backgrounds. In both the presentations and the written guides, there was awkwardness and tentativeness in knowing how to address the obvious differences between their own life experiences and those of the mentee. The two sets of written guides were virtually indistinguishable in terms of the nature of the content. In the absence

of the mentee, the oral presentations sometimes came from a perspective reflecting the students' inability to grasp the reality of someone with a low socioeconomic status, as evidenced by one group suggesting that since the mentee lived in a poor neighborhood, she "should consider sending her child to a private school." This is precisely what the students' parents had done for them. I was disappointed with the seeming lack of understanding and sensitivity for this issue. While the text did talk about the impact of poverty and socioeconomic status, that was not a major emphasis. I had hoped the students would grasp the opportunity to specifically think about the unique challenges faced by people in low socioeconomic situations. While the text alluded to numerous issues that are more challenging for people in lower socioeconomic circumstances, I believe that the students saw that as not being relevant for them and dismissed it – even to the point of not remembering that we had talked about some of those challenges. I think that, had the students known from the beginning that they needed to be looking at those issues and thinking about how they might want to counsel the mentee, they would have done a better job. In retrospect, I could have done more to engage the students in conversations about the power of one's socioeconomic situation to shape development.

A striking observation was the similarity of the oral presentations among all six groups. It was as if they had all been given an assigned format. Each group chose to make a PowerPoint presentation, highlighting what they deemed to be the important parts of their guide. Each group began with the members introducing themselves. Subsequently, it was obvious that each group member had been assigned a specific block of information, which each in turn presented. The presentations were much drier than the corresponding written Parenting Guides. It was all too scripted, with little or no interaction among the presenters. Each student gave a summary of their part of the guide, with little or no reference to the other parts. It made me wonder how and where they learned the template for oral presentations. Again, I was intentionally vague about how they were to give their oral presentation, telling them that it was totally up to them how they chose to present their guides. In the future, I would specifically suggest to the students that they be intentionally creative in their oral presentation, and to be aware that this is not a typical business presentation in which each person has a particular area of expertise, but rather a unified whole.

After the presentations were made and the Parenting Guides handed in, I continued to feel a longing to provide feedback on both the written and oral aspects. There was still more teaching / learning to do, and I wanted to do it. This was a new experience for me. I wanted there to be one more opportunity to dialogue with my students about their experience and my reaction, along with the reaction of the two mothers.

Evaluation: If I had a “Do Over”

If I were to do a similar project again, I would divide the class into two teams; one team would provide a comprehensive guide for my colleague and the other a comprehensive guide for her mentee. This would be a semester-long project, and the students could be thinking about it from the beginning of the semester.

The original course syllabus asked that the students write a personal journal entry at the conclusion of each chapter in the textbook. Using questions that encouraged them to reflect on the information, I wanted to know how it might apply to them, in meaningful or useful ways, now or in the future. Going forward, I would continue this, but with a double-pronged focus. One prong would continue the personal reflection; the other would have them focus on ways the material might be presented and used in a Parenting Guide. I envision this as a vehicle to encourage the students to investigate, elaborate and comment on the material, rather than simply summarizing what they found in the textbook. The way I presented the Parenting Guide project made it too easy for the students to limit themselves strictly to the text, denying the richness of other sources and perspectives.

I would also require the written and oral presentations to be submitted prior to the time of the final exam and use the exam time for evaluation, allowing me and the students the opportunity to share reactions and observations about the course experience. Doing this would also allow the two mothers time to read the Parenting Guides and have feedback for the students about what was helpful and any issues that, from their perspective, might have been more fully developed. I envision using the block of time reserved for the Final Exam to be used as a time of reflection on all of our parts – including allowing the students to give feedback and evaluation of their own experience and any changes that would have made the educational enterprise more beneficial for them. I see this as a way of adding one more layer of richness to the learning experience.

Conclusion

As the professor, I know what the whole process felt like. There was much more energy in the class as they worked on their final project. They acknowledged that it was much more fun than studying for a final exam. Just because a process is fun, does not make it a valuable learning experience, but I contend that by making the assignment applicable to real life situations – theirs, my colleague and her mentee – the students were much more engaged in actually thinking about the material and envisioning the practical aspects of it. The assignment engaged their imaginations and allowed for creativity, all the while encouraging them to process it from a comprehensive perspective.

Instead of simply giving the information to my students because of my position as the professor, this new way of learning allowed me to facilitate while the students sifted through the material. They used this opportunity to look for ways to be more informed and thoughtful people in the real world.

Yes, there is room for creativity – both in presenting the course material and in assessing what the students actually learned through the process. Making the effort to be creative, and inviting the students to engage their own creativity results in more enthusiasm and engagement with the material. After reading the Parenting Guides, I am convinced that my ultimate goal was better served: a deeper level of learning took place. The students left my class with a much better grasp of the complexities of the subject matter and are better prepared to use the material in the real world, incorporating it in their present and future lives.

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Common Ground for Three Cultures: Concordance Among Students, Non-Science Faculty, and Science Faculty on Perceptions of Science Course Goals

Cindy Bennington
Stetson University

Terry Farrell
Stetson University

Abstract

Science has been considered a distinct culture within academics. Do faculty and students from outside of the sciences agree with the relative importance of goals for science courses designed by scientists? We surveyed science faculty, non-science faculty and students enrolled in non-majors science courses and found little evidence for a cultural divide between non-scientists and scientists.

Introduction

More than 50 years ago, C.P. Snow described the divide between scientists and non-scientists in his now-famous Rede Lecture, “The Two Cultures and the Scientific Revolution” (Snow, 1959). Although Snow has been criticized for making broad generalizations based on a relatively narrow frame of reference (Gould, 2003), the idea that there is a gap in both worldview, and the ability to communicate those views, persists among both scientists and non-scientists (Koshland, 1985; Herrnstein, 2005; Trefil, 2008). For example, science educators in the United States continue to lament a general lack of scientific literacy among the general public (e.g., Goodstein, 1992; Greenwood & Kovacs, 1999; Miller, 2004) and have called for educational reform in both K-12 (Rutherford & Ahlgren, 1989; deBoer, 2000; Turner, 2008; Pearson, Moje & Greenleaf, 2010) and college (Nelson, 1999; Cook & Mulvihill, 2008) curricula. Recognition that science is an important part of a liberal arts education is reflected in the fact that most college general education curricula require students to take at least one science course and, in general, these courses are specifically designed for non-science majors.

Science courses for non-science majors differ from those for science majors in both the attitudes and expectations that students bring to the course as well as the goals of faculty for students completing the course. Compared to science majors, students majoring in disciplines outside of science tend to have a more negative attitude about science (Gogolin & Swartz, 1992), less confidence in their ability to be successful in a science course (Duchovic, Maloney, Majumdar & Manalis, 1998; Baldwin, Ebert-May & Burns, 1999), and, in some cases, greater conflicts between scientific perspectives and their personal beliefs. Because the good intentions of a broad general education curriculum can elude undergraduates, faculty designing non-majors courses must consider an audience that consists of students who are in the course simply to fulfill a requirement and not necessarily because of a compelling interest in the subject matter or discipline (Smith, Gould & Jones, 2004; Glynn, Taasobshirazi & Brickman, 2007; Cook & Mulvihill, 2008). Furthermore, the potential for a cultural divide between scientists and non-scientists brings into question the ability of scientists to bridge that gap in designing and implementing a course for non-scientists that meets the goals of both groups.

In this study, we recognized three constituencies that have a stake in the efficacy of our college science curriculum and also have the potential to represent three distinct “cultures”: science faculty, non-

science faculty, and students taking science courses for non-majors. While the general education curriculum at any university is expected to bridge the three cultures, the extent to which any one group (e.g., scientists) can create courses that meet the goals and expectations of the other two is less clear. Here we present the results of a series of surveys we conducted as part of a leadership initiative directed by Project Kaleidoscope (PKAL) with funding from the National Science Foundation that focused on our non-majors science curriculum. These surveys were designed to determine: a) the extent to which science faculty teaching non-majors courses embrace a series of previously adopted goals for those courses, b) the concordance between the importance science faculty and non-science faculty and students place on the stated goals for non-majors science courses, and c) the extent to which both science faculty and students in their non-science courses perceive the goals to have been met.

Methods

The Participants. The participants in our study were 11 science faculty members (seven in Biology, two in Chemistry and two in Physics) who teach non-majors science courses, 41 faculty from outside the sciences (out of approximately 60 who received the survey), and 117 students enrolled in three non-majors science courses (Human Nutrition, Environmental Biology or Chemistry in Everyday Life). Each science faculty filled out one survey for each non-major course they taught. Two instructors taught two courses while the other nine taught a single course, so there were a total of 13 surveys completed. Because some courses were taught by different instructors in different semesters, there were a total of 10 different course titles included. At the time the surveys were conducted, all students at the university were required to take a science course and all of the courses offered had a laboratory component that met separately from the lecture. The research adhered to university IRB practice. In particular, the survey was exempt from the university's IRB review processes given that the survey met the criteria for exemption (i.e., research participation was voluntary and anonymous, and the survey didn't request sensitive information, use active deception, or subject participants to mental or physical stress).

The Survey. As a foundation for our investigation, we used a set of goals for non-majors science courses that had been developed and unanimously approved by our faculty in the Division of Natural Sciences in 2001 (Table 1). The survey sent to science faculty during the 2005-06 academic year consisted of five Yes/No questions that related to an instructor's knowledge of the goals and the degree to which they

explicitly introduced those goals to students (Table 2). A list of the 12 goals for non-majors courses and the instruction for respondents to state the degree to which each item was covered (hereafter referred to as coverage) using a Likert-type scale (strongly covered = 3, covered = 2, slightly covered = 1, not covered = 0, and not sure = NS) made up the second part of the survey. Following this was the same list and scale with the instruction to state the degree to which the participant believed each goal is an important component (hereafter referred to as importance) of the course taught. Student surveys were similar except that there were three, rather than five, Yes/No questions related to student knowledge of goals. Non-science faculty were given surveys with the same three Yes/No questions as the students and were asked only about perceived importance (and not coverage) for each of the twelve goals. None of the surveys asked respondents to suggest different goals.

For the surveys completed by students and science faculty, we calculated the average importance and coverage scores for each of the 12 goals. For the surveys completed by non-science faculty we calculated the average importance score for each goal. Using these averages, we calculated correlation coefficients to determine the strength of the relationship between: a) science faculty importance and coverage scores, b) science faculty and non-science faculty importance scores, c) science faculty and student importance scores, and d) science faculty and student coverage scores.

Table 1. A list of goals for non-majors courses developed and adopted by science faculty. This list of goals was distributed with surveys to both non-science faculty and students enrolled in non-majors science courses.

Goal	Every non-majors science course should:
1	Teach a great deal about the methods of inquiry in the Natural Sciences. A diversity of methods (i.e. careful observation, experimentation, and modeling) should be addressed and students should understand the critical role of quantification and falsification in science.
2	Contain at least one highly detailed example of the immense utility of analytical mathematics in the description of natural processes.
3	Clearly distinguish between valid scientific methods and pseudoscientific studies.
4	Provide a clear example of how scientific knowledge progresses. This necessarily involves a historical component and should reveal how science has been advanced by new data, new ideas, and new interpretations. It should also show how advancement has sometimes been slowed by an unwillingness to deal with changing paradigms.
5	Develop the students' abilities to speak clearly and persuasively about scientific methods and results.
6	Involve a large amount of active learning. All students should engage in a variety of learning experiences. The "laboratory" aspect of the course is critical to learning about both the concrete and abstract portions of a discipline.
7	Develop a curiosity and interest in the natural sciences in students that endures well beyond the end of the semester.
To accomplish these goals, every non-majors science course should contain as many as possible of the following:	
8	A detailed example of the immense utility of computer simulations in understanding natural processes.
9	Examples of consilience (the strong unity of knowledge among the different disciplines of the natural sciences) in the natural sciences. Specifically, the instructor should show how knowledge originally developed in a different discipline ultimately had strong influences on the field of study.
10	Information that helps students develop an active appreciation of both the potential benefits and potential dangers of scientific advances.
11	Examples of how scientific knowledge helps inform responsible ethical decision making. When possible, the course should empower students with the scientific knowledge needed to conserve our environment.
12	Discussion of the aesthetic dimension of science--of what it means to seek an elegant theory and experiment. The students should develop a sense of the beauty of natural forces they explore and understand the need for commensurate beauty in scientific theory.

Results

Of the 11 instructors who completed surveys, more than half were aware of the goals at the time they taught the course, but a smaller percentage actually considered the goals when designing their course and none of them shared the goals with their students (Table 2). However, when asked about the goals after the course, instructors generally considered each of the 12 goals important. Given that there was significant overlap between science faculty who voted to adopt the 12 goals for non-majors science courses and those teaching the courses, there was limited variability in importance scores among the 12 goals. Mean importance scores ranged from 1.83 to 2.83. The goals with the highest importance scores were 1, 6, and 7 while goals 8, 9, and 12 (see Table 1 for description of goals) were considered least important. Similarly, goals 6 and 7 were those that instructors self-reported as giving the greatest coverage and goals 9 and 12 were given the least. Although there was strong agreement between importance and coverage scores reported by science faculty, Goals 3 and 6 were noticeable outliers in the relationship (Fig. 1), with Goal 3 being given less coverage than would be expected based on its importance score and Goal 6 being given greater coverage than expected. In general, importance scores ($\bar{x}_{Importance} = 2.38, sd = 0.32$) were higher than coverage scores ($\bar{x}_{Importance} = 2.38; \bar{x}_{Coverage} = 2.01; t = 2.96, p < 0.01$)

Table 2. List of Yes or No questions (with summary of responses) included in the survey sent to science instructors teaching courses for non-science majors.

Question	# Yes	%Yes	# No	%No
1. Did you know that we had a set of goals for non-majors courses?	8	61.5	5	38.5
2. Did you know what was stated in this set of goals?	8	61.5	5	38.5
3. Did you consider this set of goals when considering material for your course?	5	38.5	8	61.5
4. Did you share this list of goals with students?	0	0	13	100
5. Is this list of goals on your syllabus?	0	0	13	100

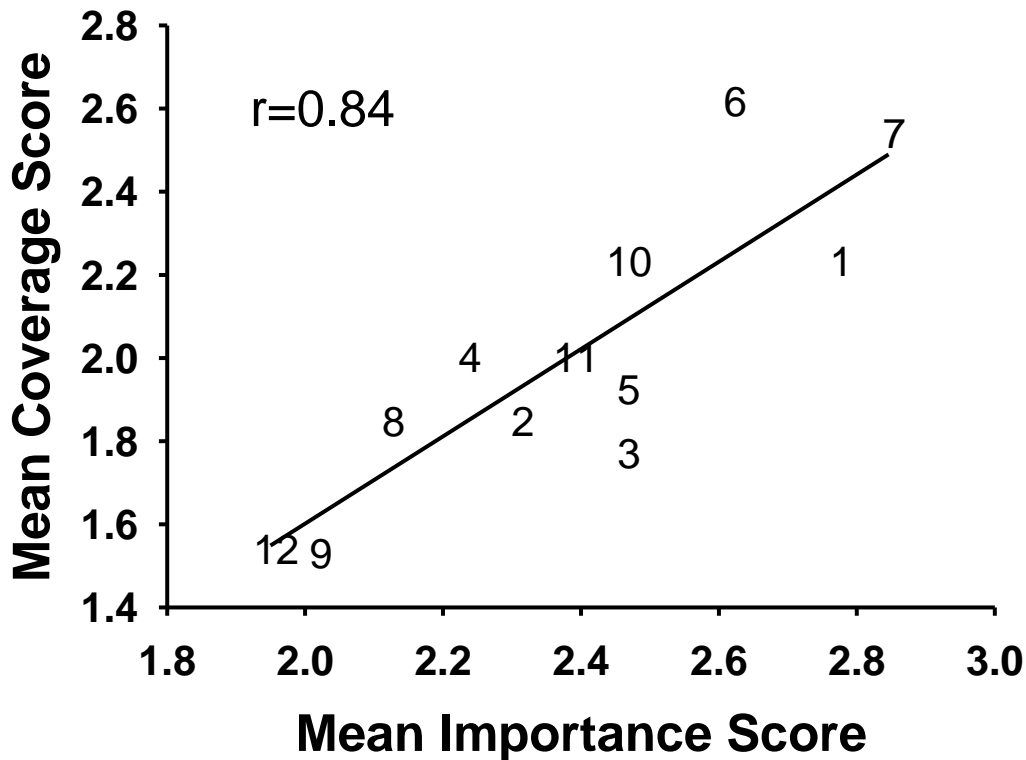


Figure 1. Relationship between the importance science faculty attributed to each of the 12 goals for non-majors science courses and the coverage they reported giving each goal in the course(s) they teach. Data points for the correlation are the average importance and coverage for each goal and are symbolized on the graph by the number assigned to each goal in Table 1.

Faculty outside of the natural sciences tended to agree with scientists about the relative importance of the 12 goals (Figure 2). Student perceptions of importance, however, were more variable than those of either faculty group (Figure 3), although the positive linear relationship was still strong ($r = 0.55$). In particular, students tended to rate Goals 10, 11 and 12 as more important than would be expected based on the overall linear relationship between the two variables while faculty rated Goal 2 as more important than students.

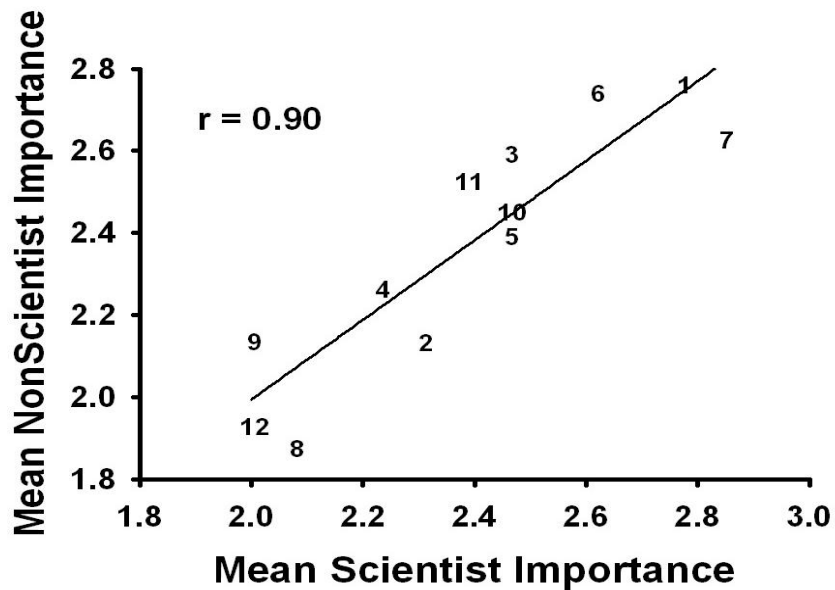


Figure 2. Relationship between the importance science faculty and non-science faculty attribute to each of the 12 goals for non-majors science courses. Data points for the correlation are the average scientist and nonscientist importance scores for each goal and are symbolized on the graph by the number assigned to each goal in Table 1.

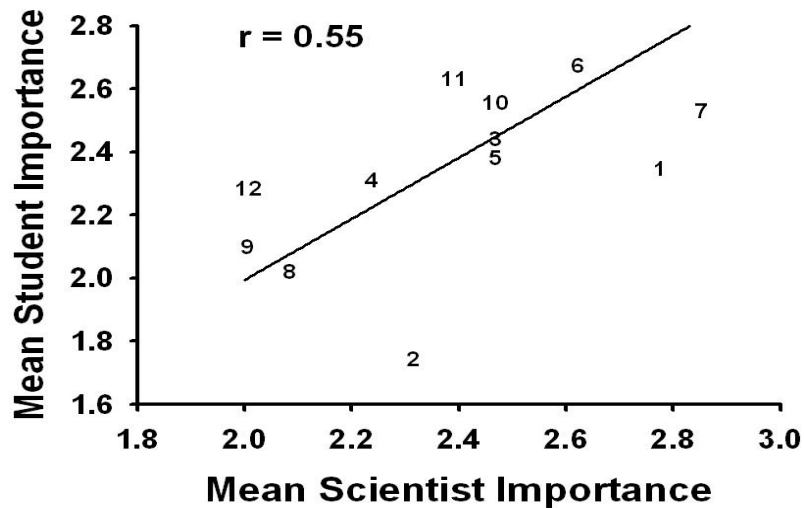


Figure 3. Relationship between the importance science faculty and students attribute to each of the 12 goals for non-majors science courses. Data points for the correlation are the average scientist and student importance scores for each goal and are symbolized on the graph by the number assigned to each goal in Table 1.

Discussion

Overall, there was a strong positive relationship between the importance science faculty placed on a goal and the self-reported coverage allotted in their courses. However, the majority of faculty stated that they did not consider the existing set of goals when designing their courses, and no faculty communicated the list of goals to their students, suggesting that instructors were not teaching toward the established goals. Thus, the strong correlation between self-reported coverage and importance may include the bias of responders who, in retrospect, assume they must have given heavy coverage to those items they felt were most important. On the other hand, almost all of the faculty we surveyed had reviewed and accepted the list of goals four years before the survey was administered, and the list was derived from discussions among the same faculty members about what/how they teach non-majors. Thus, the unspoken, individual goals of instructors were presumably similar to those adopted by the group, and could also account for the correspondence between reported importance and coverage.

One notable exception to the general pattern of a positive relationship between importance and coverage was that faculty placed a relatively high importance on distinguishing between science and pseudoscience ($\bar{x} = 2.46$), but reported relatively low coverage ($\bar{x} = 1.77$). The high importance attached to this goal is appropriate given the proliferation of pseudoscience in the mainstream media. The relative lack of coverage may reflect that pseudoscientific claims are more important and topical in some disciplines (i.e. the study of biological origins) than in other disciplines (i.e. physics of music). This lack of coverage could also reflect a reluctance of instructors to teach in areas outside their training (which typically doesn't involve investigation of pseudoscientific claims) or a reluctance of instructors to delve into controversial subjects. Teaching science content does not necessarily increase student understanding of the nature of scientific inquiry (Johnson & Pigliucci, 2004). Thus, instructors of non-majors science courses should strike a balance between the presentation of content and examples of scientific process in order to increase critical thinking skills and the ability to distinguish between research-based evidence and unscientific claims.

Science faculty and students enrolled in non-majors science courses generally viewed the importance of the 12 goals similarly. Since students were surveyed at the end of the semester, their

perceptions of importance may have been, at least in part, shaped by the bias of their instructor. There were, however, several goals that were rated differently in terms of importance by faculty and students. In particular, students did not consider the utility of analytical mathematics in science (Goal 2) to be as important as faculty did. Math anxiety in college students is common (e.g., Perry, 2004), so this result was not completely surprising, but did cause us to reflect on our own views about the importance of math to science. Although quantitative techniques form the basis of scientific inquiry, a great deal of science can be understood without a firm grasp of the underlying mathematics (Trefil, 2008) and the inclusion of math in science courses could actually exacerbate the anxiety of non-science majors about both science and math.

We remain convinced that Goal 2 is important for non-majors for three main reasons:

1) solutions to some of the most important scientific issues facing civilization today (e.g., climate change, disease spread, water and food shortages) are being investigated using mathematical models, and a scientifically literate society needs to be able to understand the utility of such models even if the particulars of the model are unknown, 2) providing practical applications for mathematical models within a science course may actually reduce anxiety about math (Arnett & van Horn, 2009), and 3) if we want non-majors to understand the nature of scientific inquiry as well as absorb science facts, we cannot eliminate the mathematical component (Hohman, Adams, Heinrichs & Hickman, 2006). In fact, emphasizing the quantitative nature of science is one way to demonstrate the way in which questions are answered differently in science compared to non-scientific disciplines.

Given differences in the kinds of academic questions that are asked by non-scientists and scientists, a cultural divide between the two groups would be expected to be manifested in the relative importance of educational goals in the disciplines. Our surveys, however, suggest that the divide may be smaller than anticipated. In general, the relative importance of the course goals rated by scientists is similar to that of non-scientists. Perhaps most striking is the fact that this agreement was similar even for those goals related to the application of science to societal concerns (i.e., Goals 10, 11, and 12). Our results may be biased by the fact that non-science faculty who responded may have been those predisposed to thinking positively about science and scientists, although faculty respondents came from

our School of Business (n=8), School of Music (n=6), and College of Arts and Sciences (n=27). Furthermore, faculty in all disciplines likely share an academic interest in “ways of knowing” that results in a correspondence between scientists and non-scientists for the importance of learning goals. This commonality, combined with the act of scientists reaching out to non-science faculty by asking their views about our courses, may have also had some non-tangible rewards in bridging the cultural divide.

The fact that we created a list of goals for non-majors courses reflects that, at our institution, we teach non-science majors differently from science majors, and perhaps suggests that we are guilty of deepening the cultural divide. We argue, as have others (e.g., Wright, 2005), that non-majors courses are less bound by content than those for majors and should be designed to create citizens who appreciate and understand science, not to create scientists (Trefil, 2008; but see Sundberg & Dini, 1993; Klymkowsky, 2005). Thus, while our goals may not necessarily translate to curricula for non-science majors at other institutions, their approval at our university by all math, chemistry, biology, and physics faculty members satisfies us that they are consistent with the purpose of including a natural science course within our general education curriculum. Furthermore, while our surveys did not allow respondents to suggest additional goals, the general agreement of importance between scientists and non-scientists suggests that others at our institution agree with our approach.

In conclusion, there were two positive outcomes from simply distributing our surveys to faculty. By reminding science faculty about the previously agreed upon goals of our non-majors courses, we encouraged them to think broadly about course content and management and to consider the relationship between what they consider to be important and the material they actually include in their courses. After we distributed our surveys, several faculty teaching non-science majors modified their course content and included the 12 goals on their course syllabi, something that none had done previously. We do not know whether this explicit inclusion on the syllabus increased efforts to teach toward the goals, but our findings provide a starting point for a discussion about course design (e.g., Wiggins & McTighe, 2005; Handelsman, Miller & Pfund, 2006). The distribution of the survey and goals to non-science faculty also demonstrated that science faculty recognize that classes designed for non-science majors should have different foci than courses for science majors who will take many science courses in multiple disciplines during their academic career. By giving our non-science colleagues a voice in the development of these

courses, we acknowledged that an understanding of the differences between these groups is needed to effectively teach students from across Snow's cultural divide. Finally, the results of our study showed that the cultural divides between different faculty groups and students are narrower than we expected, which bodes well for maintaining a central place for science in a liberal arts education. While our research sample was limited to faculty and students at one small institution, it would be interesting to know whether a narrower-than-expected cultural divide also exists at larger and/or international universities.

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Facilitating Learning in a Human Anatomy and Physiology Course through Microtheme Writing Assignments

Farshad Tamari, Ph.D.
Kingsborough Community College

Mohamed Lakrim, Ph.D.
Kingsborough Community College

Loretta Brancaccio-Taras, Ph.D.
Kingsborough Community College

Abstract

The process of “writing to learn” has been documented in many disciplines. In this study, a specific type of writing, microthemes, was implemented in a human anatomy and physiology course in order to determine whether this type of writing assignment enhances student exam performance. Student performance on exam questions dealing with topics covered in microtheme assignments was compared to performance on exam questions with no such related assignment. Statistically significant improvements were recorded on two of the four exams.

Introduction

The importance of writing in learning has been investigated and documented in several disciplines including accounting (Garner, 1994), psychology (Stewart, Myers & Culley, 2010), and the biological sciences (Lakrim, 2007; Litchfield, Mata & Gray, 2007). Many educators have become interested in incorporating writing into their classes as a result of Writing Across the Curriculum initiatives (Bean, 1996; Defazio, Jones, Tennant & Hook, 2010; Demski, 2012; Khourey-Bowers, 2011; Knipper & Duggan, 2006; Kurfiss, 1985; Perelman, 2011). Such initiatives may vary from one institution to the next in the types of writing used to improve student learning. Recently much attention has been given to implementing web-based writing (Cooper, 2012; Demski, 2012; Gerdeman, Russell & Worden, 2007). Some writing assignment examples that can be used in any discipline include informal journals, summary write-ups, formal short or long reports and essays, and microtheme assignments (Bean, 1996; Ferrario, 2005; Knipper & Duggan, 2006).

No matter what type of writing is used, there is a consensus among educators that writing contributes positively to student learning at different levels of education and among different disciplines (Bean, 1996; Dixon, 1994; Litchfield et al., 2007; McDermott, 2010; Moore, 1997; Stewart, 2010). A number of studies have demonstrated that writing promotes cognitive development and enables students to process information and learn the material more effectively (Bean, 1996; Dixon, 1994; Ediger, 1999; Haynes, 1993; Moore, 1997). "Writing to learn" is routinely connected to developing critical reading skills (Haynes, 1993). Often, students do not read the textbook before coming to class unless they are asked to complete a written assignment. It is possible that students are poor readers to begin with (Bean, 1996) and thus, might need to be encouraged to read. Wilcox and Murray (2000) reported that when the nature and the amount of material is complex, students are discouraged from reading in anatomy and physiology. Regardless of mechanism, it is evident that the sentiment that students do not read enough, especially in a community college, is supported beyond anecdotal evidence at least for literary reading (Long, 2009).

One way to encourage the development of writing and reading skills, as well as mastering content knowledge, is assigning writing such as microtheme papers. Microtheme assignments allow the students to widely explore a lesson or group of lessons through a single and precise question and empower students to complete the reading assignments for upcoming lectures. Microtheme assignments are concept driven and relatively short compositions. They can vary in length from text that can fit in a 5-8 inch index card (Miles, 1982) to longer assignments between 100-250 words (Ferrario, 2005). The purpose of a microtheme assignment is to have students focus on one particular concept. Through the process of writing, students will gain knowledge, comprehend and potentially apply the material, and use the knowledge to develop analytical and critical thinking skills (McDermott, 2010; Olson, 2010; Quitadamo & Kurtz, 2007). The rationale for this approach is that through the writing of microtheme assignments, which typically focus on a specific concept in the course, students will explore the material, prepare for lectures, and will better comprehend the new and complex concepts presented in lecture. They might do so by reading from the course assigned textbook as well as other resources.

The objective of this study was to determine if microtheme assignments can be used to encourage students to read information about the course content. It is expected that students will perform better on written exam questions on which they completed a microtheme assignment compared to those on which they did not.

Methods

This study was conducted at Kingsborough Community College (KCC) of The City University of New York (CUNY), an urban community college located in Brooklyn, New York. All participants (N=97) were students in Human Anatomy and Physiology I, the first semester course of the one-year anatomy and physiology sequence. For some students, it was their first college-level science course. KCC's Human Anatomy and Physiology course covered, in order, the following major topics: General introduction to the human body, basic chemistry, the cell and tissues, the integumentary system, the skeletal system, the muscular system, the nervous system, and the endocrine system. The study was conducted using five different sections of this course over two consecutive semesters.

Assigning Microtheme Assignments and Analyzing their Effectiveness

The authors designed five microtheme assignments. The microtheme assignments constituted approximately 10% of students' final grades, while being worth approximately 25-30% of each exam. To complete these assignments, students were required to read related sections in their textbook and then submit their written answer. In order for the students to prepare for the lecture presentation, microthemes were assigned prior to discussing the topic in class and were submitted by the students before the start of the lesson. The answers to the microtheme assignment were then discussed. The first microtheme assignment included material that the students might have been exposed to in other KCC biology classes or in high school while the next four microthemes were on topics that were new to the students. The same assignments were used for all sections of the course. To assess the usefulness of microtheme writings to improve student learning, we administered four exams comprised of multiple-choice questions and written answers. This study reports on the analysis of written answers. The microtheme assignments were designed around relatively complex human anatomy and physiology topics (Table 1).

Table 1: Microtheme topic and the related microtheme assigned to students.

Microtheme Topic	Microtheme Assignment
Basic Chemistry	<i>List the 4 major macromolecules. Name their subunits and briefly describe how these subunits are bonded to form these macromolecules. Include in your answer the type of the bonds and name two types of food in which you can find them.</i>
Cell Biology	<i>Briefly describe the development of the Cell Theory. How does material move in and out of the cell? Name all of the cell organelles. For each, describe its structure and function.</i>
Skeletal System	<i>Compare and contrast the two types of bone development (Intramembranous Ossification and Endochondral Ossification). In your own words, describe the processes involved in each and highlight the similarities and differences.</i>
Muscular System	<i>Part I: Label the muscle cell diagram. Part II: Using your own words, but with the correct scientific terms, describe the physiology of muscle contraction, including the sliding filament theory.</i>
Nervous System	<i>In detail, describe, and then compare and contrast, the steps involved in the local and action potentials.</i>

Data Collection

Each of the four exams had questions centered on the topic of the microtheme assignments (MT) that required a written-answer as well as additional written-answer questions that were on topics not addressed in the microtheme assignments (NMT). The written answers for both MT and NMT questions were graded and standardized based on a percentage scheme. For this study, the written question averages were calculated first, based on pooling all student grades across the five sections of the course, and then for individual exams. This was done for the microtheme and non-microtheme exam questions independently.

Statistical Analyses

Data was compiled using Microsoft® Excel 2010. All parametric and nonparametric analyses were performed using SigmaPlot® version 12 (Systat Software, Inc.). The pooled data for all student grades for microtheme (MT) and non-microtheme (NMT) exam questions were initially compared using a two sample student-t-test. The tests of normality of distribution and homogeneity of variances (homoscedasticity) failed for the pooled data and therefore, a Mann-Whitney Rank Sum test (non-parametric) was used. All test scores were converted to values out of 100.

In a second statistical test, comparing student performance on each exam, a one-way analysis of variance (ANOVA) was used to compare student grades for microtheme and non-microtheme exam questions on each of the four exams and among the different exams. This was followed by a *post-hoc* test to determine which mean was different from the others.

For each microtheme assignment, there were students who did not complete the work. We used these data as an internal control to assess variability in difficulty between microtheme and non-microtheme exam questions. A one-way ANOVA was used to compare the means for student performance on microtheme and non-microtheme questions for students that did and did not complete the microtheme assignments. The student group that did not complete the microtheme assignment was treated as the control group. A *post-hoc* test (Tukey) was performed *a posteriori* to determine which means were statistically different from the others.

Research with Human Subjects

This research study protocol was approved by the KCC Institutional Review Board (IRB approval number 10-07-030-0138) and all students who agreed to participate in the study signed consent forms.

Results

To determine whether microtheme assignments better prepare students, we compared student performance on exam questions dealing with topics covered in the microtheme assignments (referred to as MT questions) to those without a microtheme assigned (referred to as NMT questions). An analysis of the pooled data for the five human anatomy and physiology classes comparing the means for student performance on questions that related to the microtheme assignments (MT) versus those that did not (NMT) indicated failure of tests of normality of distribution and homogeneity of variance (homoscedasticity, Shapiro-Wilk, $p < 0.050$). This rendered the two sample student-t-test not appropriate for the comparisons of the means and prompted us to use a Mann-Whitney Rank Sum Test instead. However, it should be noted that if normality of distribution and homoscedasticity are ignored and a two sample student-t-test is performed, the two means are statistically different ($p < 0.001$). The mean grade for the MT exam questions ($\bar{x}_{MT} = 67.21 \pm 31.4$, $n = 351$) is larger than that of the NMT questions ($\bar{x}_{NMT} = 50.4 \pm 33.8$, $n = 351$). The more appropriate Mann-Whitney Rank Sum Test yielded the same results ($\bar{U} = 43602.0$, $\text{Median}_{MT} = 75$, $\text{Median}_{NMT} = 50$, $p < 0.001$).

A one-way ANOVA was used to compare mean grades for students' performance on MT and NMT exam questions for each of the four exams administered. The results are provided in Table 2.

Table 2: ANOVA results comparing mean student performance on microtheme (MT) and non-microtheme (NMT) portions of exams I-IV. N=sample size, SD=standard deviation, $p < 0.05$ depicts statistical significance. A significant difference between the means of microtheme and non-microtheme scores is denoted by *.

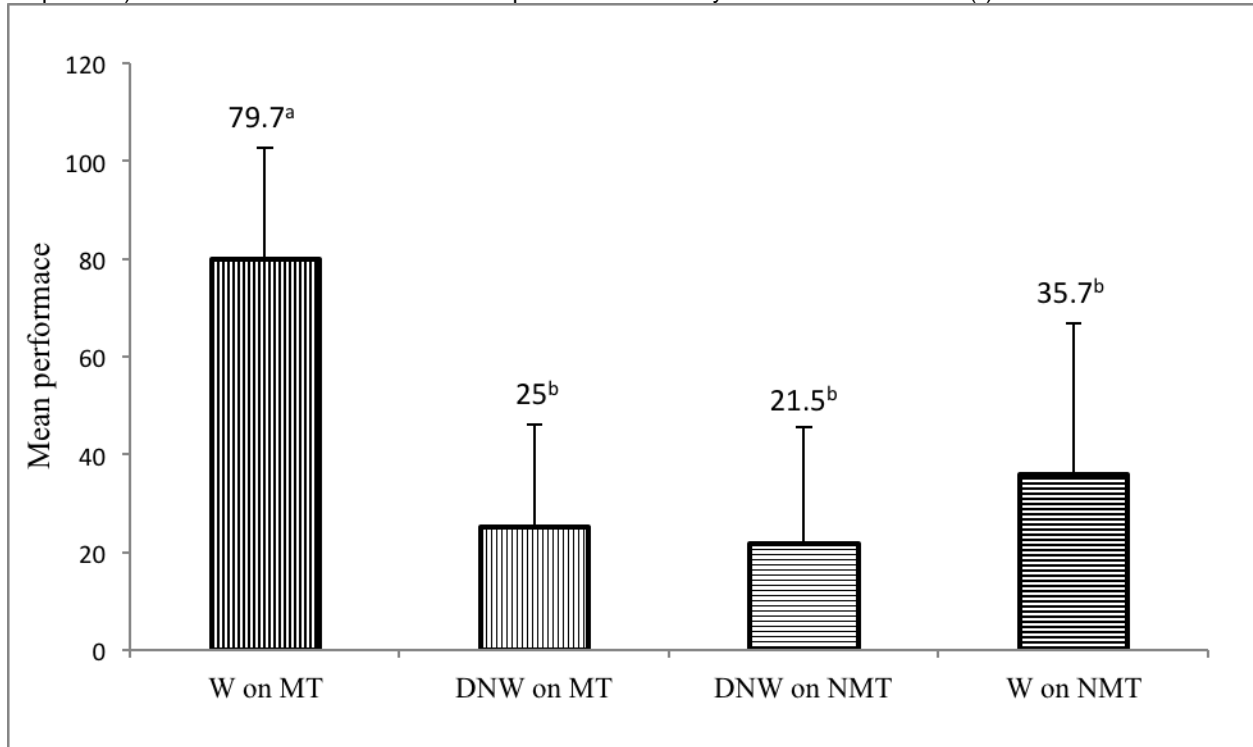
Exam No.	MT/NMT	N	Mean \pm SD	P
Exam I	MT	97	72.7 \pm 23.2	0.731
	NMT		65.4 \pm 27.6	
Exam II	MT	96	78.2 \pm 27.3	<0.001*
	NMT		51.5 \pm 34.9	
Exam III	MT	83	53.0 \pm 33.7	<0.001*
	NMT		32.5 \pm 29.1	
Exam IV	MT	75	61.8 \pm 36.0	0.205
	NMT		49.3 \pm 35.2	

For all four exams, students had more correct answers for exam questions on which they wrote a microtheme (MT in Table 2) compared to those on which they did not write a microtheme assignment (NMT in Table 2). However, the differences are statistically significant only for exams II and III ($p < 0.001$ for both, Table 2) and not for exam I and IV ($p = 0.731$ and 0.205 , respectively, Table 2).

As a control (Figure 1), for two of the sections, a one-way ANOVA was used to compare student performance on microtheme (MT) versus non-microtheme (NMT) exam questions for students that completed the microtheme assignment with those that did not. It is expected that students that completed the microtheme assignments would do better on microtheme exam questions compared to non-microtheme exam questions. Furthermore, it is expected that students that did not complete the microthemes would have similar performance on microtheme and non-microtheme exam questions. Finally, it is expected that students who did not complete the microtheme assignments would perform the same on non-microtheme exam questions compared to students that did complete the microtheme assignments.

When combining all data for the four exams, students that completed the assignments did significantly better on both MT and NMT questions compared to those that did not complete the microtheme assignments (Figure 1). We did not observe a significant difference between students that did not complete the microtheme writings on MT versus NMT exam questions, indicating that the overall level of difficulty between microtheme and non-microtheme exam questions is the same. The mean grade for students that did not write the microthemes on microtheme questions was $\bar{x}^b = 25.0 \pm 21.6$. This was not significantly different from the mean grade of students that did or did not write the microthemes on non-microtheme questions ($\bar{x}^b = 35.7 \pm 30.8$ and $\bar{x}^b = 21.5 \pm 23.7$, respectively). By extension, the mean grade for students that did complete the microtheme writings on microtheme questions ($\bar{x}^a = 79.7 \pm 22.8$) was significantly higher than the performance of students that did not write the microthemes on both MT and NMT questions ($\bar{x}^b = 25 \pm 21.6$ and $\bar{x}^b = 21.5 \pm 23.7$, respectively), and those that wrote the microthemes on non-microtheme questions ($\bar{x}^b = 35.7 \pm 30.8$). Interestingly, student grades for those that wrote the microtheme assignments are higher, albeit not statistically significant, than those that did not write the microthemes.

Figure 1: Bar graph illustrating average (mean) grades for students that did not write the microtheme assignments (DNW, n=11) and those that did write the microtheme assignments (W, n=119) on exam questions that were microtheme related (MT) and those that did not relate to the microthemes (NMT). Students did significantly better when they wrote microtheme assignments on exam questions that are microtheme related (^a). This mean was statistically higher than the means for students that did not write any microthemes (regardless of MT or NMT nature of question) and on the non-microtheme exam question even if they wrote the microtheme (^b).



Discussion

Student preparation for lectures has important implications for their learning as well as their success. Generally, it is recommended that for every hour of class, students spend additional two hours on course work; however, this is rarely accomplished (McCormick, 2011). One way to promote studying is through writing. The concept of using the process of writing to foster student learning has been explored in a number of disciplines including those at community colleges. For instance, at Kingsborough Community College, a “writing to learn” approach was used in an anatomy and physiology class by Polizzotto and Ortiz (2008) through a “design project” assignment. Selove (1992) showed that writing helped develop critical thinking skills in an anatomy and physiology course at Lord Fairfax Community College. Furthermore, Wilcox and Murray (2000) examined the effectiveness of writing in an anatomy and physiology class. They reported students were less anxious due to their participation in the writing

process. The use of a specific type of writing, such as microthemes, has been discussed in a number of courses (Bean, 1996; Ferrario, 2005; Miles, 1982; Stanley, 1991a, 1991b). However, in our literature review, the use of microthemes in a community college human anatomy and physiology class has not been explored.

Our results indicate that the students who participated in this study performed better when they completed microtheme assignments. This enhanced performance is reflected in the pooled data for the four exams for all five sections of the course. It is also reflected for two of the four exams individually (Table 2). Student performance was significantly better on microtheme questions that had a writing component for exams II and III. For exams I and IV, there was a benefit for students that completed microtheme assignments, however, it was not statistically significant. There may be a few different reasons for the lack of significance. For exam I, a great deal of the work was material considered in earlier college or high school science or biology courses. This is supported by two lines of evidence. First, the mean performances for the students in microtheme and non-microtheme exam questions are relatively close to each other. Second, student performance on non-microtheme exam questions on exam I (review material) is higher than student performance on non-microtheme questions on exams II-IV (Table 2). For exam IV, the likely reason is that the variation in student performance was so high so as to render the results between microtheme and non-microtheme questions not significantly different. To investigate this variation further, it is possible to assess student knowledge before the administration of the corresponding microtheme and exam IV.

It appears that we have also found evidence to support our hypothesis that student preparation through completing microtheme assignments motivates the students to spend greater “time on task” with the course content. Students possibly read above and beyond the microtheme material as they were completing these assignments. This is evident through better performance on non-microtheme exam questions for students that completed the microthemes compared to those that did not (Figure 1), albeit that for exams I and IV the difference in performance on exams was not statistically significant (Table 2). For example, a question relating to physiology of muscle contraction (Table 1, assignment 1) will inherently prompt students to read about muscle structure (macroscopic and microscopic such as organ,

fascicles, and fiber), as well as material on the neuromuscular junction. These topics are not explicitly specified in the microtheme assignment. Therefore, before being able to complete the microtheme assignments, students must first explore all of the above mentioned topics. Furthermore, it is possible that the assigned microthemes for materials for exams II and III provided an opportunity to identify and review pertinent information.

In order for this microtheme approach to work, the students must complete the assignments before the lecture topic is covered in class. It is our opinion that the use of microtheme assignments enhances the classroom experience for students as well as instructors, in addition to providing a medium for better learning for students (Yule, Wolf & Young, 2010). Students come to class having read and written about particular anatomy and physiology principles. The instructor can readily assess the topics students understand and then focus the lesson on more difficult concepts requiring higher order thinking such as chemical bonding, action potential, and nerve impulse transmission. Since the students are better prepared, they understand the concepts more quickly. Instructors can more promptly get through the basic material and have time for students to ask more questions and participate in discussions about the course content.

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**Self-Directed Learning and Higher Education Practices:
Implications for Student Performance and Engagement**

Alisha Francis
Northwest Missouri State University

Abraham Flanigan
Northwest Missouri State University

Abstract

Self-directed learning (SDL) is associated with a number of characteristics which are emphasized within the higher education curriculum. There is some question, however, regarding the degree to which higher education is compatible with SDL. We consider that question based on data from 188 college students who completed the Oddi Continuing Learning Inventory (OCLI), the Academic Motivations Inventory (AMI), and items evaluating perceptions of instructional techniques. The results suggest SDL is not directly related to academic performance or preferences for instructional techniques. Patterns of academic motivation suggest increasing levels of SDL may be associated with disengagement from formal higher educational structures.

Self-Directed Learning and Higher Education Practices: Implications for Student Performance and Engagement

Continuous technological development contributes to a unique, continuously evolving culture which requires skills and abilities unique to the 21st century – including those of self-directed learning (SDL) (Bedard, 1997; Teo et al., 2010). It is not surprising, then, that interest in SDL is spreading beyond its initial focus within adult education (Hiemstra, 2004). Self-directed learning has been the topic of hundreds of articles, books, and dissertations since it emerged as a focus of scholarship in the late 1960's (Long, Redding, & Eisenman, 1994). Within that literature, SDL is characterized by a proactive approach to learning where individuals take responsibility for identifying necessary learning resources and implementing strategies appropriate for their goals (Knowles, 1975; Pilling-Cormick & Garrison, 2007).

More than 30 years ago, Knowles (1975) asserted that this proactive approach to learning would become a necessary survival skill. Indeed, SDL is associated with critical thinking as well as improved understanding and decision making (Candy, 1991) – characteristics which are frequently emphasized within the higher education curriculum (e.g. Hambur, Rowe, & Tu Luc, 2002; The Association of American Colleges and Universities, 2011). There is some question, however, regarding the degree to which higher education is compatible with SDL. From one perspective, the structures necessary for consistency within formal education systems prevent optimal alignment between students' varying levels of SDL and the methods of instruction (Brockett & Hiemstra, 1991; Grow, 1991b). This perspective is consistent with assertions that instructor controlled structures which characterize the elementary and secondary school systems obstruct children's natural tendency toward SDL (e.g. Eisenman, 1990; Kasworm, 1992; Piskurich, 1992).

That lack of alignment between SDL and traditional instructional methods may explain, in part, the relative ambiguity of findings related to SDL and academic performance. Self-directed learning is positively correlated with academic achievement in traditional higher education classroom settings for some samples (Long, 1991; Pao-Nan & Wei-Fan, 2008), though the relationship with subject matter learning is less definitive (Candy, 1991). Levels of SDL are associated with technology use in online courses (Shinkareva & Benson, 2007), but the relationship between SDL and achievement in those courses is not consistent (Pao-Nan & Wei-Fan, 2008). Collectively, theoretical discussion and these

empirical findings suggest that SDL should be considered in the context of both instructional techniques and individual differences (Brockett & Hiemstra, 1991; Long, 1990). The current study is consistent with that suggestion, drawing upon perspectives from SDL and academic motivation to consider students' perceptions of the higher education learning environment and contribute to our understanding of factors which influence academic performance.

Perspectives on Self-Directed Learning

Long (1989) emphasizes the role of learner characteristics within the SDL process, asserting those characteristics are the most significant indicator of whether the individual will engage with learning structures. Theoretically, individual difference variables of particular relevance include knowledge, attitudes, values, motivations, cognitions, and affective characteristics (Kasworm, 1992; Oddi, 1987). Empirical findings suggest that psychological variables directly influence the degree to which college students demonstrate self-directedness while social and demographic considerations have indirect effects (Oliveira & Simoes, 2006). Among the psychological variables of interest, personality characteristics of emotional stability, independence, super ego strength, sensitivity, and conscientiousness are each positively correlated with SDL (de Bruin, 2007; Lounsbury, Levy, Park, Gibson, & Smith, 2009). Consistent with reports that a match between student characteristics and instructional style facilitates learning (e.g. Brockett & Hiemstra, 1991; Sternberg, Grigorenko, & Zhang, 2008), discussions of SDL also consider the way the topic or environment interacts with those characteristics to influence learner emotions (Rager, 2009). From this perspective, an understanding of the behaviors of self-directed learners also requires considering instructional techniques (Long, 1992).

Grow's "Staged Self-Directed Learning Model" (1991a) offers one framework for considering the interaction between students and their environment. Grow emphasizes the alignment between students' levels of SDL abilities and the methods of instruction. The conceptualization underlying the model is consistent with perspectives which place instructional methods along a continuum with complete instructor control at one end and complete learner control at the other (Candy, 1991). One implication is that decreased instructor control is accompanied by increased learner responsibility (Candy, 1990). Grow's emphasis on alignment between student characteristics and instructional techniques highlights

variations in the degree to which students are prepared for the increasing responsibility which accompanies decreasing instructor control (Brockett & Hiemstra, 1991).

The Staged Self-Directed Learning Model (Grow, 1991a) emphasizes the impact of misalignment between pedagogical decisions and student characteristics. At the most fundamental level, alignment between SDL levels and course structures is related to the outcomes associated with those structures (Dyner, Cate, & Rhee, 2008; Shinkareva & Benson, 2007; Winne & Nesbit, 2010). In a more complex interaction, a student's level of academic preparedness and understanding of course material also affects the degree to which they will benefit from processes characterized by low levels of instructor control (Bhat, Rajashekar, & Kamath, 2007). In addition, and suggesting broader implications, theoretical discussions of misalignment between instructional structures and learner characteristics discuss these results in the context of learners' affective responses, including frustration, dissatisfaction, anger, resentment, anxiety, and loss of confidence (Brockett & Hiemstra, 1991; Candy, 1991; Grow, 1991b; Long, 1989).

Self-Directed Learning and Academic Motivation

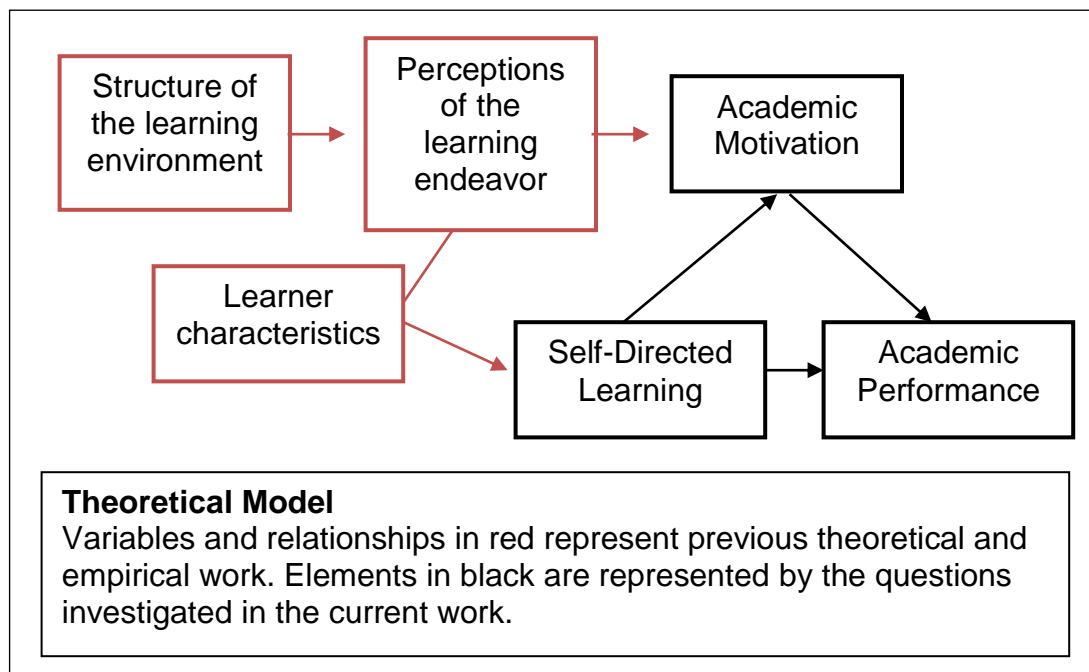
The affective responses associated with a structure-learner mismatch suggest the relationship between SDL and academic performance may be influenced by other variables. Relationships between self-regulated learning and academic goal orientation (Abar & Loken, 2010) highlight one potential mediating variable: academic motivation. The potential mediating effect is also consistent with the reported relationship between motivation and engagement (Loving, 1992; Pilling-Cormick & Garrison, 2007; Winne & Nesbit, 2010).

Theory and research suggest academic motivation is the product of an interaction between the structure of the learning environment and learner characteristics. The characteristics of the setting, including the level of instructor control, will influence the learner's perceptions of the learning endeavor and engagement with that endeavor (Candy, 1991; Kember, Hong, & Ho, 2008). Research suggests that variations in teaching techniques are associated with variations in academic motivation (Komarraju & Karau, 2008). Individual differences between learners, however, make the relationship between learning environment and academic motivation more complex (Dowson, McInerney, & Nelson, 2006; Kasworm,

1992). That complexity is reflected in Ricard's (2007) model of SDL which places the learner at the center of a learning process which also includes the influences of the learning setting, facilitator, and resources.

Interactions between academic motivation, learner characteristics, and instructional setting highlight one mechanism by which a mismatch between instructional setting and learner characteristics may affect performance (Long, 1992). Given that, the purpose of the present study is to investigate the relationships between SDL, academic motivation, and academic performance. Discussions of SDL indicate that the alignment between a learner's SDL characteristics and the structure of the learning environment has a number of implications. Similarly, the structure of the learning environment has been associated with variations in academic motivation. Based on these threads, we seek to answer three questions:

1. Is there a relationship between levels of SDL and preferences for specific learning activities characterized by high levels of instructor control?
2. Are levels of SDL related to academic motivation in settings characterized by high levels of instructor control?
3. Do variations in academic motivation mediate the relationship between SDL and academic performance?



Method

The current study extends work related to SDL, learning preferences, and academic motivation in college students using a survey-based methodology. Participants completed the Oddi Continuing Learning Inventory¹ (OCLI) and the Academic Motivations Inventory (AMI) as well as items designed to evaluate perceptions of specific instructional techniques.

Participants

A convenience sample of 188 participants completed at least a portion the research instruments. The majority ($n = 139$, 74%) were General Psychology students at a moderately-selective 4 year university in the United States who received course credit for research participation. The remaining participants were recruited via social networking contacts of the research assistants. Participants initially reviewed an informed consent statement noting that the project had been approved by the Institutional Review Board. That statement also emphasized that participation was voluntary and their responses would remain anonymous. In order to reduce perceptions of coercion, all students who proceeded to the survey via a link in the subject-pool management system received credit for participation. In addition, all participants received the same link to the survey in order to safe guard against potential identification of individual participants.

Participants ranged from 18 to 36 years of age ($M = 19.4$, $SD = 1.87$). The majority were classified as freshman ($n = 105$, 55.6% of the sample), with 15.3% of participants reporting they had sophomore standing, 13.8% reporting junior standing, and 15.3% reporting senior standing. Females represented 62.8% of the sample ($n = 118$). The sample was also primarily Caucasian (87.8%, $n = 165$), with 5.3% ($n = 10$) reporting they were African American. Participants represented a wide range of academic majors.

Procedure

The OCLI, AMI, learning preferences questions, and demographic questions were administered as part of a survey study of students' approaches to learning activities. Participants completed the instruments via a commercially available internet-based survey site, for which they received the link via a subject pool management program or via a social networking site.

Oddi Continuing Learning Inventory. One of two widely used SDL measures, the OCLI is a 24-item instrument designed to measure the degree to which individuals demonstrate motivational, affective, and cognitive characteristics associated with being a self-directed learner (Oddi, 1986; Oddi, Ellis, & Altman Roberrson, 1990; West & Bentley, 1991). The 7-point response scale ranged from “strongly agree” to “strongly disagree.” Accompanying instructions indicated the items were designed to collect information about how participants approached learning and provided a brief explanation for each level of the scale (e.g. strongly agree = you would agree most of the time). For the purpose of this research, the items were considered as one general factor (West & Bentley, 1991). A SDL score was computed based on the sum of responses to all items, creating a potential score range of 24 to 168.

Academic Motivation Inventory. The AMI is designed to measure the factors which influence the degree to which students engaged with curricular activities (Moen & Doyle, 1977). Participants completed the 90-item version of the AMI consisting of sixteen sub-scales (R.E. Moen, personal communication, February 23, 2009). In responding, participants were asked to indicate the degree to which the items described their feelings about school. Given the educational environments represented in our sample, the responses can also be interpreted as representing feelings about higher education practices characterized by high levels of instructor control. Responses were based on a 5-point scale ranging from “not true at all” to “extremely true.” Scale scores were completed based on the sum of responses to items within the scale, with potential scores varying depending upon the number of items in the scale.

Questions about Learning Preferences. To measure preferences for learning activities characterized by varying levels of instructor control, four items were adapted from Messineo, Gaither, Bott, and Ritchey’s (2007) measure of preferences for active learning in large classes. Items were adapted to remove references to “large classes” and responses were based upon a 7-point scale ranging from “strongly agree” to “strongly disagree.” Two items were intended to represent activities high in instructor control:

- In class I simply want to be told what I need to know take the exams and that is it.
- I prefer lecture as the format of class instruction.

Two items were intended to represent activities high in learner control:

- I consider class discussion in small groups with other students to be a valuable way to learn the course material.
- I think doing group work in class is a valuable way to learn material.

Academic Performance. Self-reported Grade Point Average (GPA) was utilized to measure Academic Performance.

Results

Preliminary reliability analysis indicated the OCLI was sufficiently reliable to warrant further analysis ($\alpha = .77$). Eleven of the sixteen AMI scales were retained for analysis with Cronbach's Alpha levels of 0.68 or higher. Table 1 includes specific Alpha levels for each scale as well as means and standard deviations for scales retained for analysis.

In order to evaluate the relationship between levels of SDL and preferences for learning activities characterized by high levels of instructor control, a series of bivariate correlations tested the relationship between OCLI score and responses on the four preference items. Responses to the item "In class I simply want to be told what I need to know, take the exams, and that is it," are significantly correlated, though the coefficient is weak in strength ($r = -.17, p < .05$). Preference for lecture-based instruction was not significantly correlated ($r = -.11, p > .05$). Preference for small group discussion was significantly and positively correlated ($r = .27, p < .001$) as was preference for small group activities ($r = .15, p < .05$). The significance levels and strengths of the correlation indicate there is not a clear relationship between levels of SDL and preferences for learning activities.

Table 1
Reliabilities and descriptive statistics for research measures

Scale	Items	Cronbach's Alpha	M	SD
Oddi Continuing Learning Inventory	24	.76	77.80	13.81
Achieving Motives	5	.84	17.80	4.37
Affiliating Motives	4	.51	--	--
Approval Motives	9	.79	25.83	7.05
Competing Motives	3	.71	8.36	2.93
Debilitating Anxiety	5	.61	--	--
Demanding	5	.43	--	--
Desire for Self-Improvement	6	.69	17.55	4.41
Discouraged about School	7	.74	17.57	5.15
Dislike School	4	.68	10.41	3.33
Economic Orientation	4	.57	--	--
Facilitating Anxiety	3	.64	--	--

Grades Orientation	7	.81	26.48	5.63
Influencing Motives	4	.64	--	--
Persisting Motives	3	.78	9.99	2.78
Thinking Motives	9	.79	23.64	6.25
Withdrawing Motives	6	.68	16.17	4.68
Grade Point Average (GPA)	1	---	3.21	.47

Note: AMI scales with an alpha level below .68 were excluded from further analysis

A series of bivariate correlations were also employed to address the second research question, considering the relationship between levels of SDL and academic motivation. Six of the AMI scales retained for analysis were significantly correlated with SDL: thinking motives ($r = -.45$, $p < .001$), withdrawing motives ($r = .32$, $p < .001$), discouraged about school ($r = .29$, $p < .001$), dislike school ($r = .27$, $p < .001$), achieving motives ($r = -.26$, $p < .001$), and persisting motives ($r = -.25$, $p < .05$). Table 2 includes correlation coefficients for each of the scales retained for analysis.

Table 2
Correlations between OCLI score, AMI scores, and GPA

Scale	Correlation with OCLI score	
	n	r
Oddi Continuing Learning Inventory	--	--
Achieving Motives	170	-.26*
Approval Motives	169	-.04
Competing Motives	168	-.11
Desire for Self-Improvement	170	-.13
Discouraged about School	168	.29**
Dislike School	170	.27**
Grades Orientation	170	-.06
Persisting Motives	169	-.04**
Thinking Motives	169	-.45**
Withdrawing Motives	169	.32**
Cumulative GPA	158	-.1

* $p < .01$ ** $p < .001$

To evaluate the question of whether variations in academic motivation mediate the relationship between SDL and academic performance, preliminary analysis tested the relationship between OCLI scores and cumulative GPA (per the procedure discussed in Baron & Kenny, 1986). The lack of a significant relationship ($r = -.10$, $p > .05$) precludes further analysis. Given that the data was collected during the fall semester, there is some question of whether the self-reported GPA data for freshmen accurately represents their collegiate performance. As a result, the analysis was repeated excluding participants who reported a freshman standing. The results were similar, however, with no significant relationship between OCLI scores and cumulative GPA ($n = 77$, $r = .03$, $p > .05$).

In light of the patterns that emerged in investigating the three research questions, we also considered the degree to which OCLI scores differed depending on a students' class rank. Table 3 includes the means and standard deviations for each class rank. Average scores for freshman scores were the highest, with the averages decreasing for each class. A one-way analysis of variance (ANOVA) indicated, however, that the differences are not significant $F(3, 179) = 1.76, p > .05$.

Table 3
OCLI Scores by Class Rank

Rank	M	SD
freshman	79.82	13.92
sophomore	76.21	13.24
junior	75.16	16.09
senior	74.36	10.91

Discussion

The current study considered the relationship between SDL and three facets of the learning experience: learning activities, academic motivation, and academic performance. The results were mixed. The relationship between levels of SDL and preferences for learning activities associated with high levels of instructor control suggest the two are not directly related. Similarly, SDL was not directly related to academic performance for the current sample. Six academic motivation subscales were, however, significantly correlated with characteristics of self-directed learners as measured by the OCLI.

Each of the academic motivation scales considers feelings and behaviors in the context of a student's course work, a context which participants may associate with high levels of instructor control. The results suggest increasing levels of SDL characteristics are associated with less interest in achieving and persisting within those contexts. In addition, increased SDL is associated with feelings of discouragement and dislike as well as disengagement with learning activities in those contexts, in terms of both participation in class sessions and intellectual engagement with the material.

Limitations and Future Research

The use of self-reported cumulative GPA may have affected the findings related to academic performance. As noted in the results section, the large proportion of freshmen in the sample may have reduced the validity of the measure – though analysis excluding that group did not change the results. Beyond that consideration, there is evidence that GPA reports are less accurate for lower performing

students (Kuncel, Credé, & Thomas, 2005). Inaccuracy in reporting may have limited our ability to detect an effect. As a result, our findings related to academic performance could be confirmed with higher levels of confidence by drawing upon institutional data related to academic performance.

Future research may also seek to address limitations due to the relatively homogeneous sample which primarily included members from a particular area of the United States. Cultural variations and academic background may affect the interactions between learning structures, SDL, preferences, and motivation. Cross-sectional data would also illuminate whether the patterns are representative of college students in general or if they are simply representative of the current cohort of traditional college students. Similarly, a longitudinal design would extend the present findings related to academic motivation by allowing for insights into persistence in academic settings.

Self-Directed Learning, Academic Motivation, and Student Learning

Collectively, the academic motivation findings have a number of implications for learning. At the most extreme, the patterns lend support to Long's (1991) assertion that SDL skills are not correlated with years of education because students high in SDL skills withdraw from the formal educational system – an assertion which also explains the patterns of SDL scores for the current sample. From a less dramatic perspective, students high in SDL characteristics may continue in the formal education system but engage with that system in a manner which circumvents the established learning objectives (Kasworm, 1992). Both interpretations may also explain the lack of relationship between SDL and GPA: students high in SDL may literally or cognitively withdraw from the assessment procedures upon which GPA is based.

In discussing the proactive use of resources, Knowles (1975) indicates self-directed learners do not simply identify the necessary resources, they identify the specific portion that is relevant. The process of determining relevancy is of particular concern in considering the degree to which self-directed learners will achieve key learning outcomes. Students high in SDL characteristics may establish a learning agenda which emphasizes information which is interesting to them – but not necessarily key to understanding the topic at hand (Senko & Miles, 2008). This can result in incomplete or disorganized knowledge, as well as misconceptions about the subject matter (Kirschner, Sweller, & Clark, 2006; Mayer, 2004). At the same time, they may overestimate their preparedness for formal learning assessments and sabotage their

academic performance (Vancouver & Kendall, 2006). These dynamics may also be reflected in the findings related to GPA.

Self-Directed Learning and Instructional Decisions

The lack of a clear relationship between SDL and learning activity preferences may reflect the patterns Kasworm (1992) identified in discussing students as “master planners” (p. 242). Kasworm noted that each individual will experience unique thoughts and feelings about institutional learning structures, adopting one of four orientations toward those structures. Each orientation represents a unique perspective relative to instructor control in the learning setting. For example, students demonstrating a “withdrawal pattern” view the learning process as an act of compliance necessary to achieve a desired outcome. Courses high in instructor control may be viewed as a more efficient and definitive means to achieve that outcome.

This conceptualization is consistent with the view that learners are active, self-initiating agents within the educational process (Winne & Nesbit, 2010). At the same, a balance between instructor- and learner-control provides for the instructional guidance necessary for many learners (Kirschner, et al., 2006). Candy (1991) emphasizes this point in asserting “to force learners into a self-directed or learner controlled mode for which they may feel unprepared seems to me every bit as unethical as denying freedom when it is demanded,” (62). The present findings suggest, however, that the pedagogical decision making related to instructor control may not be as simple as selecting discussion over lecture. Similarly, the lack of a significant difference between OCLI scores of freshmen and seniors suggest that the level of the course does not necessarily provide insight into a student’s level of SDL.

Bridging the Gap: Balancing Curricular Objectives and Self-Directed Learning

Synthesizing the literature and the present findings suggests a number of options for addressing curricular objectives while utilizing methods which allow for alignment with varying levels of SDL. By allowing students to influence specific topics of study, instructors can engage students as active agents in the learning process and acknowledge their need for relevancy in order to counteract the dynamics noted above. For example, allowing students to select from a small number of options for papers and projects represents a relatively high level of instructor control while still allowing students some discretion in their focus. Similarly, when the topics that can be included in a course exceed the time available to cover them, allowing students to provide input about course content can allow them to express their interests

with minimal impact on day-to-day teaching techniques. In some cases, course objectives can be met while allowing students to select their own topic for projects or other activities (without instructor provided options). Macario (2011) provides an example of one such activity where students utilized established guidelines for analysis, but selected articles of interest in order to practice applying the guidelines.

Problem-based learning structures can also be utilized to emphasize learner choice and responsibility, allowing them to influence learning process while still providing a context which allows students to achieve course objectives. Specific focal problems can be selected such that they are consistent with the objectives of the course and highlight issues relevant to students' current and future experiences (Lee & Lim, 2011). Students can then be provided varying levels of discretion in the methods they utilize in identifying solutions, with specific structures depending upon the competence and interests of the learner. For example, an instructor may initially specify appropriate sources of information and criteria for evaluating solutions. Learner responsibility can be progressively increased by providing fewer limitations until students have complete autonomy in identifying resources and determining the criteria for evaluating their solution.

Conclusion

Collectively, the present findings and related theoretical discussions underscore the importance of considering student characteristics in pedagogical decision making. In order to address the dynamics related to SDL and student engagement, instructors must consider allowing students to influence the topics of study, the process of learning, or both topics and processes. When considered in conjunction with Grow's (1991a) "Staged Self-Directed Learning Model," however, the current findings suggest pedagogical decisions related to SDL are complex. In order to scaffold engaging learning experiences with appropriate levels of learner responsibility instructors must mindfully consider the unique student populations within each class.

Notes

¹ For the purposes of this research, a royalty-free copyright license for the use of the OCLI was granted by Lorys F. Oddi.

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