

# MountainRise

Volume 2, Number 2 (2005)

Table of Contents

Poetry

Contributors

Contributors

Articles

Their Grades Are Higher, but are They Learning?: Examining the Impact of Cooperative Testing on Individual Learning

*Theresa R. Castor*

The Somethingness of Learning Plans: A Scholarship of Teaching and Learning Project

*Kat Lui*

If You Build It, They Will Come: Conceiving a Saturday Class in Economic Education to Link Content, Applications, Implementation, and Assessment

*Kathy Parkison and Margo Sorgman*

Service-Learning in a Clinical Curriculum: A Case Study

*Kathy Starr*

Using a Telehealth Program to Provide a Teaching Learning Experience for College Students

*Janice Putnam, Amy Kiger, Allison Norwood, Kim Steiglitz, and Peggy Ward-Smith*

Recognizing Student Misconceptions about Science and Evolution

*Daniel J. Wescott and Deborah L. Cunningham*

Reflections

The Student / Teacher Partnership

*Geoff Currie*

Copper-hued, not white: An ethnic minority educator in New Zealand

*Edwina Pio*

Why Do I Teach?

*Bruce Saulnier*

*Poetry*

Joe Mills  
Academic Programs  
North Carolina School of the Arts  
Winston-Salem, North Carolina, USA

**Turning in Grades**

Turning in grades  
is an act of forgetting.  
After the final calculations,  
names slide from faces  
into files and cabinets,  
so that just months later,  
when someone calls out,  
although you'll recognize  
the chin, the eyes, the clothes,  
and you may remember  
paper topics and titles,  
you won't trust yourself  
to say a name;  
instead you'll smile,  
shake hands  
ask about coursework,  
or vacation or life  
after graduation,  
all the while wondering  
if having taught them  
to read closely  
and consider not only  
what's being said  
but what's not,  
they'll notice  
how you treat them  
as the most intimate  
of strangers.

## **When My Students Ask Why They Need Poetry**

What should I say? Because perhaps they don't. Now. Or next year. Or ever. These poems won't get them a job or raise. They may never feel a connection, need, or desire, but they may also find in the waiting room, at the head of the banquet table along the road, or by the grave, a poem will say for them what they cannot. Maybe they should consider poetry a type of insurance, like extra batteries, fire extinguishers, something in case of emotional emergencies, or dry socks, a spare key, money stashed away, a handy resource for what lies ahead.

But even if poems are useful to some, what of the others? Perhaps it's better to consider me a kind of merchant offering poems like bottles of fine wine so after they have accomplished their goals of money, fame, and love, and find they have time for luxuries like literature, they'll discover, stacked away, a cellar of ripened poems, waiting to be savored. What should I say to my students? Maybe this: Whatever you think of these, take some. They don't cost you much now and may be worth a great deal later if you should live long enough to return to them. I hope you will.

## Contributors

**Theresa Castor** [[castor@uwp.edu](mailto:castor@uwp.edu)] is an Assistant Professor of Communication at the University of Wisconsin - Parkside. She received her doctoral degree from the University of Washington, and received her bachelor's and master's degrees from the University of California - Davis. Prior to moving to Wisconsin, she taught at Wake Forest University and the College of William and Mary. In 2003-2004, she was a Wisconsin Teaching Fellow. Her research primarily focuses on the social construction of knowledge in a variety of institutional contexts, including organizations and the classroom.

**Deborah Cunningham** [[dlcfc@missouri.edu](mailto:dlcfc@missouri.edu)] received her doctorate in biological anthropology from the University of Missouri - Columbia in 2005, and she currently holds a post-doctorate position at the Smithsonian National Museum of Natural History. Her research focuses on the evolution of early African hominids, species boundaries in the fossil record, patterns of human variation and dispersal at the Pleistocene/Holocene boundary, teaching methods, and evolution and "creation science" issues.

**Geoff Currie** [[gcurrie@csu.edu.au](mailto:gcurrie@csu.edu.au)] is the Course Coordinator for the Nuclear Medicine program at Charles Sturt University in Australia. Teaching commitments include; nuclear medicine science, radiopharmacy, research methods and physics/instrumentation. Geoff also coordinates a number of post graduate modules including; clinical judgement and decision making, and clinical teaching techniques. He has a Masters degree in Medical Radiation Science, a Masters degree in health management and a graduate certificate in university teaching and learning. Geoff is currently completing his PhD investigating post processing techniques for improving diagnostic efficacy and localisation accuracy of gastrointestinal bleeding and is also in the process of completing a Master degree in business administration.

**Amy Kiger** [[kiger@cmsu1.cmsu.edu](mailto:kiger@cmsu1.cmsu.edu)] is the Health Promotion Coordinator at the University Health Center at Central Missouri State University.

**Kat Lui** [[luik@uwstout.edu](mailto:luik@uwstout.edu)] is an Associate Professor at the University of Wisconsin - Stout. In 2000, she earned a doctorate from Fielding Graduate University in human and organizational systems. Her research interests include the human impact of mergers and acquisitions, employee and organizational development. She has taught at Assumption College and Virginia Commonwealth University. Prior to her work in academia, Kat worked for 17 years as a regional director of a counseling and assessment center providing career services to disenfranchised individuals.

**Joseph Mills** [[millsjr@ncarts.edu](mailto:millsjr@ncarts.edu)] is a faculty member at the North Carolina School of the Arts. In addition to being the coordinator for NCSA's Critical Perspectives program – a year-long writing and critical thinking sequence -- he teaches a variety of Humanities courses ranging from "The Art of the Con" to "Astaire and Rogers." He earned his Ph.D. from the University of California, Davis. His research interests include the American West and American humor and satire. Most recently he and his wife co-wrote a guidebook to North Carolina wineries.

**Allison Norwood** [[norwood@cmsu1.cmsu.edu](mailto:norwood@cmsu1.cmsu.edu)] is an Assistant Professor of Nursing at Central Missouri State University.

**Kathy Parkison** [ [kparkiso@iuk.edu](mailto:kparkiso@iuk.edu) ] teaches economics for both business majors and education majors in the School of Business at Indiana University Kokomo where she is also involved in SIFE (Students in Free Enterprise) and directs the Center for Economic Education. As a result of her work with colleague Dr. Margo Sorgman, the Center has been actively involved in outreach, professional association presentations, and assessment research. Kathy has received many teaching awards and will be spending fall 2005 in Tbilisi, Georgia where she will be doing economic education research. She earned her Doctor of Philosophy degree from Purdue University in 1994.

**Edwina Pio** [ [edwina.pio@aut.ac.nz](mailto:edwina.pio@aut.ac.nz) ] is a senior faculty member of Auckland University of Technology, New Zealand, where she teaches graduate and post graduate business students. She travels extensively to America, Asia, Australia and Europe on research, teaching and consultancy assignments. Her research on diversity, migrant Indian women and Eastern spiritual capital has been published in international journals. Yoga, meditation and writing poetry nourish her life.

**Janice Putnam (Winters)** [ [putnam@cmsu1.cmsu.edu](mailto:putnam@cmsu1.cmsu.edu) ] is an Assistant Professor of Nursing at Central Missouri State University, where she teaches wellness, health promotion, and the use of technology. Her clinical experience includes cardiopulmonary and telehealth nursing and she is a doctoral candidate studying tobacco addiction and telehealth at the University of Missouri, Kansas City.

**Bruce Saulnier** [ [bruce.saulnier@quinnipiac.edu](mailto:bruce.saulnier@quinnipiac.edu) ] is Professor of Information Systems Management at Quinnipiac University in Hamden, Connecticut, where he uses the subject areas of systems analysis and design and e-commerce to teach students. Bruce has received many awards for outstanding teaching and service including being honored as the 1993 Quinnipiac University Outstanding Faculty Member and the 2002 Carnegie Foundation for the Advancement of Teaching Connecticut Professor of the Year, elected President of and honored in 2004 as a Distinguished Fellow of the International Society for Exploring Teaching and Learning (ISETL), selected as the 2004 recipient of the Defiance College Alumni Citation for Academic Excellence, and elected to Beta Gamma Sigma (2001) and Alpha Iota Mu (2005). His current research agenda includes teaching and learning as spiritual activities and the effects of service learning on information systems education.

**Margo Sorgman** [ [msorgman@iuk.edu](mailto:msorgman@iuk.edu) ] teaches social studies education, women studies, and economic education in the Division of Education at Indiana University Kokomo where she is actively involved in the Center for Economic Education and serves as Director of Student Teaching. As a result of her work with colleague Dr. Kathy Parkison, a unique partnership has been crafted between education and business to design team-taught standards based economics courses. She has earned many teaching awards and earned her Doctor of Education degree from Boston University in 1973.

**Kathy Starr** [ [kstarr@email.wcu.edu](mailto:kstarr@email.wcu.edu) ] is an associate professor in the physical therapy department at Western Carolina University where she teaches gross anatomy, pathophysiology and neuroanatomy. She is actively involved in the SoTL initiative at WCU as a member of the SoTL Faculty Advisory Committee and the Faculty Learning Community for SoTL research. She earned a master's and doctoral degree in anatomy from Albany Medical College as well as a master's degree in biology from Western

Carolina University.

**Kim Steiglitz** [[stieglitzk@umsl.edu](mailto:stieglitzk@umsl.edu)] is an Assistant Professor of Nursing Putnam at the University of Missouri, Saint Louis.

**Peggy Ward-Smith** [[wardsmithp@umkc.edu](mailto:wardsmithp@umkc.edu)] is an Assistant Professor of Nursing at the University of Missouri, Saint Louis, MO.

**Daniel Wescott** [[wescottd@missouri.edu](mailto:wescottd@missouri.edu)] is an Assistant Professor of Anthropology at the University of Missouri - Columbia. He received his doctorate in biological anthropology from the University of Tennessee, and his research and teaching interests focus on skeletal biology, human variation/adaptation, forensic anthropological methods, and bioarchaeology.

# **Their Grades Are Higher, but are They Learning?: Examining the Impact of Cooperative Testing on Individual Learning**

Theresa R. Castor  
Communication Department  
University of Wisconsin-Parkside  
Kenosha, Wisconsin, USA

## **Abstract**

Group tests are one format for cooperative learning and assessment. However, while groups typically outperform individuals on group tests, how does cooperation translate into individual learning? This project examines students' responses when allowed the opportunity to 're-do' quiz answers after completing a group quiz. Thematic analysis is used to identify seven categories for how students explain their new responses. While some of these categories show a positive impact in helping students to sharpen definitions and remember class experiences, other categories illustrate students' lack of understanding of course material, inability to formulate an argument and/or misunderstanding of the assessment context.

## **Introduction**

Cooperative learning is a form of active learning in which students work together toward a common goal in the process of learning (Johnson, Johnson, & Holubec, 1994). This form of learning has been utilized in several contexts such as group discussions, long-term group projects, and group testing. The benefits of cooperative learning and assessment are widely accepted (Brody, & Davidson, 1998; Johnson, Johnson, & Holubec, 1994; Slavin, 1983, 1996). The focus of this project is on group testing and specifically, the impact of group testing on individual learning.

Studies have consistently shown that groups perform higher than individuals during group testing situations. In addition, there are other benefits such as long-term retention of course material (Cortright, & Collins, 2003) and reduction of test-taking anxiety (Russo, & Warren, 1999). However, as Olivera and Staus (2004) note, "results of studies that have examined the impact of groups on individuals are mixed and provide inconclusive evidence of the nature of group effects on individual learning" (p. 442; also see Thompson, & Chapman, 2004). This project explores the impact of cooperative testing on individual learning by examining students' ability to provide verbal elaborations of course material after taking a cooperative test.

I focus upon verbal elaborations because in group testing situations students may identify what the best answer is, but a benchmark for long-term retention and translation of knowledge to other contexts is the ability to explain why a certain answer is the best choice. Verbal elaborations provide one way of having students make visible their learning (Angelo, & Cross, 1993). Hence, the guiding research question for this project is: How does cooperative testing impact students' verbal elaborations of course material?

In the study design, students are allowed an opportunity to 're-do' a maximum of two questions immediately after each quiz with the stipulation that their 're-do' will be graded based on the written explanations they provide for their new answers. I use an analytic approach that is a hybrid of a grounded theory approach and discourse analysis for

describing students' explanations. In the following sections, I review relevant literature on cooperative learning, describe the study design in further detail, and describe and analyze my results.

### **Cooperative Learning and Communication**

As described earlier, in its most basic meaning, cooperative learning involves having students work together in the achievement of learning objectives. Johnson, Johnson, and Holubec (1994) more specifically describe the conditions for optimizing cooperative learning. These involve structuring the learning environment such that there is a positive interdependence within the student group, allowing "promotive interaction" (p. 29) in which group members can help each other through interaction, holding individuals accountable for their contributions, fostering positive interpersonal and group communication skills, and allowing the group to reflect upon its own process.

The terms cooperative and collaborative learning are both used to describe conditions in which students work together in their learning. However, cooperation and collaboration differ, and as some would argue, can work against each other in that cooperation focuses on learning 'foundational' knowledge whereas collaboration is geared toward developing new or non-foundational knowledge (Bruffee, 1995). I focus on cooperative learning given that my context of group testing is designed to assess students' understanding of foundational course material, and I reserve other course assignments for allowing students to build new knowledge (Wiggins, & McTighe, 1998).

There are several theories that have been used and tested to explain cooperative learning. For example, Johnson, Johnson, and Holubec (1994) identify social interdependence theory, cognitive-developmental theory, and behavioral learning theory. Slavin (1996) describes four approaches that include motivational, social cohesion, cognitive, and developmental. The perspective assumed in this project aligns most closely to the developmental approach.

The Developmental theory is based on the work of Piaget and Vygotsky and takes a constructivist approach (Johnson, Johnson, & Holubec, 1994). This approach highlights the role of communication in learning in that it is through communication that group members provide and hone explanations and offer criticisms occurs. As Bruffee (1992) explains, thought and 'conversation' are interconnected in that "we think because we can talk, and we think in ways we have learned to talk" (p. 26). In a classroom context, students learn when they are encouraged to articulate and explain their understanding to others and in turn, when they must evaluate and respond to others (Smith & MacGregor, 1992; also see Tompkins & Cheney, 1982). For group examination situations, students must provide explanations for their responses and their peers must critically evaluate those responses in the process of determining the group's response for the test questions.

The work of John Shotter (1993a, 1993b), a social constructionist working from the field of psychology, is closely related to Piaget and Vygotsky's developmental approach. Shotter however, with a focus explicitly on language and communication, adds additional dimensions to consider to understand social interactions. Shotter (1993a) labels his approach a Rhetorical-Responsive Social Constructionist approach. In doing this, he points out that when people communicate it is from within a context in which, in order to demonstrate social accountability and have one's voice be taken 'seriously,' one must be responsive to the given context. Students must, in other words, not only know the



material, but also must be able to demonstrate their understanding of the course material in a way that is responsive to their context. However, in order to do this successfully, students must understand not only the course material, but also the rules and demands of the context. Or, as Kaartinen and Kumpulainen (2002) explain, "learning is a participatory process in which the learner gradually becomes an active member in a cultural community by learning its discourse practices, norms and ways of thinking" (p. 191).

### **Study Design**

I conducted this study in Fall 2004 in my Organizational Communication class, an upper-level class consisting of approximately 30 students, most of them majoring in Communication. There were a total of three quizzes administered during the term, consisting of fifteen to twenty multiple-choice questions. This project was a continuation of an earlier project examining group discussion during cooperative exams (Castor, 2004).

The quiz procedures were as follows. First, students take the quiz individually, with a time limit of fifteen minutes. Then, students take the same quiz again in groups of four to five, with a time limit of thirty minutes. In the groups, students decide as a collective their answers, and hand in a group answer sheet. The groups are randomly assigned and students know about a week in advance which students will be in their groups. Also, throughout the semester group work is used so that students become accustomed to small group discussion of course material. Most groups finish the quiz in less than the allotted time. Grades for the quizzes are determined by adding the individual quiz grade with a student's group's quiz grade. In this respect, individual and group accountability are evenly shared.

In Fall 2004, a third portion was added to the quiz. After handing in the group answer sheets, students were allowed to 're-do' two of the answers from their individual portion. Only a sub-set (4-5) of the quiz questions were eligible for re-doing. Usually, these questions called for application of a concept to an example or making distinctions across concepts were selected for re-doing since these would call for students to show a higher level of thinking than questions that focused on recall of definitions. Students had the remainder of the class period, usually five to ten minutes, for re-doing questions. For this portion, students were provided with the following instructions:

In re-doing your answers, identify (a) which question you are re-doing, (b) your original answer, (c) your new answer, and (d) your reason for changing your responses. Your new answer will be graded based on your demonstrated understanding of the course material. If you change a correct answer to an incorrect answer, you will be graded based on the newer response.

For my analysis, I focused on the written explanations the students provided in re-doing their responses. Because group quizzing and re-doing answers after a quiz was a new type of testing for many of the students, I did not collect responses after the first quiz. Also, responses were collected only from students who indicated agreement to participate in this research project by signing an informed consent form. Because of the limiter of using data only after the second and third quizzes and from students who agreed to participate, my total sample size is 24 student responses.

For my method of analysis, I utilized an analytic induction or grounded theory approach

(Strauss, & Corbin, 1990). A grounded theory approach is based on allowing categories to 'emerge' from the data rather than begin with categories to apply in coding the data. This process involves the researcher reading and re-reading the available data to create categories that summarize patterns in the data. In this process, I focused on categorizing the type of explanations that students offered in justifying their new responses. My reasoning in selecting a grounded approach to analyzing my data is that because this approach is inductively rather than deductively driven, it privileges understanding students' sensemaking or 'voice' with respect to the course material.

## Results

In this section, I first provide a quantitative overview of my results, followed by a qualitative overview. The former provides a summary of the student responses in terms of the number of correct versus incorrect answers. The latter, qualitative overview describes students' explanations in changing their responses.

### Quantitative Overview

Table 1 illustrates student responses in terms of correct versus incorrect and credit versus no credit. Out of the 24 responses, 20 consisted of responses in which students changed an incorrect answer to a correct answer, and 4 consisted of responses in which students either changed a correct answer to an incorrect answer or substituted an incorrect answer for another incorrect answer. However, when the persuasiveness of student explanations for the new responses is taken into account, fewer responses earned credit. Specifically, among the 20 correct responses, 12 were awarded credit, and 8 were not. In other words, while 20 answers indicated that students knew what the correct answer was, they did not articulate their reasoning for that correct answer in a way that demonstrated an understanding of the course material. The next section explores the different way students explained their change in answers.

|           | Correct | Incorrect | Total |
|-----------|---------|-----------|-------|
| Credit    | 12      | 0         | 12    |
| No Credit | 8       | 4         | 12    |
| Total     | 20      | 4         | 24    |

Table 1

Comparison of Student Responses as a Function of Being Correct and Credit Awarded

### Qualitative Overview

There were 7 forms that students' explanations took for justifying the new answer. Some individual student responses utilized more than one of these forms. The first four forms described below were not awarded credit. A summary of the 7 forms with a representative example for each is presented in Table 2.

*Group Persuasion or Influence.* Students most frequently cited (a total of 11 times) that the reason for changing their answer was due to group influence. In these cases, the students did not explain what was persuasive about the group's reasoning or discuss what the student understood regarding the course material. The student basically demonstrated that s/he is susceptible to persuasion.

*Personal Error, including Misunderstanding the Question.* There were six instances in which the student explained his/her change in response as being due to initially putting

down the incorrect answer due to a personal error and asserted that they in fact did understand the concept. However, in some of these instances, the students often failed to present evidence for their understanding or to address the substance or content of the quiz question.

*Assertion, no other form provided.* In two instances, the students' responses took the form of stating the new answer without attributing any reason for the change or provide any other information to indicate an understanding of the relevant course concept.

*Guessed.* One student explicitly stated that his/her initial response was just a guess. The student however did not provide any additional explanation as to why the newer response was a more appropriate choice. While guessing is a form of personal error, I separate the categories of personal error from guessing since in the former category, students claim to have actually known the correct answer from the beginning.

While the preceding types of responses did not receive credit, the following three types of responses tended to be awarded credit.

*Define the relevant concepts.* Eleven student responses basically presented definitions of the course concepts relevant to the questions. These responses often took the form of asserting or stating the definition, rather than referring to an external authority source. Subsequently, sometimes students defined the concepts incorrectly. For example, one student used folk knowledge to define the terms. In other words, s/he defined the terms based on breaking down the key terms using everyday definitions, and did not realize that the definitions were specific to a particular theory.

*Class Experience.* There were four instances in which students cited a specific class example or experience. As indicated by student responses, this memory was often triggered by the discussion with other group members reminding the student of the context for the concept. In all cases, the discussion focused on a specific example or visual image (i.e., graph on chalkboard, video) described in class.

*Re-Analyze Example.* Finally, there were three instances in which students would develop a re-analysis of a given example from a quiz question to explain how they developed their new conclusion. In these cases, students made explicit their new reasoning and understanding of a concept in relation to the example provided in a question.

| <b>TYPE OF EXPLANATION</b>   | <b>EXAMPLE</b>  | <b>TOTAL</b> |
|------------------------------|---|--------------|
| Group Influence              | I will change my answer to C because everyone else agreed it was classical approach.  | 11           |
| Personal Error               | I had the order flipped around.   | 6            |
| Assertion                    | Another answer was just as good and chose to do both B/C.   | 2            |
| Guessed                      | I'm changing my answer to D. because when answering the question I relied on my intuition that having money associated with safety.   | 1            |
| Define the relevant concepts | I'm changing to C because safety deals with rent and being able to buy food for yourself.   | 11           |
| Class Experience             | Our group remembered the chart on the board and negative feedback goes down eventually climbs back up helping. . .  | 4            |
| Re-Analyze Example           | I thought that this was accurate because she was giving and feedback but said it positively. I'm now changing it to negative feedback because she was actually complaining about the product. | 3            |

*Table 2*  
*Types of Student Explanations with Examples*

### **Discussion**

There are multiple ways to interpret the student responses. On the plus side, the student responses show some of the different ways that group interaction benefited the understanding of various students. For example, the discussions helped in triggering other students' memories by reminding them of specific examples and explanations for concepts provided from classroom lessons. Also, the cooperative testing situation helped students to view questions and answers from different perspectives through the discussion with their peers. The discussions and opportunity for re-doing responses helped students to define concepts more precisely. The opportunity to re-do quiz questions also provided a second chance for students who may have made errors in answering the test questions initially due to anxiety and not reading the question and answer options carefully. Other studies have shown that group testing helps in reducing testing anxiety. Therefore, when allowed the chance to re-do question after group discussion, students are enabled to show their understanding in a situation that is less anxiety-filled for them.

On the other hand, there are ways in which the student responses do not bode well in terms of showing the efficacy of group testing in relation to student learning. While a majority of the students knew what the 'correct' answer was, they were limited in terms of their ability to explain why. One explanation for this is that the group testing format (which lasted a total of 50 minutes) was too limited an amount of time for students to learn concepts that they had an initially weak understanding of prior to the group test. Also, students may have been motivated to 're-do' their answers as a type of gamble to get more points, as opposed to wanting to demonstrate their newly-honed understanding of course material. Finally, there was a weak interdependence among students for the group testing process. In essence, the group grade was dependent upon the group as a whole indicating the best answer rather than upon every member understanding the material. Therefore, there was no incentive for more knowledgeable group members to make sure that less knowledgeable members understood the material thoroughly. The student responses also illustrate a mismatch on the part of my assumptions as the instructor and students understanding of the grading context. Specifically, I assumed that students would know how to craft a persuasive argument to show their understanding of the material. Also, I assumed that they clearly understood that their new responses were being graded based on explicitly discussing the course material, as opposed to generally discussing their reasons for changing their answers. The student responses do demonstrate a type of accountability in that the students provided accounts of why, in terms of their decision-making. Their responses, therefore, can be interpreted as a misunderstanding of the context of their responses, as opposed to exclusively being a failure to articulate the course material. In essence, students were not responsive to the context under which they were being graded by not integrating course material into their explanations and formulating an argument in the traditional format of stating a claim and providing evidence and/or reasoning.

### **Conclusion**

Group testing is beneficial for both assessment and learning purposes. While group tests function to assess students' learning, they also provide a context for students to continue to learn from each other. The context of the test provides a motivator for students to discuss, defend, and challenge answers to reach a group goal of achieving a high score on the exam. However, there were some ways in which this testing situation was not truly a cooperative testing situation. For example, students were not truly interdependent. In other words, the group grade was not based on everyone in the group understanding the material, but instead on the group determining the best answer. To do this, not everyone had to be on board. However, while the group had no motivation to ensure that everyone accurately understood the material, individual students who did not understand the material had some motivation for asking for clarification given the re-do opportunity after the group portion. One implication of the student responses is to illustrate students' misunderstanding of the grading context. In my instructions for the re-do option in asking students to show their understanding of the course material in explaining why they selected their newer response, I assumed that my students would understand how to present an argument, and that they would understand what it means to present reasons. When given the opportunity to earn more points, they failed to demonstrate their understanding of the concepts, and also, correlated with this, failed to demonstrate that they understood how to develop a persuasive argument. Students, through their responses did not seem aware of their rhetorical situation or context, or the need to persuade the instructor and the basis for developing a persuasive argument. This project shows the various ways in which cooperative testing impacts

students' verbal elaborations of course material. Some of the results are promising in terms of emphasizing the importance of cooperation in enhancing individual student learning. Overall, this project demonstrates the positive impact that group testing has on student learning and the benefit of allowing students to show their individual learning resulting from cooperative experiences. In addition, this project demonstrates the need to instruct students in not only the content of the course, but also in how to construct arguments that are responsive to their specific context.

### References

Angelo, T. A., & Cross, K. P. (1993). *Classroom assessment techniques: A handbook for college teachers* (2nd ed.). San Francisco: Jossey-Bass. Author. (2005).

Brody, C. M., & Davidson, N. (Eds.). (1998). *Professional development for cooperative learning: Issues and approaches*. Albany, NY: State University of New York.

Bruffee, K. (1992). Collaborative learning and the "conversation of mankind." In A. Goodsell, M. Maher, & V. Tinto (eds.), *Collaborative Learning: A Sourcebook for Higher Education*. University Park, PA: National Center on Postsecondary Teaching, Learning, and Assessment.

Bruffee, K. (1995) Sharing our toys: Cooperative learning versus collaborative learning. *Change*, 27 [Electronic version]. Retrieved from Academic Search Elite.

Castor, T. R. (2004). Making student thinking visible by examining discussion during group testing. In M. V. Achacoso, & M. D. Svinicki (Eds.), *New Directions for Teaching and Learning, Volume 100: Alternative Strategies for Evaluating Student Learning* (pp. 95-99). San Francisco, CA: Jossey-Bass.

Cortright, R. N., & Collins, H. L. (2003). Student retention of course content is improved by collaborative-group testing. *Advances in Physiology Education*, 27, 102-109.

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (1994). *The new circles of learning: Cooperation in the classroom and school*. Alexandria, VA: Association for Supervision and Curriculum Development.

Kaartinen, S., & Kumpulainen, K. (2002). Collaborative inquiry and the construction of explanations in the learning of science. *Learning and Instruction*, 12, 189-212.

Olivera, F., & Straus, S. G. (2004). Group-to-individual transfer of learning: Cognitive and social factors. *Small group research*, 35, 440-465.

Russo, A., & Warren, S. H. (1999). Collaborative test taking. *College Teaching*, 47 [Electronic version]. Retrieved from Academic Search Elite.

Shotter, J. (1993a). *Conversational realities: Constructing life through language*. London: Sage.

Shotter, J. (1993b). *Cultural politics of everyday life: Social constructionism, rhetoric, and knowing of the third kind*. Milton Keynes: Open University Press; and University of Toronto Press.

Slavin, R. E. (1996). Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary Educational Psychology*, 21, 43-69.

Slavin, R. E. (1983). *Cooperative learning*. New York: Longman.

Smith, B. L., & MacGregor, J. T. What is Collaborative Learning? In A. Goodsell, M. Maher, & V. Tinto (eds.), *Collaborative Learning: A Sourcebook for Higher Education*. University Park, PA: National Center on Postsecondary Teaching, Learning, and Assessment.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Thompson, J. C., & Chapman, E. S. (2004). Effects of cooperative learning on achievement of adult learners in introductory psychology classes. *Social behavior and personality*, 32, 139-146.

Tompkins, P. K., & Cheney, G. (1983). Account analysis of organizations: Decision making and identification. In L. L. Putnam & M. E. Pacanowsky (Eds.), *Communication and organizations: An interpretive approach* (pp. 123-146). Beverly Hills: Sage.

Wiggins, G., & McTighe, J. (1998). *Understanding by design*. Alexandria, VA: Association for Supervision and Curriculum Development.

## **The Somethingness of Learning Plans: A Scholarship of Teaching and Learning Project**

Kat Lui  
Center for Performance Improvement  
University of Wisconsin - Stout  
Menomonie, Wisconsin, USA

### **Abstract**

Every attempt to teach or learn occurs in the context of what the learner already knows. This project investigates how the use of learning plans (constructed through instructor and student collaboration) facilitated learning. These plans were used as a means to identify previous knowledge and to motivate students to reflect on their own learning process. During fall semester 2004, 30 undergraduate students developed learning plans in the undergraduate course, "Training Systems in Business and Industry". Results suggest that learning plans facilitate learning by focusing students on the goals of the course. At the end of the semester, students evaluated the use of learning plans. Data imply that learning plans were helpful to their learning process and promoted deep learning.

### **Introduction**

One important factor influencing learning is what the learner already knows. "Ascertain this and teach accordingly" (Ausubel, 1968 as cited in Cerbin, 2000). Learning plans are one way of discovering what the student already knows and what they hope to acquire from a college course. Knowles (1986) was a strong advocate for the use of learning contracts. However a contract often implies a legal and bureaucratic focus. The term learning plan is more accurate in describing the outcome of a process of negotiation (Williams & Williams, 1999). A learning plan is an agreement between the learner and the instructor in which students outline their individual learning objectives, strengths they bring to the course, competencies they wish to develop, and what they are willing to do in pursuit of their objectives. These plans are highly self-directed; they act as a mechanism for learners to build on past experience and determine needs as they carry out learning activities. They can also be used to negotiate for grades. Typically, learning that is self-directed and based on individually developed objectives leads to a deeper, more permanent understanding. The structure imposed on this learning experience included predetermined course objectives and assignments. However students fashioned their own version of objectives. Learning plans are a vehicle for making the planning of learning experiences a mutual undertaking between learner and teacher (Knowles, 1986).

The purpose of this paper is to describe how learning plans were used in the context of an overall teaching approach in an undergraduate level course.

### **Project Summary**

In April, 2003 a request for proposals was forwarded to faculty members from the Teaching and Learning Center at the University of Wisconsin-Stout. Instructors were asked to identify an intriguing problem, a new class project, or an assignment that might address the issue of student learning. My investigation into the use of learning plans with undergraduate students seemed an appropriate quest. After three years of using



learning plans, I wanted to focus more sharply on how these plans facilitated student learning. Cerbin (2004) suggests that students create knowledge by using what they already know to make sense of new information. Having the opportunity to study learning plans was further extended through the award of a statewide teaching fellows grant.

Over 30 students were enrolled in two course sections of Training Systems in Business and Industry in the fall 2004 semester. Learning plans were required in an effort to have learners identify their objectives, strengths, and competencies relative to this course. Ideally this research project would have been strengthened if one of these course sections used learning plans and the other was taught without learning plans, however the potential benefit of learning plans prohibited this disparity. I felt it unethical to provide this opportunity for some students and deny it to others. Results from student survey data, collected at the end of Fall 2004 term, describing the extent to which learning plans facilitated learning suggest that students found these plans helpful to their learning process and effective in promoting deep learning.

### **Course & University Context**

The key learning goal of Training Systems in Business and Industry is to develop an understanding of how training systems enhance employee development and productivity and thus increase organizational effectiveness. This course is an elective for several majors at the University of Wisconsin-Stout: Hospitality and Tourism, Service Management, General Business Administration, Industrial Management, Telecommunication Systems, and Graphic Communication Management. Consequently students from a variety of majors take this junior level course. The typical student profile is male, 22 -28 years of age.

The University of Wisconsin-Stout is a minds-on, hands-on institute of higher learning with over 8,000 students. It is located in northwestern Wisconsin in the rural community of Menomonie. Most of the students come from this area as well as border cities in Minnesota. Some students live at home driving as much as one hour to come to class. The majority work at least one job creating the need to return home over the weekend or during the week. Working-class backgrounds and first generation college students are common University of Wisconsin-Stout student characteristics.

### **Key Learning Activity**

I was curious how the use of learning plans facilitated learning. Self-directed learning is a theoretical underpinning of learning plans. Key to this strategy is creating a climate that encouraged students to take responsibility for their own learning. Part of this process requires students to uncover what knowledge they have regarding the intellectual goals of this course. The evolution of my use of learning plans began in 2001 with my first undergraduate course. Over the last 3 years there were a number of iterations which resulted in a document inviting students to reflect on past experiences to develop a plan that would truly guide their semester studies. The current document represents the combined efforts of many students from past semesters as we wrestled with how learning plans could be used to facilitate their learning. The following 6 items comprise the current Learning Plan document.

## **Learning Plan Document:**

1. List and describe 7 of your learning objectives for this course
2. List and describe your strengths as they pertain to the goals of this course
3. List and describe competencies you wish to develop
4. All courses have a level of importance to each of us. Using a scale of 1-5 with 1 signifying that this course is highly important, please rate the importance of this course to you.
5. What is the grade you seek?
6. What will you do to work towards this grade?

The research and data collection process was carried out within the context of action oriented research. The intention of this type of research is to influence or change a system. Values that ground this research are those of participation, self-determination, empowerment through knowledge, and change (Bentz & Shapiro, 1998). Action research has the potential to generate authentic improvements in education. It provides educators opportunities to reflect on and assess their pedagogy, to explore ideas and methods, and to evaluate the effectiveness of these approaches (North Central Regional Educational Laboratory, 2004).

This action oriented research process involves four steps:

### **Procedure:**

Step 1: Orient the learners to the process of self-directed learning through group activities and individual coaching. For example during the first week of class we discuss overall course objectives and the profession of Human Resource Development. Students engage in individual writing assignments and assemble in groups to investigate how this relates to their lives. Fortunately, class size is small enough for one-on-one conversations with learners when they request one.

Step 2: Negotiate the learning plan. Learners prepare the first draft; through individual coaching I review (assuring plans are grounded in course content) and make recommendations. If necessary, students revise their plan.

Step 3: Provide support and monitor progress. Individual coaching sessions are held at mid-term and students revise their plans (if necessary).

One-on-one coaching was an added activity that evolved from the process of this action oriented research project. By putting a spotlight on the use of learning plans, students took charge of their learning by expressing the desire to meet and discuss their learning. This became a sort of "check in" at the half way point in the term.

Step 4: End of Term - Student Survey Reflection Students were asked a series of questions (see finding #3) at the end of the term. Their survey responses were analyzed to determine how learning plans facilitated learning.

## **Key Findings**

**Finding #1:** Through reflective writing students describe significant learning that occurred for them at the culmination of the semester.

Support: At the end of the term students were given a survey which asked them to review their plans and address these questions:

- Describe how your objectives were met this semester.  
The majority, 97%, of students felt their objectives were met during the class. Comments such as "I feel that I've become more in touch with how 'training people' works." "I now understand the problems associated with training. I feel that if I have people under me I will now be able to better access their learning strengths and weaknesses." "This will allow me to implement a training plan much more suited to the individuals needs." "Before when I thought of training I always focused on the objective of the training not the people..."
- How were your strengths enhanced?  
Many students, 86%, expressed improvement in their strengths, for example: "My strengths were enhanced because I learned the tricks of the trade from doing the Proposal. It gave me a real life example to apply..." Another student commented: "My 2nd strength was my passion for training. This course enhanced my passion for training. From this course I have a better understanding of how training and human development have a great importance in the workplace. In addition, by recognizing this importance it has increased my interest and passion to become an effective service manager and implement effective training programs in my future occupation." Of the 14% who indicated their strengths were not changed many expressed "my strengths remained the same throughout the semester".
- How were your competencies developed?  
Responses to this question varied according to individual goals. Most students, 82%, reported progress was made in developing competencies. "...especially the one about learning when training has failed or succeeded. After covering that in the class...I started thinking about previous experiences I've had with training, and was better able to identify what went wrong, or right..." Some students expressed an interest for more "real world" practice in order to fully address their competencies. Others felt "group work" was motivating stating they wished all classes were like this.
- At the beginning of the semester you provided a numerical ranking of importance for this course. Upon reflection would you change this? Explain.  
Most (77%) said they would apply the same or an improved rating. This suggests that once students developed their learning objectives, they were able to assess the level of importance with accuracy. At the end of the semester they recognized that their improved rating was more indicative of the personal value of course content. Eli states: " I did give the course a '2' rating and I honestly felt it was somewhat important to me, but never did I imagine I would change my mind throughout the semester and if so I was expecting to lower it in importance. As it turns out, I would say I feel this course became ... highly important to me, and I know that by taking it I have better prepared myself for the business world..."
- Please describe how your learning plan has facilitated learning in Training Systems in Business & Industry.  
The majority of learners, 73%, provided detailed comments that their learning plans were instrumental in their learning. Comments such as; "...it's relatively clear that it played a crucial role in my learning process." "...knowing there were

things that I really wanted to learn helped me pay greater attention in class." "...it helped me stay on track and made me think what I wanted to get out of the class." Of the 27% responding that their learning plan did not facilitate learning or that they felt unsure, many stated that they did not look at their learning plans unless directed to do so. Some reported that, as an elective course, they felt little investment in learning course content. It is not surprising that students taking this course merely to fulfill a requirement might be less engaged by the learning plan. However, it is possible that there were long-term positive effects of being required to reflect on one's own learning process. The process of reflection required in the construction of a learning plan is intrinsically useful. Its value is not tied to specific course content.

**Finding #2:** Students are able to locate themselves in the course. Through completion of a learning plan within the first 2 weeks of the semester, students were not only familiar with the intellectual goals of the course but were able to plot out their personal objectives. "The learning plan forces you to look at what is ahead (student, 2004)." Learners find their unique place in the content through consideration of university mandated course objectives and development of their personal learning objectives. Analysis of the learning plans collected at the 2-week point revealed that all students had at least an adequate understanding of these issues.

*Support:* A variety of activities conducted in the beginning of the term facilitated personal interest and investment in the course. The first week of the semester focused on why training is important to business and industry. Students participated in discussions and activities designed to familiarize them with course content. In the beginning of week 2, I provided an in-depth orientation to the concept of learning plans and invited students to create their individualized plan. By the end of week 2 students submitted their plans. In order to develop their learning plan, they reviewed the text, text outline, glossary, associated online presentations, and course syllabus. They listed their competencies and strengths as they understood them to be at the beginning of the semester. Students commented that this activity forced them to review this material in a way that prepared them for course content. "It helped me to consider what I hoped to gain in this class (student, 2004)." In addition, they analyzed their backgrounds to determine how their strengths applied to this course and to discover what competencies were important to develop.

**Finding #3:** Students use mid-semester coaching in order to reflect on their plans, asking questions and seeking information to modify their plans. Course activities shift.

*Support:* Mid-semester coaching involved a one on one meeting with each student. We reviewed their learning plan and discussed what was working for them and what they needed to change. Some students took this opportunity to revise their plans, discarding objectives that no longer held meaning and developing others that were pertinent to their interests. For example, one student used this opportunity to discuss his interest in the field of Training & Development, expressing a desire to investigate internship possibilities. Another student commented, "This is a great idea, I don't know why we don't do this in all of our courses." An unexpected benefit of this mid-semester check in was that students did a grade check to determine if they were on target with what they hoped initially. If their current performance fell short of their initial estimate, we talked about strategies to assist with what they initially set out to accomplish. Perhaps of equal importance, shifts happen when learners request additional information that enhances

their understanding of the training and development profession. We agree to have one week devoted to guest speakers. Students engage in a process of researching speakers, asking questions in advance of class, and setting up opportunities for focused dialogue.

**Summary of findings:** The most important conclusions that arise from this study are that learning plans act as a vehicle for focusing students on the goals of the course. In addition, mid-term coaching served to uncover learning needs of students resulting in shifting course activities. This focus on course goals and participation in mid-term coaching seem to be key components in the success of learning plans.

The depth of learning continued to build throughout the semester. Overall, students appeared to learn based upon their reflection in the areas of objectives and strengths. Some students were unsatisfied that competencies continued to need development. This suggests that more applied, real world, activities may have been helpful to their learning process. Course ratings regarding level of personal importance remained the same or increased throughout the semester. The majority (75%) of students rated this course a "2" (somewhat important) at the beginning of the course. At semester's end, 41% indicated they would now rate it as "1" (highly important).

Developing a learning plan invited students to reflect upon course content and what they brought to the learning environment through their experiences. This has industrial applications. As Garavan and Sweeney (1994) suggest, a learner centered approach generates "commitment and allows the trainee to take responsibility for his/her own learning." Mid-semester coaching was highly effective for me as well as students. It was an opportunity for students to take stock of where they were, based on what they said at the outset. More importantly, coaching was a key factor in this investigation. Industrially speaking, a learning plan is most effective when supported by a framework which includes the active involvement of a manager (Garavan, Sweeney 1994). This suggests why my earlier attempts to use learning plans may have failed. I simply was not involved enough.

Finally, end-of-the semester reflective writing of 81% of students suggested that their learning plans helped build deeper meaning. This is perhaps best summed up by Emma (student) when she says: "I think the learning plan gave me expectations for the course...students tend to concentrate on the expectations of the instructor, school, or their parents...the learning plan shifted that focus so that I was forced to look at what the actual content was...at the end of the semester it's pretty satisfying to look at my learning objectives and feel like I have a good working knowledge of those topics."

### **Lingering Questions**

I am left with some questions regarding one of the premises of learning plans. Knowles (1986) suggests that learning plans are based on the assumption that self-directed learning is a mechanism for learners to build on past experience and determine needs as they carry out learning activities. Typically, learning on one's own implies that a deeper, more permanent learning takes place. Schapiro (2003) questions this assumption and suggests that we view self-directed learning as a psychological disposition and as a learning process. Students may have the disposition but may not have the skill needed to design, manage, and direct their own learning. There are differences in students' capacities for self-directed learning. It is inaccurate to assume that learning solely on one's own creates deeper learning. Connected learning (with

each other, between student and instructor) seem important to learners at the undergraduate level. One of the essential pieces of this project appeared to be the mid-semester coaching sessions when students were able to discuss their learning. This facilitated learning in a way that my earlier attempts at learning plan utilization failed. Collaborative learning implies a level of reciprocity. Students need faculty input and guidance in their learning endeavors. Faculty need student input regarding their perceptions of learning in order to adjust and provide necessary resources. This input was key in adding activities that met learners' needs.

I am confident that learners' past experiences impact and engage them in future learning. This fits the constructivist view of learning which takes into account prior ability and knowledge of the learner in determining their approach to skill acquisition (Moon, 1999). However, labeling learning models as self-directed is misleading (Schapiro, 2003). This often implies a solitary pursuit of knowledge when in reality co-directed and collaborative learning is what fosters progress for both faculty and students.

In the end, reflection seems critical to student learning. As Moon (1999) posits, reflection can be generated by asking the kinds of questions that do not have clear-cut answers. After presenting this project at a national conference this summer (Lui, 2004) participants suggested rewording the end-of-the-semester reflection questions so they are not value laden. For example the first reflective question ("Describe how your objectives were met this semester") could be reworded allowing students to consider whether their objectives were indeed met. A revised question might be: "Were your objectives met this semester? Why / Why not?" In addition, questions which assess more explicit aspects of learning plan content could be developed as well as a rubric for the evaluation of students' reflective writing.

### **Conclusions**

One way to improve teaching and learning on campuses involves the scholarship of teaching and learning (SoTL). SoTL goes beyond trying to facilitate student learning and reading the pedagogical literature. It involves in depth reflection on teaching and learning as well as the public sharing of this work (McKinney, 2003). I have appreciated the opportunity to take time to reflect on my use of learning plans with undergraduate students. This process of reflection is liberating.

As Palmer (1997) suggests teaching emerges from inwardness and a review of the tangles of teaching. I am struck by the reciprocity and mirror image for both instructor and students. Learning plans invited students to reflect upon their learning from the beginning. I was able to investigate and review learning plans from looking inward and outward as I worked with students. As this project is a work in progress I am beginning to untangle the somethingness of learning plans.

### **References**

Bass, R. (1999). The scholarship of teaching: What's the problem? *Inventio*. Retrieved 7/8/2004 from <http://www.doit.gmu.edu/Archives/feb98/andybass.htm>.

Bentz, V., Shapiro, J. (1998). *Mindful inquiry in social research*. CA: Sage Publications.

Boyer, N. (2003). The learning contract process: Scaffolds for building social, self-directed learning. *The Quarterly Review of Distance Education*. 4(4). 369-383.

- Buckley, M.R., Novicevic, M., Halbesleben, R., Harvey, M. (2004). Course Management and students' expectations: Theory-based considerations. *The International Journal of Educational Management*. 18(2). 138-144.
- Bullock, K., Wikeley, F. (1999). Improving learning in year 9: Making use of personal learning plans. *Educational Studies*, 25(1), 19-33.
- Cerbin, W. (2000). Investigating student learning in a problem-based psychology course. In P. Hutchins (Ed.), *Opening lines: Approaches to the scholarship of teaching and learning* (pp. 11-21). CA: Carnegie Publications.
- Cerbin, W. (2002). A thumbnail sketch of teaching for deeper understanding. Paper presented at Faculty College. UW-Richland. June, 2002.
- Fileva, M. (2004). Change-adept classroom. *Journal of American Academy of Business*. 5(1/2). 183-188.
- Garavan, T., Sweeney, P. (1994). Supervisory training and development: The use of learning contracts. *Journal of European Industrial Training*, 18 (2), 17-26.
- Garrison, D.R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly*, 48(1), 18-33.
- Hogan, C. (1995). Creative and reflective journal processes. *The Learning Organization*. 2(2). 4-17.
- Hutchins, P. (2000). *Opening lines: Approaches to the scholarship of teaching and learning*. CA: Carnegie Publications.
- Knowles, M. (1986). *Using learning contracts: Practical approaches to individualized and structured learning*. CA: Jossey-Bass.
- Lemieux, C. (2001). Learning contracts in the classroom: Tools for empowerment and accountability. *Social Work Education*. 20(2). 263-267.
- Lui, K. (2004) Mixing Fielding approaches with learning in traditional higher education: Experiences of a new tenure track faculty member. Presentation at Fielding Graduate Institute Summer Session, July 14, 2004. Alexandria, VA.
- McKinney, K. (2003). Applying the scholarship of teaching and learning: How can we do better? *The Teaching Professor*. 17(7), 1,5,8.
- Moon, J. (1999). *Reflection in learning and professional development*. London. Kogan Page.
- North Central Regional Educational Laboratory. (2004). Action research. Retrieved 7/30/04 from <http://www.ncrel.org/sdrs/areas/issues/envrnmnt/drugfree/sa3act.htm>.
- Palmer, P. (1997). *The courage to teach: Exploring the inner landscape of a teacher's life*. NY: Jossey-Bass.

Schapiro, S. (2003) From andragogy to collaborative pedagogy: Learning for academic, personal, and social empowerment in a distance-learning Ph.D. program. *Journal of Transformative Education*, 1(2), 150 -166.

Williams, A., Williams, P. (1999). The effects of the use of learning contracts on student performance in technology teacher training. *Research in Science & Technological Education*. 17(2). 193-201.



**If You Build It, They Will Come:  
Conceiving a Saturday Class in Economic Education to Link Content,  
Applications, Implementation, and Assessment**

Kathy Parkison  
Center for Economic Education  
Indiana University Kokomo  
Kokomo, Indiana, USA

Margo Sorgman  
Professor of Education  
Indiana University Kokomo  
Kokomo, Indiana, USA

**Abstract**

Economic standards have been set, are here to stay, and must be met. Therefore, professional development in economic education is vital. To that end, a three phase course for K-12 teachers was collaboratively designed and delivered by faculty members in both education and economics. It enhances teachers' knowledge and comfort with economic concepts and their ability to successfully implement and assess the economic learning and enhance the economic attitudes of their K-12 students.

**Introduction**

There is a national mandate in the United States to enhance the economic literacy of elementary and secondary students. To meet these expectations, classroom teachers must become knowledgeable about economics, comfortable teaching economics, and able to implement economics in the classroom. Studies by the authors (Authors, 1998, 1999, 2001, 2003, 2004 forthcoming and 2004 working paper) reveal that the primary influence in teachers' economic literacy is taking a course in economics that teaches key macro and microeconomics concepts and requires them to develop, implement, and assess economic curriculum in their classrooms.

While teachers may have the economic knowledge after some form of economic education training, they do not necessarily have the disposition towards both the importance of economics and how to teach the economic concepts to their students that result in their comfort with economics. Principle #1 of the INTASC standards (which shapes teacher education programs, licensure, and accreditation) says that, "teachers must understand the central concepts, the tools of inquiry, and structures of the discipline(s) he or she teaches and can create learning experiences that makes these aspects of the subject matter meaningful for students" (INTASC, 1991). In addition, there are four dispositions that define comfort with teaching subject material:

1. "The teacher realizes that subject matter knowledge is not a fixed body of facts but is complex and ever-evolving. S/he seeks to keep abreast of new ideas and understandings in the field.
2. The teacher appreciates multiple perspectives and conveys to learners how knowledge is developed from the vantage point of the knower.
3. The teacher has enthusiasm for the discipline(s) s/he teaches and sees connections to everyday life.
4. The teacher is committed to continuous learning and engages in professional

discourse about subject matter knowledge and children's learning of the discipline." (INTASC, 1991)

### **Saturday Economic Education Course**

The missing piece in the economics education literature and in the authors' research has been the implementation of economic curriculum and the assessment of its impact on K-12 student learning. The National Council for Economic Education (NCEE) has recognized this lack of scholarship and has called for additional research on this topic. The first step in filling this gap was made possible when a summer course for teachers became a Saturday class during spring semester. This Saturday class, designed and team-taught by faculty from both economics and education, is a unique partnership in the nation and the only one in Indiana, and was cited by the IU Kokomo Center for Economic Education's accreditation visitation team as a model for centers nationwide. Many of the teachers in our service area have not had any formal training in economics or the teaching of economics. Additionally it has resulted in campus and university awards, recognition by the Indiana Council for the Social Studies, selection for international travel by the National Council for Economic Education, and numerous presentations at the state, national, and international levels. The active learning approach in the course, (using simulations, role plays, games and other such active learning methodologies) for teachers makes a powerful impact on teachers' efficacy with economics content and curriculum.

The purpose of the course is twofold: first, to examine how individuals make choices and how the price system plays a role in those choices; and secondly, to increase awareness of how the U.S. economic systems functions at an aggregate level. K-12 teachers who attend the course are underwritten by a stipend from the Indiana Council for Economic Education. These teachers typically are not economics teachers. So their lack of training in economics, coupled with the state mandates, results in their view these content mandates as challenging.

The goals for the course are to enhance the teachers' economic literacy of major economic concepts and institutional structures; to develop economic reasoning by improving their ability to think logically and critically about economic approaches to behavior, analysis and issues; and to explore economic applications by studying how economics applies to situations. Upon completing the course, teachers should be competent on nine learning objectives. These learning objectives were developed in conjunction with the School of Business and the economics faculty members at IU Kokomo to ensure that major economics content inherent in a micro/macro survey course is mastered. They are as follows:

1. Describe the basic functions of our economic system in allocating resources.
2. Be able to identify positive/normative economic statements.
3. Be able to understand and illustrate the concepts of scarcity, opportunity costs, comparative advantage, and absolute advantage.
4. Understand and apply supply and demand curves, know how those curves are derived, distinguish between shifts in curves vs. movements along the curve, and make applications of curves.
5. Know the types of market conditions (perfect competition, oligopoly, monopoly) what gives rises to these different conditions, and pricing/regulation implications.

6. Know how to apply economic reasoning to such topics as the labor market, market failure problems, externalities, taxation issues, and other current topics.
7. Understand the international implications of comparative advantage, specialization, trade, and trade barriers.
8. Be able to identify linkages between and among markets and household, businesses, government, and international sectors of the economy.
9. Understand the role of money, what it is, how it is measured, and the role of the Federal Reserve System.

### Course Structure

The seven Saturday 9 a.m. - 3 p.m. class is organized into three phases. In the **FIRST PHASE** teachers are introduced to nine learning objectives (listed above) via presentations, curriculum applications, and exposure to published economic materials and student-developed materials housed in the Indiana University Kokomo Center for Economic Education Library. For example, after Supply and Demand are introduced via lecture, the concept of market price is shown graphically with examples from the news to guide understanding. Then a simulation is played where teachers become buyers and sellers and through their trades begin to see the emergence of market price as it is recorded on the board. To learn the Impact of Regulations on Productivity, another simulation is played where teachers make friendship pins and then are required to wear gloves to protect their hands as a result of a fictionalized OSHA regulation. Finally, teachers end up wearing paper plate masks to protect their eyes, due to a second fictionalized OSHA regulation. This dynamic activity, designed by NCEE, and its follow-up analysis, shows the impact of regulations on productivity and models an interactive and hands-on learning approach. These active-learning approaches are central to the scholarship on best practices for teaching and learning (Zemelman et al., 1998).

The **SECOND PHASE** of the course is the development of curriculum projects for implementation and assessment in K-12 classrooms. Of the six lessons, two may be adapted, at least one must have an international component, and a micro-macro concept balance must be evidenced. The curriculum must include a five page rationale which is a justification for the selection of the economic concepts, the goals for the curriculum, and objectives to be measured. Teachers are challenged to detail their instructional approaches and where possible link them to school district initiatives (such as using the Internet). A four page analysis of pre and posttest data assessing their K-12 students' economic literacy gains and attitudes toward economics are also required. Exemplars and demonstration lessons are provided to model integration of economic content with other subject areas.

In the **THIRD PHASE**, classroom teachers are mentored by faculty and by their campus peers via mini presentations of their intended project. During the off-campus period, teachers designed, implemented, and assessed their curriculum. The role of the faculty members is mentor and observer. Multiple visits to each classroom are scheduled to assist teachers in implementing and analyzing their curriculum applications. The final class is an on-campus presentation of curriculum, with an emphasis on assessment outcomes. The celebratory nature of that session is in marked contrast to the fear and trepidation teachers exhibited on day one.

### Course Data and Analysis

Success of the Saturday Course was determined by multiple measures. First teachers were assessed by a series of mini-examinations on the nine economic learning outcomes. These course exams were designed to determine teachers' knowledge of economics so that teachers can connect the correct economics to their curriculum and meet the curriculum development requirement as suggested by NCEE and state economic standards.

Second, teachers were given the National Council for Economic Education (NCEE) Test for Economic Literacy (TEL), Version 3, 2002) as a pre and posttest measure which is designed to assess the economic literacy of high school graduates. The TEL is designed to measure student understanding of basic economic concepts as listed in either the Framework for Teaching Basic Economic Concepts (Saunders & Gilliard, 1995) or the Voluntary National Content Standards in Economics (NCEE, 1997) It has been extensively used throughout the United States and around the world. The past history of the development of the TEL is well documented in the Third Edition's Examiner's Manual (NCEE, 2001) and can serve as a nationally normed measure of our teachers' ability before and after instruction in the economic content of the course.

The TEL was administered to these teachers as a pretest to test basic knowledge of economics PRIOR to taking the course to determine the baseline knowledge of economics. This was done anonymously, resulting in aggregate scores as shown in Table 1. The TEL was a new addition to our assessment procedures in Spring 2004, therefore we do not have 2003 data.

**TEL Scores in spring 2004  
Sample of 13 teachers – (standard deviation)**

| <b>TEL Pre-test<br/>Aggregate Scores</b> | <b>TEL Post-test<br/>Aggregate Scores</b> |
|--|---|
| 16.31<br>(4.008)                         | 20.58<br>(7.76)                           |

*Table 1*

The sample size is too small to do any standard statistical analysis, such as comparison of means. However, it is clear that while the teachers' average score increased, the standard deviation also increased. This will bear watching for the future. A future research study will compare teachers' post TEL scores with the quality of their curriculum and their K-12 student assessment data.

Third, teachers were assessed on the quality of their curriculum projects, which varied widely with scores ranging from A's to D's. These curriculum projects were graded using the following criteria using criteria adapted from Connecting the Pieces: Building a Better Economics Lesson (NCEE, 1997):

1. Is the curriculum tied to the appropriate grade level standards? (Teachers did often have to drop back grade levels on their testing and teaching of the standards as students were not ready for the appropriate grade level standards).
2. Is there a clearly expressed and appropriate rationale for teaching of economics?
3. Is the economics correct?
4. Is there an assessment of student learning plan?
5. Are there two microeconomics lessons and two macroeconomics lessons? Does

- at least one lesson have an international focus?
6. Are lessons identified as original or adapted? If adapted, is a bibliography for the source of the lesson?
  7. Is there an Internet component to at least one lesson?

Fourth, teachers completed a survey at the end of the course assessing their knowledge, comfort, and application outcomes. This self-report measure, shown in Table 2, has a small sample of 10 teachers for spring 2003 and spring 2004 semesters. The survey questions were clustered into three major categories: content and comfort; implementation and assessment; and course elements.

### Survey Results for spring 2003 and 2004

| Question - 1 (low) to 5 (high)  | Score<br>2004/2003 |
|---|--------------------|
| <b>Content/Comfort</b>  |                    |
| Taught me basic micro and macro economics concepts needed to develop my curriculum                        | 4.8/4.6            |
| Taught me basic micro and macro economics concepts needed to increase my understanding of economic issues | 4.4/4.6            |
| Increased my comfort in teaching economics  | 4.5/4.6            |
| Increased my economic literacy  | 4.5/4.5            |
| <b>Implementation/Assessment</b>  |                    |
| Effectiveness of the development/implantation phase of the course   | 4.3/4.4            |
| Classroom visits  | 3.9/4.1            |
| Usefulness of end-of-course student presentations in enhancing my classroom application                   | 3.8/4.7            |
| Access to economic resources  | 4.4/4.3            |
| Enhanced development of active learning approaches  | 3.8/4.6            |
| Enhanced ability to connect economics to other content areas  | 4.6/4.6            |
| Enhanced inclusion of global/international economic content   | 4.4*               |
| Enhanced development of collaborative learning  | 4.2/4.2            |
| Enhanced development of my students' higher order thinking skills   | 4.2/4.5            |
| Enabled me to learn from other teachers   | 4.4/4.1            |
| Assessment requirement led to better economic lesson planning   | 3.9*               |
| <b>Course Elements</b>  |                    |
| Saturday format   | 4.2/4.3            |
| Professor presentations   | 4.5*               |
| Multiple exams  | 4.3/4.3            |
| Content/curriculum balance  | 4.5/4.3            |
| Textbook  | 4.0/4.3            |

Table 2

Some preliminary conclusions from survey data can be drawn. Teachers liked the

Saturday format, especially with the content front-loaded and implementation time in the middle of the semester. They also felt that the course increased their knowledge of economics, comfort with economic content, and enhanced their implementation of economics curriculum. This survey confirmed our earlier research finding that a strong knowledge base of economics helps increase teachers' comfort with economics. Teachers rated highly the opportunity to work with others.

Qualitative comments were also analyzed. Teacher comments revealed that the curriculum requirement made linked economic content, curriculum objectives, and instructional approaches. One math teacher stated, "Now I know how to lead discussions in math class. Students had fun and we got away from what we usually do. There is no going back." Perhaps the most telling response was from one teacher's student who asked, "Why didn't we do this last year?"

Fifth, teachers were required to develop and administer assessment measures in their own classrooms. The assessments were both qualitative and quantitative in nature. For example, one teacher had the students rate their confidence level on both the pre- and post-tests. These self reported levels are listed in Table 3. Overall, this same teacher's students' scores improved 19.4% on economic content assessment measures from the pre-test to the post-test.

### Self reported knowledge

| <b>Student confidence level – “right now I think my knowledge on economics is:”</b> | <b>Pre test</b> | <b>Post test</b> |
|---|-----------------|------------------|
| “Outstanding. I know it all!”   | 1               | 17               |
| “Okay I guess”  | 31              | 63               |
| “Not very good”   | 28              | 3                |
| “Terrible, I’m clueless”  | 26              | 0                |

*Table 3*

Other teachers gave paper and pencil pretest measures. One second grade teacher's students' scores improved from 40.5% average accuracy to 72.5%. She reported that, "Students approached the post-test with enthusiasm as they wanted to see how much they had gained. They enjoyed finding the economic concepts within the stories that were read to them. In fact, I noticed them using the economic vocabulary in other areas of the curriculum." She concluded by saying, "I never would have made this econ. connection without the class requirement. I will enthusiastically teach this unit in subsequent years, because the children have gained so much." These teacher comments confirm the Chen et al. research. They note that when in-service is characterized by needs assessment, classroom visits, and university credits, teachers have an increased sense of renewal and connections to their field. (Chen, 1990)

In her study of money, a third grade teacher reported that the kids viewed money as, "something that helps you get good things and can hurt if you get bad things such as drugs or guns." She also reports that, "Money is not always seen as something to buy with, rather they are thinking about saving their money instead of spending it now."

A high school teacher, who designed a classroom economic system to improve student dispositions, created a series of fines for questionable behavior such as sleeping in class, attention to non-class material, late work, noise pollution, not having the correct

materials, and leaving the classroom. One of her students discovered that two absences left her without enough income to meet expenses. Powerful statements from her students include, "I studied harder to get more money. I didn't miss class as much and I learned about the economy from this project." And "I enjoyed that this was close to simulating real life."

### **Conclusion**

According to Gentile & Lalley (2003), effective in-service for teachers should provide, among other things, opportunities for active rather than passive learning, opportunities for practice and feedback, a focus on content, a requirement that teachers think at higher levels of complexity, and a sustained focus on the content involved. This course was designed with these aspects in mind and in doing so, linked content, applications, implementation, and assessment.

Additionally, faculty members returned to campus with new insights about the course and elements that might be "tweaked" for the next semester. For example, the assessment component will be strengthened to require at least one NCEE normed quantitative measure of economic content gained to supplement the rich qualitative analyses. We have just finished teaching a new course -Teacher as Action Research - which was designed for K-12 teachers who completed this initial course. Our next research study will examine the impact of economics teaching on K-12 students' knowledge of and attitudes toward economics.

Preschool through high school students need informed teachers who can design and implement appropriate economic curriculum so that their students can understand the economic issues in society. Without that, they will be like the adults in the Foundation for Teaching Economics and the Gillette Company survey, reported in the Indianapolis Star on July 5, 2003, "91% of them said they apply basic economic concepts each day, but only 25% could answer questions about those concepts." (p. B-7)

Since economic standards have been set and are here to stay, they must be met. Therefore, professional development in economic education is vital. To that end, a three phase course, collaboratively designed and delivered by faculty members in both education and economics, has been successful because it enhances teachers' knowledge and comfort with economic concepts and their ability to successfully implement and assess the economic learning and attitudes of their students. One of our teachers said it best, "While I become more proficient in bringing economic concepts into the classroom, the students will be gaining knowledge. This will help them into high school as more knowledgeable students, more efficient consumers, and wiser for their future."

### **References**

Authors, (November, 1998). "Enhancing Economic Literacy of Classroom Teachers," International Advances in Economic Research, Vol.4, #4, 418-427.

Authors, (1999). "The Impact of a Survey Course in Economics on Teachers' Curriculum and Personal Decisions: A Follow-up Study," Journal of the Indiana Academy of the Social Sciences, Vol. #3, 50-56.

Authors, (December, 2000). "Internationalizing an Economics Curriculum for Teachers,"

Business Education Forum, Vol. 55 #2, 35-37.

Authors, (2000 presentation), "Origins of Economic Knowledge: A Study of Factors Influencing Pre and In-Service Teachers," NCSS Great Lakes Regional Conference, Indianapolis, IN, April 2000.

Authors, (forthcoming) "A Comparative Study of Area Professionals and Undergraduate Education Majors' Economic Literacy and Curriculum Applications," (accepted for publication in the Economics and Economic Education Research Journal).

Authors, (2003) "Economics in Action: A SIFE, University, and Classroom," Journal of Entrepreneurship Education, pp. 77-85, Volume 6.

Chen., W. et al., "Impact of a Continuing Health Inservice Program on Teachers' Competence," Health Education, November 1990, cited in "Inservice for Teachers Characteristics of Effective Programs," downloaded from [http://www.schoolfile.com.inservice\\_for\\_teachers.htm](http://www.schoolfile.com.inservice_for_teachers.htm)

Connecting the Pieces : Building a Better Economics Lesson, National Council for Economic Education, 1998.

Gentile, J. Ronald & James Lalley. (2003). Standards and Mastery Learning: Aligning Teaching and Assessment So All Children Can Learn, Thousand Oaks: Corwin Press Inc.

Model Standards for Beginning Teacher Licensure and Development: A Resource for State Dialogue, INTASC, Council of Chief State School Officers, 1991, pp. 10 - 11. Indiana Academic Standards - Social Studies, (Teacher's Edition). (2001). Indiana Department of Education.

National Council for Economic Education April 2003. Survey of the States: Economic and Personal Financial Education in Our Nation's Schools in 2002.

National Science Foundation, Historical Perspectives on Current Teacher Enhancement Programs in Science and Mathematics, downloaded on July 12, 2004, <http://www.ehr.nsf.gov/ehr/rec/pubs/eval/tep/tep.html>.

Saunders, P., & Gilliard, (Eds.) A Framework for Teaching the Basic Economic Concepts, National Council on Economic Education, New York, 1995.

Voluntary National Content Standards in Economics, National Council on Economic Education, New York, 1997.

Walstad, William & Denise Robson (1990). Basic Economics Test Form A, Second Edition, National Council for Economics Education.

Zemelman, Steven, Daniels, Harvey, & Hyde, Arthur, (1998). Best Practice for Teaching and Learning America's Schools, 2nd Edition.



## **Service-Learning in a Clinical Curriculum: A Case Study**

Kathy Starr  
Department of Physical Therapy  
Western Carolina University  
Cullowhee, North Carolina, USA

### **Abstract**

Physical therapy (PT) students participated in a service-learning project in which they provided clinical anatomy workshops with prosected (previously dissected) cadavers for physical therapist assistant students from a nearby community college. Topics included the respiratory system, nerves of the arm, and shoulder rotator cuff muscles. Each workshop covered basic anatomic principles, selected pathologies and treatment options. Pre- and post-tests were used to determine whether curriculum objectives had been met. Workshop evaluations provided important feedback. PT students maintained reflection logs throughout the service-learning project. Responses from the workshop evaluations and the student reflections indicated that this was a valuable learning experience for both groups of students.

### **Introduction**

Service-learning is an educational strategy that is being incorporated into many disciplines in higher education. It is an instructional method that utilizes the concept of active learning by the acquisition of skills and knowledge through service to the community (Hatcher and Bringle, 1997). Service-learning involves community service activities based on educational goals. Proponents of service-learning are careful to point out that this type of learning strategy differs from community service or volunteerism in which service is at the center, rather than learning (Furco, 1996). Indeed, the hyphen in service-learning suggests a dependent relationship between the two components (Jacoby, 2001). The concept of service-learning has been around for a long time. In 1979 Robert Sigmon characterized service-learning as a kind of "reciprocal learning". Students are not working for the community, but rather with the community. As a result community members also learn from the experience. Bringle and Hatcher (2002) stress that service-learning builds important campus-community partnerships that can have a positive impact on both the student and the community.

In addition to clinical experiences or internships many health care education programs are now incorporating service-learning into their curricula as a type of experiential learning. Siefer (1998) suggests that service-learning differs from traditional clinical experiences because the service component involves community partners and gives students an opportunity to meet community needs while also meeting curriculum goals. Service-learning activities help students in health care professions become an integral part of the community and foster relationships that will benefit these students in their clinical careers (Ferrari and Cather, 2002).

At Western Carolina University (WCU) service-learning has been a part of the Master's in Physical Therapy (PT) curriculum for several years (Little, 2000; Starr, 2000a, 2000b). The primary mission of the PT department is to graduate physical therapists that can practice autonomously in a variety of settings. Upon graduation PT students will be involved in physical rehabilitation following injury or illness, training and education to restore and maintain health, and research to develop new therapies and techniques for

rehabilitation. As part of the PT curriculum at WCU, PT students develop service-learning projects that meet one or more of the department's educational goals.

An important component of the service-learning strategy is reflection on the process. Throughout the service-learning project PT students maintain a weekly reflection log. Student reflections address what they are doing, why they are doing it, and how they are benefiting from the experience. Hatcher and Bringle (1997) state that reflection connects the service activity to learning by forcing students to focus on the experience in relation to the educational goals. Community-based service-learning has been shown to develop critical thinking skills in nursing students as indicated by their written reflections (Sedlak, Doheny, Panthofer, and Anaya, 2003).

The purpose of this paper is to describe a service-learning project completed in 2004 by three PT students in which they organized clinical anatomy workshops with prosected cadavers (cadavers previously dissected by PT students) for physical therapist assistant (PTA) students from a local community college. In health care settings the PTA performs certain physical therapy procedures selected by and under the direct supervision of the PT. The PT, therefore, must have a firm understanding of the academic background of the PTA in order to provide the best quality of care for the patient. Robinson et al. (1994) distributed two surveys in 1986 and 1992 to evaluate the physical therapists' perceptions of the role of the PTA in the health care setting. Although survey results indicated that the therapists' perceptions of the PTA's role were, in general, consistent with the published guidelines for practice, there were misconceptions about the role of the PTA in certain selected activities. To help PT students better understand the role and academic backgrounds of the PTA, this service-learning project was developed to provide an opportunity for PT and PTA students to interact with each other in a teaching/learning environment.

### **Needs-Assessment Surveys**

To determine the type of teaching/learning experience that would be most beneficial for PTA students it was important to understand the PTA curriculum and the needs of the practicing PTA. Two PT students from the class of 2000 gathered this information from surveys distributed to PTA programs and practicing PTAs in North Carolina. PTA faculty indicated a desire to enhance the anatomy content in their curricula using alternative teaching strategies, such as cadaver dissections. Practicing PTAs responded that access to cadavers would have improved their clinical knowledge. Their opinion is consistent with published survey data collected from occupational therapists, physician assistants, and physical therapists licensed in the state of Texas, in which the single most recommended teaching method involved the use of human cadavers (Latman and Lanier, 2001).

### **Developing a Project that Meets Curriculum Objectives**

Based on the needs-assessment surveys the faculty advisor worked with PT students to develop a service-learning project in which clinical anatomy workshops with associated prosections would be provided for PTA students. Prosected materials were obtained from the cadaver dissections performed by first-year PT students as part of their two semester human gross anatomy course. While this service-learning project was first implemented in 2000, this paper will describe the project completed by three PT students in 2004. For the PT students, a key component of this project was an opportunity to develop their teaching skills. Thus, this project met two WCU PT program

curriculum objectives: (a) communicating effectively with multiple audiences using appropriate strategies and technologies, and (b) employing effective educational strategies and technologies when teaching audiences with varied needs. Providing opportunities for PT students to improve their communication skills is vital to their becoming effective clinicians because a primary role of the PT is patient education (Chase, Elkins, Readinger, and Shepard, 1993).

Three PT students chose to participate in the service-learning project because of their desire to teach, to interact with PTA students, and to deepen their knowledge of clinical anatomy. The clinical instructor at the community college PTA program acted as the community liaison helping the PT students to develop the workshops. After reviewing the PTA program curriculum objectives with the community liaison, the PT students selected the respiratory system, the nerves of the arm (known as the brachial plexus) and the shoulder rotator cuff muscles as workshop topics. Each student was required to develop the content and lead one workshop. All the students, however, were involved in teaching the three workshops.

### **Learning Contract and Permission for Human Subject Research**

Before beginning the service-learning project the PT students wrote a learning contract to outline the details of the project. Included in the learning contract were the purpose of the project, the learning objectives for the PT students, the methods used, a description of the literature review that would provide background information, and a timetable for completing all facets of the project. The PT students were also required to develop grading criteria by which their performance would be evaluated. The final contract was signed by the three students, the community liaison, and the faculty advisor.

Since each workshop included collection of data related to the PTA students' performance on pre- and post-tests, the PT students were required to complete a Request for Review of Human Subjects Research form which was submitted for approval to the WCU Institutional Review Board. All PTA students who attended the workshops voluntarily gave informed consent to participate in the service-learning project.

### **Students' Literature Review**

The PT students developed a literature review to provide evidence that they had read the current literature as foundation material for each workshop. Using appropriate journal articles or other sources they defined service-learning and how it specifically related to their project. They also summarized the previous needs-assessment surveys and discussed how the findings supported their work. Since one aspect of the project was to foster a better understanding of the PT/PTA relationship, the PT students researched the role of the PTA as it relates to the practice of a PT. To insure that their workshops addressed the needs of the PTA curriculum, the PT students described how this service-learning project met the course objectives of the PTA program at the participating community college. They also summarized several current journal articles on the clinical topics they had chosen and on the efficacy of using cadavers for human anatomy instruction.

## **Designing the Clinical Anatomy Workshops**

The three workshops covered basic anatomic principles, selected pathologies and appropriate treatment options. For each workshop the PT students developed a list of learning objectives that were approved by both the community liaison and the faculty advisor. The workshops were approximately two hours in duration, beginning with classroom activities followed by a study of related cadaver dissections. PT students developed a detailed lesson plan, created presentations with handouts and overhead transparencies, and produced interactive laboratory exercises. Since the PTA students attending these workshops did not have previous experience working with cadavers, the PT students also discussed appropriate ethical behaviors when working with cadavers (Starr, 2003). Prior to conducting the workshops, the PT students did a mock presentation for other members of their own class. Using feedback from their peers, the PT students modified the workshops before their final presentation to the PTA students.

### **Assessment of the workshops**

Ten to twelve first and second year PTA students attended the workshops. To determine whether the learning objectives had been met, PTA students were given pre- and post-tests at the beginning and end of each workshop. Knowledge of the same material was tested using a multiple-choice question format on the pre-tests and a fill-in-the-blank format on the post-tests. Test results were evaluated statistically and summarized to determine the effectiveness of the presentations. Mean test scores for the post-tests were higher than those for the pre-tests in all three workshops. Using dependent *t* tests, scores were significantly higher for the brachial plexus workshop ( $t = -5.511$ ,  $df = 9$ ,  $p < .001$ ) and the shoulder rotator cuff workshop ( $t = -4.722$ ,  $df = 11$ ,  $p < .001$ ). The PT students were asked to discuss how the data related to their teaching effectiveness as part of a comprehensive notebook of materials they submitted to the faculty advisor at the conclusion of the service-learning project.

PTA students provided feedback on the workshops by completing evaluation forms. They were asked to assess whether workshop information was helpful and appropriate in difficulty, whether instructional tools (handouts, diagrams and overhead transparencies) were adequate, whether the PT student instructors were well prepared, and whether cadaver dissections were useful for understanding the clinical topics. They were also asked to comment on the most beneficial and least effective aspects of the workshop and to provide suggestions for improvement. Responses on workshop evaluations were very positive. PTA students consistently expressed a desire to spend more time in the cadaver lab.

### **PT Student Reflections**

As part of the service-learning protocol, PT students were asked to maintain a weekly reflection log of the service-learning experience. In their reflections they were to address what they had learned, how they felt about the learning experience, and how they would apply what they had learned. It was possible to see a progression in the students' thoughts about the experience as the project moved forward.

One PT student, who had been a practicing PTA for 15 years prior to entering the PT program, wrote in her reflections "spring semester [the faculty advisor] planted the idea of my choosing this project. I am just now realizing how much of a complement it will be to my overall education. I am very excited to be participating in this partnership." As the

PT student developed her workshop she reflected, "I had initially been disappointed that I was to prepare and teach a lesson on the brachial plexus and related injuries. I felt that it was somewhat uncommon and I would rather do something that would be more clinically relevant. But after reflecting on the issue, I have realized that this may not be something that the PTA students get much exposure to. That is the whole point of this project, to present them with information that they may not have gotten otherwise. I too will benefit from something that I don't know a whole lot about."

Another PT student, who was formerly a high school teacher, wrote in his reflections "I did know from my previous teaching experience that there is a lot of extra time required to be prepared for a lesson. It has been interesting to observe the newly gained respect my peers now have for teaching." He also wrote, "I feel that this is a great opportunity for us as student PTs to share the wealth of knowledge we have acquired with our soon to be peers." As the time approached for him to present his workshop, the PT student wrote "I am very excited to have the opportunity to teach once again. I will use my excitement to propel me through the rest of this project, while insuring that I am giving the students the best class possible."

The third PT student, who was new to the health care profession with no previous teaching experience, wrote in her reflections "I have learned that our service-learning project will be a detailed and challenging assignment. Organization and time-management will be important goals." As the PT student began to prepare for her workshop she noted "I was able to complete a broad outline [of the workshop] this morning, so that has encouraged me some, and I feel like I know what needs to go in the holes." On the day of her workshop she wrote "the workshop itself was really fun, and it went by quickly! The cadaver lab went well and the students improved on their post-test scores with regards to knowledge about the muscles."

It was apparent throughout their reflection logs that the PT students developed a greater understanding of the importance of planning and organizing in order to meet curriculum objectives. Their reflections also addressed the importance of good communication skills, not only in the presentation of their workshops, but in the teamwork necessary for developing the workshops. In addition to the weekly reflections the PT students also shared their experiences in videotaped interviews for future PT students who may also be interested in this service-learning project.

### **Revision of Earlier Service-Learning Projects**

This service-learning project was first implemented in 2000 with two second-year PT students developing and presenting three clinical anatomy workshops for PTA students. This project was briefly described in the HAPS Educator, the official publication of the Human Anatomy and Physiology Society (Starr, 2000). In the current service-learning project implemented in 2004, several significant changes were made to enhance the learning experience for both the PT and PTA students. While in the initial project two PT students worked together to produce three workshops, in the current project three PT students were recruited so that each student would be personally responsible for creating a workshop. These PT students worked much more closely than previous students with the community liaison to develop workshops specifically tailored to the course objectives of the PTA program.

The literature review was expanded to include information from several current peer-reviewed journal articles about the latest physical therapy techniques related to the

workshop topics (a form of evidence-based practice). More information was included from peer-reviewed journal articles relating to the use of cadavers as an instructional tool for teaching anatomy. A discussion on how the needs assessment related to the implementation of this project was also added to the literature review.

Students participating in the earlier service-learning projects asked for more feedback on their teaching. To provide greater feedback the PT students in the current project did a mock presentation for peers prior to implementing the workshops in order to help determine whether the presentations, handouts and tests were appropriate and meaningful. A formal written evaluation by the faculty advisor at the completion of each workshop also provided important feedback.

In earlier service-learning projects PT students compared performance on pre- and post-tests by determining whether the number of correct answers increased from pre- to post-test scores. No formal statistical analyses were done. Since students in the current service-learning project would be required to present their results in a poster session at a national conference, they were required to perform statistics on pre- and post-test results in order to analyze the test scores. They were also required to obtain approval from the WCU Institutional Review Board for a review of Human Subjects Research in order to publish these results.

In earlier service-learning projects PT students only wrote reflections at the end of each workshop summarizing their performance. In the current project students were required to maintain weekly reflections in order to think more about what they were learning during the process of developing the workshops rather than focusing solely on the results of the project.

### **Conclusion**

Service-learning is an instructional strategy in which learning is accomplished through a community service activity. The learning experience must be directly tied to educational goals. In this service-learning project the educational goals for the PT students were to learn more effective communication skills and to be able to teach using multiple teaching strategies. The community service activity used to accomplish these goals involved having PT students implement clinical anatomy workshops for PTA students from a nearby community college. Using prosected materials to enhance the workshops provided a unique opportunity for PTA students to view anatomic structures discussed in the classroom portion of the workshop.

By bringing the PT and PTA students together, both groups gained a greater understanding of the PT/PTA relationship. These interactions will provide a basis for increased respect and cooperation when these students become practicing clinicians. The PT students had an opportunity to gain valuable teaching experience through the development and presentation of the workshops. Their weekly reflections indicated that they now felt a greater appreciation for the time and effort involved in teaching at an educational level appropriate to the target audience. Their reflections also indicated that they had gained self confidence and a sense of accomplishment. After completing the project they presented their results in a poster session at a national meeting of the American Physical Therapy Association (Bunge, Brown, Mirovsky, and Starr, 2005).

## References

- Bringle, R. G. & J. A. Hatcher (2002). Campus-community partnerships: the terms of engagement. *Journal of Social Issues*, 58(3), 503-516.
- Bunge, M., D. Brown, T. Mirovsky, and K. A. Starr (2005, February). *Enhancing a physical therapist assistant anatomy curriculum with cadaver dissections: a servicelearning project*. Poster session presented at 2005 Combined Sections Meeting of the American Physical Therapy Association in New Orleans, Louisiana.
- Chase, L., J. A. Elkins, J. Readinger, & K.F. Shepard (1993). Perceptions of physical therapists toward patient education. *Physical Therapy*, 73, 787-796.
- Ferrari, N. & G. A. Cather (2002). Community service, learning and the medical student. *Education for Health*, 15(2), 222-227.
- Furco, A. (1996). Service learning: a balanced approach to experiential learning. In *Expanding boundaries: Service and learning*. Columbia, MD.: Cooperative Education Association.
- Hatcher, J. & R. G. Bringle (1997) Reflection: Bridging the gap between service and learning. *Journal of College Teaching*, 45(4), 153-158.
- Jacoby, B. (2001). *Service Learning in Today's Higher Education: Concepts and practice*. San Francisco: Jossey Bass.
- Latman, N. S. & R. Lanier (2001). Gross anatomy course content and teaching methodology in allied health: clinicians' experiences and recommendations. *Clinical Anatomy*, 14, 152-157.
- Little, C. D. (Winter, 2000). Service-learning: developing community-campus partnerships for physical therapy education. *Academic Exchange*, 80-88.
- Robinson, A. J., M. McCall, M. T. DePalma, D. Clayton-Krasinski, S. Tingley, S. Simoncelli, et al. (1994). Physical therapists' perceptions of the roles of the physical therapist assistant. *Physical Therapy*, 74(6), 571-582.
- Sedlak, C. A., M. O. Doheny, N. Panthofer, & E. Anaya (2003). Critical thinking in students' service-learning experiences. *College Teaching*, 51(3), 99-103.
- Siefer, S. D. (1998). Service-learning: community-campus partnerships for health professions education. *Academic Medicine*, 73(3), 273-277.
- Sigmon, R. L. (1979) Service-learning: Three principles. *Synergist*, 8, 9-11.
- Starr, K.A. (2000a, June) Physical therapy students use cadaver dissections to teach basic anatomy to students in a physical therapist assistant program. Poster session presented at 14 th Annual International Human Anatomy and Physiology Society Conference, Charlotte, North Carolina.
- Starr, K. A. (2000b) Students teaching students through service-learning. *HAPS Educator*, 5(1), 24-25.

Starr, K.A. (2003, June) *Making dissection a more positive experience: a student-centered approach*. Poster session presented at 17 th Annual International Human Anatomy and Physiology Society Conference, Philadelphia, Pennsylvania.



## **Using a Telehealth Program to Provide a Teaching learning Experience for College Students**

Janice Putnam  
Department of Nursing  
Central Missouri State University  
Warrensburg, Missouri, USA

Amy Kiger  
University Health Center  
Central Missouri State University

Allison Norwood  
Department of Nursing  
Central Missouri State University

Kim Steiglitz  
Department of Nursing Putnam  
University of Missouri, Saint Louis, Missouri

Peggy Ward-Smith  
Department of Nursing  
University of Missouri, Saint Louis, Missouri

### **Abstract**

This study explored the use of nursing students (N = 65) as tele-health counselors for smoking cessation. The nursing students were instructed to use therapeutic communication and behavior change theory to interact online with the subjects (N = 24). The course was monitored by the clinical instructor, and discussed in a clinical post-conference setting. Results: The nursing student evaluations were mixed. The students liked: "communicating therapeutically", learning about Blackboard, developing technology skills, the wellness setting, and "helping people stop smoking". Several students were uncomfortable talking to someone who they did not know. The students generally reported that the technology was effective for learning.

### **Introduction**

In response to differing accessibility needs for smoking cessation programs for college students (Central Missouri State University's State of Tobacco Usage Report, 2003), a peer delivered, telehealth smoking cessation program was implemented. Junior level baccalaureate nursing majors applied the principles of therapeutic communication and client education using telehealth in the educational delivery platform Blackboard™. These individuals fully developed and implemented this innovative smoking cessation course. The purpose of this project was to provide education directly to those unable to attend a face-to-face program. The results indicate that the telehealth intervention was as successful as face-to-face support for smoking cessation. The focus of this article is on the teaching and learning experiences of the nursing majors and clinical instructor participating in this project.

**Prevalence** The Centers for Disease Control (CDC) (2003) estimate a yearly loss of 5.6

million years of life, over 440,000 deaths each year, \$75 billion in direct medical costs, and 6.4 million children that will die prematurely because of tobacco use. The surveillance data specific to Missouri reveals an adult prevalence of smoking of 27%, the third highest in the nation (CDC, 1998). Of adults aged 18-24 years, 40.8% of males and 30.8% of females reported smoking. According to the Missouri Partnership on Smoking or Health, Missouri ranked last nationally for funding tobacco prevention programs, and the economic cost to Missouri residents is \$3.841 billion annually (CDC, 1997). Despite the high prevalence of tobacco abuse, there have been no formal smoking cessation programs available at this university prior to fall semester 2003.

**Smoking Cessation Programs** The American Lung Association (ALA) has developed a "gold standard" smoking cessation program titled the "Freedom from Smoking Program". This program is a multiple component intervention that adapts combinations of individual counseling, education, pharmacotherapy, and peer support. Program efficacy for the traditional "Freedom from Smoking Program" has been reported to be 27% sustained abstinence at 3 months, and 19% abstinence at 1 year (Lando, McGovern et al. 1990).

The "Freedom from Smoking Program" is delivered face-to-face by certified counselors. This program had two limitations restricting its implementation at the university. The classroom delivery format was not accessible to the rural population of smokers who reside off campus. The second limitation surrounded scheduling difficulties, which resulted in little flexibility in group meeting times.

**Technology and smoking cessation** There is an exponential increase in the use of and research documenting the implications of technology as an alternative delivery format in changing health behaviors. High-level technology delivery formats for health behavior change interventions include the use of interactive technology, CD-ROMs, and accessing the Internet or "Web".

These high-level technology delivery approaches were identified in health promotion literature. Studies include smoking cessation programs (ONeill, Gillispie et al. 2000), preventing alcohol and smoking use (Gerbert, Berg-Smith et al. 2003), smokeless tobacco cessation programs (Fisher, Severson et al. 2001), self-help programs for students with eating disorders (Parham 2001), and cancer education and prevention (Agre, Dougherty et al. 2002; Thomas, Stamler et al. 2002).

### **Teaching Learning for Nursing Students**

Nursing informatics has been defined as the integration of nursing and computer science to expand the knowledge of nursing and to provide support for nursing practices (Simpson, 1998). One aspect of nursing influenced by computer technology includes telenursing / telehealth as a method of patient education. The use of telehealth has been documented as an effective intervention for weight loss management (James, Folen et al. 2001). The need for computer skills in nursing is well documented (Elfrink, 2000, Hannah, 1988, Hovenga et al, 1996, Lowry & Johnson, 1999, McGonigle & Eggers, 1991, Travis & Brennan, 1998). McNeil and colleagues (2003) explored the skill preparation and computer technology of nursing students, faculty and clinicians. Telehealth was identified as one intervention available that may improve the quality and cost effectiveness of patient care.

The use of telehealth has been documented in fields of medicine, social work and school-based care (Young & Ireson, 2003; McCarty & Clancy, 2004). There is a paucity

of telehealth and computer technology education in the curricula of many nursing programs (Kenny, 2002). This documents the need for research related to optimal teaching and learning strategies using telehealth in nursing programs. Incorporating a telehealth intervention in nursing education encourages students to explore the benefits and risks of using computers in health care. The educational goal of this project was to allow the student to integrate knowledge of the adult teaching / learning process into clinical practice. The objectives were to discuss the benefits and purpose of client teaching, articulate factors that facilitate and factors that are barriers to learning, to discuss how principles of learning affect nursing care, to discuss learning in relation to age, environment, mental capability, education, readiness, timing, desire or interest, and previous knowledge, to include sociocultural diversity into the learning experience, and to apply the nursing process. Therefore, delivering the Freedom from Smoking program using the Blackboard format included telehealth support from nursing students in the form of small online group discussions in an instructor supervised environment. A review of the literature revealed no articles evaluating the use of the Blackboard format to deliver a smoking cessation program.

**Technology and the College Student** Many of today's college students are members of the newest generation, the Millennial Generation. This population is a group of individuals who insists upon the use of computer technology and who find computers a non-threatening source of information and entertainment (Howe & Strauss, 2003; Eng & Gustafson, 1999). Many colleges provide online education using the Blackboard format. This allows students to become accustomed to, as well as expect, online learning.

Blackboard Incorporated (Blackboard, 2003) has developed an extremely successful course management system designed to enhance teaching and learning. Over 2,000 higher educational institutions in the United States are currently using this system (Blackboard, 2003). The features of Blackboard include flexible content management, assessment management, an online grade book, communication tools (including a virtual classroom), chat rooms and discussion boards. The communication features provides synchronous or asynchronous communication. Small group discussions or private messaging is also available. The discussion boards and virtual classroom features encourage peer engagement. Blackboard provides a password secured course management system that integrates and protects the participant's identity.

Macromedia Breeze (Macromedia, 2005) is computer software that integrates Power Point with Macromedia Flash to provide more effective educational communication. By adding streaming audio to Power Point presentations, Breeze enhances distance teaching and learning. Requirements for Breeze include Windows, a web browser, Macromedia Flash Player, and Microsoft Power Point software. A microphone with noise suppression and speakers on the desktop are the hardware required. An advantage to this software system is the increased online download speed of files that are converted to Breeze. This is important for students using modem connections. The process to convert a Power Point presentation to a Breeze presentation involves recording the audio, uploading the presentation to Macromedia, and then publishing the presentation where it is converted into an online format including streaming audio.

**A Needs Assessment** In 2002, a needs assessment using the Core Alcohol and Drug Survey (n = 521) revealed the daily use of tobacco increased as students progressed towards graduation (Central Missouri State University's State of Tobacco Usage Report, 2003). Smoking prevalence was reported by 48% of the males, and by 26% of the

females. These data support the need to develop smoking cessation programs specifically for this population.

### **Specific Aim**

The aim of this project was to provide a teaching / learning opportunity for undergraduate nursing majors to use telehealth. Under the supervision of a clinical instructor, these students applied the principles of therapeutic communication and adult education to assist smokers in the quitting process.

Specifically, this feasibility study provided an opportunity to develop and implement an online smoking cessation intervention. The outcome of this project provided data on student perspectives of telehealth as a teaching learning tool.

### **Research Design and Methods**

**Setting** This smoking cessation program was implemented at a Midwest state university with 1,581 graduate and 8,340 undergraduate students. Nearly 7,000 students have used interactive television and online learning courses at this university since 1998.

**Sample** The traditional classroom format of the ALA intervention was converted and modified into the Blackboard format in three consecutive semesters. This was completed with the support of a junior-level baccalaureate nursing majors (N= 65). Enrollment in the course for the purpose of quitting smoking was available free of charge to any student currently enrolled at the university.

*Intervention* The ALA lecture materials were converted into seven weekly online modules during a full day computer workshop by nursing students who served as Teaching Assistants. These students, in groups of 3-4 individuals, developed content for each module. Homework, assigned the week before, provided each student with the course content. This content familiarized the student with the ALA program. These students were instructed to consider attraction, comprehension, acceptability, involvement and persuasion for each module developed (Rice, 1991). These modules were designed in a standardized template which included learning objectives, fact sheets, and Power Point files. Within each module a discussion board was developed that posted questions and scenarios to engage the smokers in peer support. The nursing majors designed these discussion boards to address the objectives for the module.

Consultants were available to assist with the development of the course. Assistance for technical issues was available from a representative from Information Services. These nursing majors had no previous experience creating a course, or using the teaching learning options available in Blackboard. The University's Health Promotion Coordinator reviewed all course material and recommended modifications, providing expert validity. The clinical instructor also reviewed these materials for clarity, spelling, and editing before enrolling smokers.

After piloting the program (n=4 smokers), recommendations were made. These recommendations included reformatting the Power Point presentations into Breeze presentation files. This added audio to the lecture material and condense the file size for improved transmission. Word processed files provided the viewer with options in accessing materials. The weekly discussion boards were condensed to encourage continuity of conversations. After incorporating these changes, the program was again

piloted (N=11 smokers). Recommendations from this group resulted in two additional modifications, which addressed smokers' attrition. First, the nursing majors reduced the number of weekly session to four by doubling the number of lectures available each week. Second, two chat sessions were added on the quit day and the following day to provide peer support. The program was piloted once more (N= 25 smokers), with daily monitoring of the discussion board assigned to individual nursing majors.

*Procedure* After completing the course construction, these nursing majors used the principles of therapeutic communication and knowledge of behavior change to interact online. Each group was responsible for the weekly module they developed. The assignment included introducing themselves using the discussion board, and responding to all entries within 24 - 48 hours. The course was monitored daily by the clinical instructor. The clinical instructor assigned clinical grades based on the course syllabi. Teaching opportunities for each nursing major resulted from interactions and included HIPPA confidentiality guidelines.

An evaluation was developed, to be completed by the nursing majors at the end of the semester. This evaluation consisted of an open ended questionnaire assessing the perspective of the nursing major's role in this project. These data were secured in a locked cabinet by the clinical instructor. There were no attempts to match the surveys with specific students.

## **Results**

This project outlines the steps for program development and evaluation. The results of this project identified feasibility indicators related to the description of program development and design (information material), participation rates as indicated by the number of "hits" (accessibility), and barriers and facilitators of the program implementation from the perspective of the nursing major.

**Description of the Program** Implementing the modifications described in the Intervention Section resulted in a smoking cessation telehealth program. This program consists of four weekly educational units and weekly telehealth interactions using the discussion board which provides therapeutic assistance for smoking cessation.

**Accessibility** The statistics from the first pilot revealed 1,310 program hits. The statistics generated by the second pilot were lost due to a technological problem. These statistics were irretrievable from back up files. This problem remained through the student teaching portion of the third pilot, but was resolved prior to smoker participation. The third program pilot resulted in 815 program hits.

The frequency of program hits was, in descending order, discussion boards, announcements, contents area and communication. The most popular time of the day for the students to access the course was at 10:00 - 12:00 pm. The most active days of the week were Monday and Tuesday. Interestingly, there were no hits on Sunday.

**Results of Nursing Majors Evaluations** Positive comments from nursing majors included: "creating the power points in class", "communicating therapeutically", "trying something new and mentoring someone", the "required time online" that they otherwise would not do, interacting, "being teachers", "the chance to help other", learning how to post on Blackboard, developing their technology skills, the wellness setting as a whole, and "helping people stop smoking". This was consistent with the second pilot, where

data identified that the new technology "...is up and coming with younger people and is vital to our learning", the availability to work from home, the week by week learning that built upon their experiences, and that so many people were giving their input into this program. A comment, from the third pilot, indicated that the fact that everyone on campus has internet access shows "no discrimination or bias".

Negative comments were not prevalent, but highlight the nursing majors being uncomfortable with therapeutic communication. "It was the most difficult task for me". Other comments were related to the perceived lack of knowledge about smoking. "I didn't know if I knew enough about smoking at first to mentor someone. I soon realized however that I was basically there for support". A few were uncomfortable "telling them what to do." i.e. advice, not support. Two suggested having more than one workshop day would have contributed to their knowledge base. Being a non smoker was reported to be a perceived disadvantage to the nursing student. Some worried that the technology would not function and that they "would miss vital client interaction." The attrition rates of smokers were also of concern.

The results of this project conclude that the telehealth intervention was effective. Although not in the scope of this article, the results of this telehealth intervention mirror the success of face to face programs as reported by Lando and colleagues (1990). There was concern for the client's ability to use the technology during the first pilot because of the long download time requirement. The audio component of the lectures added in the second pilot was well received. However, the attempt to communicate using the Blackboard software did not work well in the rural community where many use dial up modems. One student said "...different than anything I had ever dealt with before...I thought it was a great opportunity."

The nursing majors stated that they developed clinical expertise using telehealth skills. Positive comments included: "I'm learning everyday, and enjoy the convenience." "I really enjoy telehealth. I think it is a good way to reach a mass of people." "It is a learning tool." "I am learning so much more than I thought I would." "It is something to help the community in a convenient, confidential way". Grading, according to the evaluation criteria in the syllabi reflect satisfactory attainment of educational goals. Student grades correlated closely to grades obtained through traditional teaching / learning approaches.

**Recommendations** The Macromedia Breeze audio component provided a sense of diversity to the lectures by multiple students recorded the material. Further program development is needed to address the inability of nursing majors and smokers to access Blackboard's lightweight chat with a dial up modem. Macromedia Breeze Live has been suggested by the instructional technology consultant to enhance the speed of interaction during live chats.

**Discussion** Smoking cessation will continue to be an area requiring nursing attention. There are no superlative interventions. As long as the tobacco industry is allowed to market to new smokers, and new waves of social smokers transcend into addicted smokers, there will be a need for research on how to teach evidence based interventions, such as telehealth.

The nursing majors were successful in the development and implementation of this innovative smoking cessation course. As a novice nurse, it is a challenge to use therapeutic communication. The access to a greater number of smokers would give

nursing majors more interaction time to promote teaching and learning. Additional recruitment and retention of smokers is one way to make this happen.

These data revealed challenges with technology and access specific to rural populations. The increased availability of online college programs that emphasize flexibility and ease of access may increase the response or decrease barriers associated with traditional smoking cessation programs. An online smoking cessation program might provide a forum for remote healthcare providers to reach their clients.

Limitations to this project include the small sample size of the pilot program, the lack of diversity among nursing majors, the smoking cessation program only being available at the university. The possibility that the nursing majors would know the smokers may have altered the intervention. Reporting bias and decreased generalizability may be present due to the self-report format of data collection, however self-report is a feasible approach in this type of study (Polit & Beck, 2004).

Future studies should include measures of effectiveness of telehealth in smoking cessation. A review of studies in the adolescent population demonstrates that peers are at least equally effective as their adult counterparts (Mellanby, Rees et al. 2000). Peer influence has been difficult to utilize because of geographical separation or lack of access to transportation (Hunt, Fagan et al. 2003). Studies on the influence of peers and the impact that increased accessibility using telehealth provides are indicated.

One should also consider other populations for telehealth smoking cessation interventions. School aged children and adolescents were targeted in the past by the tobacco industry in the psychologically based marketing and advertising campaigns featuring Joe Camel and other promotional campaigns. Age appropriate teaching learning materials and interactions should be applied to primary as well as secondary and tertiary health promotion and disease prevention activities.

As the prevalence of smoking among college students remains high, the need for educational programs and the delivery of these programs, specifically developed for this population, is a healthcare challenge. These individuals prefer to use a computer-based internet format to obtain healthcare education. Allowing nursing majors to develop these programs provides peer-based interventions. The purpose of this project was to allow junior nursing majors with the opportunity to apply theoretical knowledge in the development of a healthcare intervention. Thus, this teaching / learning project concluded with a healthcare educational program, aimed at smoking cessation, which was appropriate for the young adult college student. In addition, these nursing majors were provided with the knowledge necessary to provide telehealth. This skill will impact future patients receiving their care.

## References

Agre, P., Dougherty J., et al. (2002). "Creating a CD-ROM program for cancer-related patient education." *MEDSURG Nursing* 8(6),330-332. Blackboard Incorporated. (2003). Retrieved March 2, 2005 from <http://www.blackboard.com>. CDC (1997). Youth risk behavior surveillance: National college health risk behavior survey of the United States, 1995. *MMWR*, Centers for Disease Control,1-54.

Elfrink, V., Davis, L., Fitzwater, E., Castleman, J., Burley, J., Gorney-Moreno, M., Sullivan, J., Nichols, B., Hall, D., Queen, K., Johnson, S., Martin, A. (2000). "A

comparison of teaching strategies for integrating information technology into clinical nursing education." *Nurse Educator* 25, 136-144. Eng, T. & Gustafson D. (1999). *Wired for Health and Well-being: The Emergence of Interactive Health Communications*. Washington, DC, USDHHS. Fisher, K. J., Severson H. H., et al. (2001). "Using interactive technology to aid smokeless tobacco cessation: a pilot study." *Journal of American Health Education* 32(6), 332-342. Gerbert, B., Berg-Smith S., et al. (2003). "Using innovative video doctor technology in primary care to deliver brief smoking and alcohol intervention." *Health Promotion Practice* 4(3), 249-262. Hannah, K. (1988) "Using computers to educate nurses." In *Nursing Informatics: Where Caring and Technology Meet* (Ball, M., Hannah, K., Jegler, U. & Peterson, H., Eds), Springer-Verlag, New York, 289-300.

Hovenga, E., Kidd, M. & Cesnik, B. (1996). *Health Informatics: An Overview*. Churchill Livingstone, Melbourne. Howe, N. & Strauss, W. (2003). *Millenials Go To College*, Lifecourse Associates. Hunt, M. K., Fagan, P.H., et al. (2003). "Feasibility of implementing intervention methods in an adolescent worksite tobacco control study." *Tobacco Control* 12, 40-45. James, L. C., Folen R.A., et al. (2001). "Behavioral telehealth applications in the treatment of obese soldiers: a feasibility project and report on preliminary findings." *Military Psychology* 13,(3): 177-187.

Kenney, A. (2002). "Online learning: Enhancing nurse education?" *Journal of Advanced Nursing* 38(2), 127-136. Lando, H., McGovern, P. et al. (1990). "Comparative evaluation of American Cancer Society and American Lung Association smoking cessation clinics." *American Journal of Public Health* 80(5), 554-559.

Lowry, D.L. & Fishel, A.H. (1991). "Computer assisted learning: The potential for teaching and assessing in nursing." *Nurse Education Today* 19, 521-526.

Macromedia Incorporated. (2005). Retrieved May 20, 2005 from <http://www.macromedia.com>. McCarty, D. & Clancy, C. (2004). "Telehealth: Implications for social work practice." *Social Work* 47(2), 153-162.

McGonigle, D & Eggers, R. ( 1991). "Establishing a nursing informatics program". *Computers in Nursing* 9, 184-189. McNeil, B. J., Elfrink, V.L. et al. (2003). "Nursing Information technology knowledge, skills, and preparation of student nurses, nursing faculty, and clinicians: A U.S. Survey." *Journal of Nursing Education* 42(8), 341-349. Mellanby, A. R., Rees, J.B. et al. (2000). "Peer-led and adult-led school health education: a critical review of available comparative research." *Health Education Research* 15, 533-545. Niaura, R. & Abrams, D.B. (2002). "Smoking cessation: Progress, priorities, and prospectus." *Journal of Consulting and Clinical Psychology* 70(3), 494-509. O'Neill, H. K., Gillispie, M.A. et al. (2000). "Stages of change and smoking cessation: A computer administered intervention program for young adults." *American Journal of Health Promotion* 15(2), 93-96. Parham, E. (2001). "Eating disorder prevention on college campuses." *Healthy Weight Journal* 15(3), 42-45.

Polit, D.F., & Beck, B. (2004). *Nursing Research Principles and Methods*. Philadelphia: Lippincott Publishers. Pressley, C. A., Harrold R., et al. (1994). *Core Alcohol and Drug Survey: User's Manual*. Carbondale, IL, Core Institute. Rice, M. (1991). "A simple guide for design, use and evaluation of educational materials." *Health Education Quarterly* 18, 79-85.

Simpson, R. L. (1998). *The technologic imperative: A new agenda for nursing education*



and practice, part 2. *Nursing Management* 22, 24-25. Thomas, B., Stamler, L. et al. (2002). "Using the internet to identify women's sources of breast health education and screening." *Women & Health* 36(1), 33-49. Travis L.. & Brennan, P. (1998). "Information science for the future: an innovative nursing informatics curriculum." *Journal of Nursing Education* 37, 162-168.

Young, T. L. & Ireson, C. (2003). "Effectiveness of school-based telehealth care in urban and rural elementary schools." *Pediatrics* (5), 1088-1094.

# Recognizing Student Misconceptions about Science and Evolution

Daniel J. Wescott  
Department of Anthropology  
University of Missouri-Columbia  
Columbia, Missouri, USA

Deborah L. Cunningham  
Department of Anthropology  
University of Missouri-Columbia  
Columbia, Missouri, USA

## Abstract

It is well documented that student misconceptions can create barriers to learning, especially in introductory biological science courses. In this paper, we examine some of the misconceptions that students enrolled in *Introduction to Biological Anthropology* at the University of Missouri-Columbia have about the nature of science and evolutionary processes, and compare them to published data. We then combine these results with a review of the educational literature to illustrate why it is important that instructors identify and fully comprehend the misconceptions of their own students as a first step in assisting their students achieve conceptual change.

## Introduction

Most students enter introductory biological science courses with misconceptions about the nature of science and evolutionary theory that can impede their ability to understand the scientific explanations presented in class (Bishop & Anderson, 1990; Brumby, 1984; Posner, Strike, Hewson, & Gertzog, 1982; Vosniadou & Brewer, 1992; Wandersee, Mintzes, & Novak, 1994; Wilson, 2001). Although the students' misconceptions are often naïve, they frequently have strong explanatory power to the student (Bahar, 2003; Fisher & Lipson, 1986; Greene, 1990). Furthermore, these misconceptions are often deeply rooted, extremely complex, and reinforced by the popular media, instructors and textbooks attempting to simplify concepts, and other sources (Bishop & Anderson, 1990; Losh, Tavani, Njorge, Wilke & McAuley, 2003; Modell, Michael, & Wenderoth, 2005; Wandersee, Mintzes, & Novak, 1994). As a result, it is often difficult or impossible for students to recognize and prevail over these misconceptions in biological science courses. But, if the students fail to recognize and reject their misconceptions and fully comprehend the scientifically accurate explanation offered in class, they will commonly fall back on their former conceptions (Greene, 1990; Hellden & Solomon, 2004; Mintzes, Wandersee, & Novak, 2000; Wandersee, Mintzes & Arnaudin, 1989). Research suggests that even science graduate students continue to cling to misconceptions about evolution (Brumby, 1984; Mintzes, Wandersee & Novak, 2001).

Student misconceptions in science courses have been addressed by numerous authors (e.g., Bishop & Anderson, 1990; Greene, 1990; Wandersee, Mintzes, & Novak, 1994; Wilson, 2001), but we contend that it is vital for instructors to investigate the misconceptions of *their own* students as a first step in helping students recognize conceptual difficulties and undergo conceptual change. While students across the country have many similar misconceptions about science and evolution, these

misconceptions can vary by sex, age, geographical location, and student motivation or interest, between urban and rural areas, and can change over time (Almquist & Cronin, 1988; Losh, Tavani, Njoroge, Wilke & McAuley, 2003; Morrison & Lederman, 2003; Palmer, 2003). In this paper, we discuss questionnaire results of students entering *Introduction to Biological Anthropology* (IBA) at the University of Missouri-Columbia (UMC) and compare them to published results in order to identify common themes or discrepancies between the misconceptions of UMC students and those of college students in other parts of the country. We developed the questionnaire in order to reveal student misconceptions about the nature of science and evolutionary processes. We then intertwine these results with a review of the educational literature to illustrate why it is important for instructors to identify and fully comprehend their own students' misconceptions as a first step in helping their students achieve successful conceptual change.

## **Project Methodology**

### **Participants and Course**

Participants included 547 undergraduate students (243 males and 304 females) enrolled in IBA at UMC during the Fall 2002, Fall 2003, and Winter 2003 semesters. The majority (92%) of the students were under 22 years of age. *Introduction to Biological Anthropology* is a sophomore level course that fulfills the university's general education requirement for Biological Sciences. Normal enrollment for this course is 150 to 200 students per semester. The course is required for all anthropology majors, but the majority of students enrolled in the course are non-science majors who have limited educational background in science. During the course, students learn about a broad range of topics related to human evolution, variation, and adaptation. As a result, it is crucial that students gain a solid understanding of evolutionary principles early in the semester.

### **Questionnaire**

An anonymous questionnaire was developed to help discover student misconceptions about the nature of science and evolutionary theory in the IBA class. The questionnaire was administered on the first day of class to reduce any possible instructor influence. The students were told that there were no correct answers and that their answers would not influence their final grade.

The questionnaire was divided into two sections. The first section requested demographic data (age, sex, academic standing, and major) and asked the students to indicate if they were taught about evolution in high school (public or private) and if they have taken a college-level biology, chemistry, or physics course (Table 1). In the second section, students were asked to respond as to whether they strongly agree, agree, disagree, strongly disagree, or have no opinion on 25 statements (Table 2). The reasons for using this type of instrument are discussed in the Results and Discussion section below.

The statements on the survey were chosen to help reveal the students' conceptions regarding 1) the nature of science, 2) the survival of new traits in a population, 3) support of Lamarckian inheritance, 4) appreciation of the importance of variation within a population, 5) the process of natural selection, 6) terminology that has different meanings in the vernacular and in science, and 7) the idea of teleological evolution (evolution directed by an outside agent). These are major areas of misconceptions that have been pointed out by Bishop and Anderson (1990), Greene, 1990; Wandersee,

Mintzes, and Novak (1994), Wilson (2001) and others. We adopted many of the questions from Bishop and Anderson (1985, 1990) and Wilson (2001) so that we could compare our results with theirs.

| <b>Demographic Variable</b>      | <b>Variables</b>     | <b>%</b>     |
|----------------------------------|----------------------|--------------|
| Age                              | ≤ 22                 | 92           |
|                                  | 23-29                | 6            |
|                                  | 30-39                | 1            |
|                                  | ≥ 40                 | 0.5          |
|                                  | Not available        | 0.5          |
| Sex                              | Female               | 56           |
|                                  | Male                 | 44           |
| Class                            | Freshman             | 23           |
|                                  | Sophomore            | 37           |
|                                  | Junior               | 23           |
|                                  | Senior               | 15           |
|                                  | Graduate/Other       | 2            |
|                                  | Academic Major Area  | Anthropology |
|                                  | Other Social Science | 13           |
|                                  | Humanities           | 26           |
|                                  | Science              | 21           |
|                                  | Other/Undecided      | 32           |
| Taught evolution in high school? | No                   | 26           |
|                                  | Yes with creation    | 23           |
|                                  | Yes without creation | 51           |

*Table 1*  
*Student Profile.*

| #  | Statement  | % Response 1 |    |    |    |    |   |
|----|--|--------------|----|----|----|----|---|
|    |  | 1            | 2  | 3  | 4  | 5  | 6 |
| 1  | There is lots of evidence against evolution.   | 8            | 14 | 26 | 42 | 10 | 0 |
| 2  | Dinosaurs and humans lived at the same time in the past.   | 3            | 9  | 16 | 60 | 12 | 0 |
| 3  | Humans and chimpanzees evolved separately from an ape-like ancestor.   | 22           | 38 | 11 | 12 | 17 | 0 |
| 4  | I have a clear understanding of the meaning of scientific study.   | 29           | 49 | 11 | 4  | 7  | 0 |
| 5  | The theory of evolution correctly explains the development of life.  | 17           | 38 | 16 | 12 | 17 | 0 |
| 6  | Humans evolved from monkeys/apes.  | 15           | 32 | 16 | 21 | 16 | 0 |
| 7  | A scientific theory that explains a natural phenomenon can be defined as a "best guess."   | 12           | 28 | 22 | 23 | 15 | 0 |
| 8  | Small population size has little or no effect on the evolution of a species.   | 2            | 6  | 30 | 47 | 15 | 0 |
| 9  | If two light-skinned people moved to Hawaii and got very tan their children would be more tan than they (the parents) were originally. | 5            | 11 | 19 | 54 | 11 | 0 |
| 10 | Variation among individuals within a species is important for evolution.   | 53           | 32 | 3  | 3  | 9  | 0 |
| 11 | A species evolves because individuals want to.   | 2            | 6  | 27 | 52 | 13 | 0 |
| 12 | Humanity came to be through evolution, which was controlled by God.  | 16           | 21 | 11 | 25 | 26 | 0 |
| 13 | A species evolves because individuals need to.   | 31           | 35 | 12 | 10 | 12 | 0 |
| 14 | I have a clear understanding of the term "fitness" when it is used in a biological sense.  | 20           | 33 | 17 | 10 | 20 | 0 |
| 15 | Two of the most important factors that determine the direction of evolution are survival and reproduction.                             | 53           | 36 | 3  | 2  | 6  | 0 |
| 16 | New traits within a population appear at random.   | 10           | 30 | 33 | 12 | 15 | 0 |
| 17 | The environment determines which new traits will appear in a population.   | 19           | 59 | 8  | 5  | 8  | 1 |

|    |   |    |    |    |    |    |   |
|----|---|----|----|----|----|----|---|
| 18 | If two distinct populations within the same species begin to breed together this will influence the evolution of that species.  | 39 | 45 | 7  | 3  | 6  | 0 |
| 19 | All individuals in a population of ducks living on a pond have webbed feet. The pond completely dries up. Over time, the descendants of the ducks will evolve so that they do not have webbed feet. | 21 | 40 | 17 | 8  | 14 | 0 |
| 20 | “Survival of the fittest” means basically that “only the strong survive.”   | 33 | 31 | 19 | 14 | 3  | 0 |
| 21 | You cannot prove evolution happened.  | 11 | 16 | 29 | 28 | 16 | 0 |
| 22 | Evolution cannot work because one mutation cannot cause a complex structure (e.g., the eye).  | 4  | 9  | 27 | 27 | 33 | 0 |
| 23 | Evolution is always an improvement.   | 6  | 20 | 34 | 25 | 15 | 0 |
| 24 | A scientific theory is a set of hypotheses that have been tested repeatedly and have not been rejected.   | 39 | 39 | 8  | 6  | 8  | 0 |
| 25 | If webbed feet are being selected for, all individuals in the next generation will have more webbing on their feet than individuals in their parents' generation.                                   | 17 | 33 | 18 | 10 | 22 | 0 |

*Table 2*

*Percent response to each statement.*

1 Response:

1 = strongly agree

2 = somewhat agree

3 = somewhat disagree

4 = strongly disagree

5 = undecided/never heard of it

6 = no response

## **Results and Discussion**

### **Study Results and Comparison**

The participant profile is presented in Table 1. The majority of the students were freshmen or sophomores (60%) under 23 years of age (92%). Fifty-six percent were females and 44% were male. Only 21% of the students reported being science majors, with the rest distributed fairly equally as social science majors (anthropology, political science, sociology, social work, or psychology), humanities majors (English, foreign language, philosophy, history, music, or journalism) and other/undecided. Just over a quarter of participants reported not being taught evolution in high school, and 23% were exposed to both evolution and creationism in high school (Table 1). Only 51% of the UMC students in IBA had been taught evolutionary principles without creationism in high school science. Wilson (2001) found similar results among California college students. In his study, 46% of the students were taught evolution but not creationism in high school, 30% had been exposed to both evolution and creationism, and 24% were not taught either.

The UMC student responses to each of the 25 questions are presented as percentages in Table 2. The UMC students have many of the misconceptions found by other researchers, but they differ in the pattern of misconceptions. Like the non-science majors studied by Bishop & Anderson (1990), UMC students fail to recognize that the origin and survival of traits in a population involves two distinct processes. Instead they conflate these two processes into a single process in which species gradually change over time due to environmental causes (Bishop & Anderson, 1990). Bishop and Anderson (1990) argue that students often find that the function of a trait is sufficient to explain how the trait evolved, and we found similar results among UMC students. For example, students were asked if they would agree or disagree with the following statement (Table 2: #19) about ducks in a pond: "All individuals in a population of ducks living on a pond have webbed feet. The pond completely dries up. Over time, the descendants of the ducks will evolve so that they do not have webbed feet" (Bishop & Anderson, 1990). Sixty-one percent agreed with this statement, reflecting their belief in the use/disuse idea. However, most of the UMC students do not have the alternative conception that species evolve because individuals want to (Table 2: #11) or that acquired traits are inherited (Table 2: #9).

Variation within populations is an essential precursor for evolutionary change via natural selection. The survey of Michigan college students conducted by Bishop and Anderson (1990) found that students did not view variation as important in evolution. Our results, however, differ. We discovered that 83% UMC students tend to agree that variation matters (Table 2: #10). Only 6% of the respondents think that variation is not important. Even so, many UMC students do not fully understand the role of variation (Table 2: #25).

According to Darwin's theory of evolution via natural selection, new traits that improve an individual's fitness increase in frequency within populations as the proportion of individuals in the population with these traits proliferates with each succeeding generation. Bishop and Anderson (1990, p. 423) found that students, on the other hand, view evolutionary change as depending on "gradual changes in the traits themselves" over generations. Only half of the UMC students had this misconception (Table 2: #25). Twenty-eight percent of the UMC students did not have this conception and 22% were uncertain.

Bishop and Anderson (1990) argued that many of the students' misconceptions are reinforced by terms that have different meanings in the vernacular and in science. Our results generally support this finding. Like Bishop and Anderson (1990), we found that despite the fact that 53% of the students thought they had a clear understanding of the term "fitness" as used in biology (Table 2: #14), 64% agreed with the statement that survival of the fittest means that only the strong survive (Table 2: #20). This implies that students view fitness as health, strength, and intelligence instead of the capability of individuals to differentially survive long enough to produce surviving offspring or to produce a greater number of offspring. Likewise, biologists use the term "theory" to mean a set of hypotheses that have been tested repeatedly, have not been rejected, and explain current data and predict future observations. Students, on the other hand, often use the term to mean a "best guess," which perpetuates that idea that evolutionary theory is a best guess at explaining the development of life. Our survey indicates that 40% of UMC students in IBA do not differentiate between the vernacular and scientific use of the term (Table 2: #7). Interestingly though, when the statement was phrased differently, 78% of students correctly identified the meaning of a scientific theory (Table 2: #24).

Surveys indicate that “belief” in evolution has changed little in the United States over the past century (Bishop, 1999). However, Bishop and Anderson (1990) discovered that 49% to 55% of Michigan students accepted evolution as a theory that correctly explains the patterns of life on earth, but Wilson (2001) found that only 39% of California students “believed” in evolution. Of the UMC participants, 55% agreed that evolution correctly explains the development of life (Table 2: #5), only 22% thought there was lots of evidence against evolution (Table 2: #1), and only 27% agreed that evolution cannot be demonstrated scientifically (Table 2: #21). Similarly, Wilson (2001) found that 27% of California students thought humans and dinosaurs lived at the same time, but only 11% of UMC students had this misconception, and 12% were undecided (Table 2: #2). However, we did discover that 37% of UMC students believe in teleological evolution or that change is goal-directed by an outside agent (Table 2: #12). Students who operate under this perspective see an outside agent selecting individuals who are in need of helpful changes (Greene, 1990), which may explain why UMC students see evolution as a need driven process (Table 2: #13).

The results of this study suggest that UMC students in IBA do not follow the same patterns in their misconceptions as found by other researchers in the United States (e.g., Bishop & Anderson, 1990; Wilson, 2001). While many of the misconceptions held by UMC IBA students are the same as students in other regions, the UMC students seem to be better scientifically informed about some concepts. This was a surprising result since most of the students in IBA have taken few science courses, which suggests minimal interest in science and evolution, and had no more prior exposure to evolutionary principles than students in other studies. Palmer (2003) found a strong relationship between students’ conceptual change and interest in and motivation to learn the subject being presented, but the UMC IBA students are not likely to have a greater interest in science or evolution than students in other introductory biological science courses. Unfortunately, the reasons why UMC students differ from students in other regions cannot be clearly uncovered in this study, but probably reflect educational, religious, generational and possibly motivational differences between UMC students and those surveyed by Bishop & Anderson (1990) and Wilson (2001).

### **Why Investigate Student Misconceptions?**

A review of the literature identifies two barriers to student learning: the worldview of the student and the student’s own misconceptions (Wandersee, Mintzes, & Novak, 1994). Assuming that simply exposing students to the overwhelming evidence for evolution will “convince” them of its accuracy assumes that they have a scientifically compatible worldview, which many do not. For these students, an evolutionary explanation is not acceptable, and presenting overwhelming evidence for evolution will not make a difference. In fact, Bishop and Anderson (1990) and Sinatra, Southerland, McConaughy, and Demastes (2003) found that a stated “belief” in evolution did not affect the students’ understanding of evolutionary processes. While we, as educators, cannot change the students’ worldviews, we can address the second barrier to student learning: scientific misconceptions. Because most students come to class with a preconceived explanation of how something (e.g., evolution) works, if they do not comprehend the scientifically accurate explanation that they are offered in class, they simply fallback on the process that has explanatory power to them.



Student misconceptions are deeply rooted, extremely complex, and frequently reinforced by a number of sources. Likewise, the misconceptions students have often vary by geographical region, religious background, sex, age, and generation (Almquist & Cronin, 1988; Losh, Travani, Njoroge, Wilke, & McAuley, 2003; Morrison & Lederman, 2003; Palmer, 1999). For example, Almquist and Cronin (1999) found that males tend to have a greater scientific bias in their responses than females. Similarly, Losh et al. (2003) showed that the effect of generational experience can be easily seen by looking at changes in the pseudoscientific belief in astrology in the 1980s. Research shows that belief in astrology dropped from over 40% to 15% in 1989 because of media coverage of Nancy Reagan's consultation with an astrologer (Losh et al., 2003). Additionally, the misconceptions employed by students may be context specific (Palmer, 1999). That is, they may apply one conception to mammals and another to plants. This suggests that it is vital for educators to discover the misconceptions relevant to the context of the class. Furthermore, instructors must take into consideration the worldview and demographic makeup of students at their university or college.

While it is well documented that students have misconceptions about science and evolution, they also often have many scientifically acceptable conceptions that may be used by instructors to provide a solid learning base that links the students' existing knowledge with the class content and assists them in conceptual change (Morrison & Lederman, 2003; Palmer, 1999). Therefore, it is important for instructors of introductory biology and biological anthropology courses to not only understand the *scientific misconceptions* their students have, but to also understand the students' *scientifically acceptable conceptions*. For example, many UMC students appear to understand that new traits appear in populations at random (Table 2: #16), that humans and chimpanzees are separate evolutionary lineages (Table 2: #3), and that genetic drift (Table 2: #8) and gene flow (Table 2: #18) are important processes in evolution.

The instructor's role in the students' education is to use instructional and motivational methods that gives each student an opportunity to become dissatisfied with their existing conception, achieve some understanding of the scientific conception, and recognize the utility of the scientific conception to explain a variety of situations (Jensen & Finley, 1996; Palmer, 2003). The first step in conceptual change instruction is to understand the students' naïve scientific conceptions so that they recognize and change them (Morrison & Lederman, 2003). We contend that developing and administering a questionnaire, conducting interviews, initiating discussion, or using some other technique that elicits students conceptions at the beginning of each semester (preferably even before the syllabus is handed out) is the only way instructors will have the knowledge necessary to help their students undergo conceptual change.

### **Developing an Instrument**

We suggest that instructors develop an instrument that enables them to closely examine the misconceptions of their students that are relevant to the course. The type of instrument used will depend on class size, instructor's teaching and other workload responsibilities, and the number of areas that the instructor wishes to explore. Concept maps, individual interviews, small group discussions, journal writing, multiple choice quizzes, and questionnaires have all been suggested as techniques to help instructors reveal student misconceptions about evolution (Anderson, Fisher, & Norman, 2002; Bishop & Anderson, 1985, 1990; Morrison & Lederman, 2003; Wilson, 2001). Each instructor must decide which instrument is most effective and appropriate for his or her science course.

Several excellent and well-established diagnostic instruments have been developed to tease out student misconceptions about evolution, but these may not be appropriate for every biological science course. Anderson, Fisher and Norman (2002) developed a 20-question multiple choice instrument ("Conceptual Inventory for Natural Selection" or CINS) focusing on misconceptions regarding natural selection. Each question has four options to choose from with a scientifically correct answer and at least one common misconception used as a distraction. The advantage of their instrument is that it uses questions based on scientific studies and has been tested for validity, reliability, and readability. The disadvantage is that the CINS focuses only on natural selection and uses multiple choice questions. Almquist and Cronin (1988) found that when students were asked multiple choice questions that contained answers ranging from scientifically acceptable to theological, respondents generally chose the more scientifically acceptable answer. However, on the same survey, when participants were asked to answer how much they agreed or disagreed with statements involving misconceptions, the respondents frequently answered in strong agreement with the misconception. Bishop and Anderson (1985, 1990) developed an instrument with both open-response and multiple-choice questions that also reveals misconceptions about natural selection.

There are definite advantages to open-response questionnaire, but in a large class like IBA this type of question requires too large of a time commitment from the instructor to be practical. Open-response questions require the instructor to read all of the responses and develop a coding procedure to evaluate the answers. In addition, open-response questions can often be ambiguous because it may be unclear if students are using scientific or vernacular terminology (e.g., "theory"). Wilson (2001) developed a questionnaire with 33 statements that participants respond to in agreement or disagreement. However, his questionnaire was designed to evaluate students' beliefs about pseudoscience and therefore includes statements about conceptions regarding unidentified flying objects, Bigfoot, psychics, and the curse of the mummies.

We contend that educators will gain more insight into their students' misconceptions by developing their own instrument that address problems specific to their course, and should consult Lederman, Abd-El-Khalick, Bell, and Schwartz (1992), Mintzes, Wandersee, and Novak (2001), Morrison and Lederman (2003), the Field-Tested Learning Assessment Guide website ([www.wcer.wisc.edu/nise/cl1/flag](http://www.wcer.wisc.edu/nise/cl1/flag)) and other sources for recommendations and guidelines.

Our questionnaire adopted many of the multiple-choice questions used by Bishop and Anderson (1985, 1990) but modified them to agree/disagree statements. We found that the use of agree/disagree type questionnaires has several advantages, especially when used in large classes. First, the questionnaire can be completed by the students with relative ease and results can be quickly obtained. We had the students answer the questions on scantron forms and had them read electronically at the campus testing center. The questionnaire results were available to us before the next class period. However, we have not conducted a study to determine if agree/disagree statements provide a better understanding of the respondents' conceptions than multiple-choice questions, and suggest that, if possible, this type of instrument should be combined with interviews, concept maps, two-tiered questions or other instruments to gain a full insight into student misconceptions (Morrison & Lederman, 2003). We have recently begun incorporating free response follow-up questions and questions regarding epistemological beliefs to help gain further insight into student misconceptions. We are also

administering posttests to measure student conceptual change following instruction, which will be used to evaluate teaching strategies.

### Conclusions

Learning is a process of conceptual change where the learner proactively revises and reorganizes his or her preexisting knowledge (Bahar, 2003; Liu, 2004; Mintzes, Wandersee, & Novak, 2000; Posner, Strike, Hewson, & Gertzog, 1982). Only the learner has the ability to recognize and modify his or her misconceptions (Modell, Michael, & Wenderoth, 2005), but, as teachers, we are responsible for helping our students recognize that their misconceptions lead to erroneous conclusions and offer the students an opportunity and the motivation to reject or modify them. For many subjects, the learner's preexisting knowledge is helpful to promote conceptual change, but in science courses, the students' misconceptions often slow down or even prohibit conceptual change (Jensen & Finley, 1996). As a result, the understanding of student-held concepts regarding science and evolution is vital to effective teaching. In order for the instructor to assist students in undergoing permanent conceptual change, the instructor must first understand the misconceptions with which the student enters the classroom, make them explicit, and offer the student an opportunity to reject them in favor of scientifically accurate information (Modell et al., 2005; Morrison & Lederman, 2003).

### References

- Almquist, A.J. & Cronin, J.E. (1988). Fact, fancy, and myth of human evolution. *Current Anthropology* 29, 520-522.
- Anderson, D.L., Fisher, K.M., & Norman, G.J. (2002). Development and evaluation of the conceptual inventory of natural science. *Journal of Research in Science Teaching* 39, 952-978.
- Bahar, M. (2003). Misconceptions in biology education and conceptual change strategies. *Educational Science* 3, 55-64.
- Bishop, B.A. & Anderson, C.W. (1985). *Evolution by natural selection: a teaching module* (Occasional Paper No. 91). East Lansing, MI: Institute for Research on Teaching, Michigan State University.
- Bishop, B.A. & Anderson, C.W. (1990). Student conceptions of natural selection and its role in evolution. *Journal of Research Science Teaching* 27, 415-427.
- Bishop, G. (1999). What Americans really believe and why faith isn't as universal as they think. *Free Inquiry* 19, 1-8.
- Brumby, M.N. (1984). Misconceptions about the concept of natural selection by medical biology students. *Science Education* 68, 493-503.
- Fisher, K.M. & Lipson, I.J. (1986). Twenty questions about student errors. *Journal of Research in Science Teaching* 23, 783-803.
- Greene, E.D. Jr. (1990). The logic of university students' misunderstanding of natural selection. *Journal of Research in Science Teaching* 27, 875-885.

Hellden, G.F. & Solomon J. (2004). The persistence of personal and social themes in context: long- and short-term studies of students' scientific ideas. *Science Education* 88, 885-900.

Jensen, M.S. & Finley, F.N. (1996). Changes in students' understanding of evolution resulting from different curricular and instructional strategies. *Journal of Research in Science Teaching* 33, 879-900.

Lederman, N.G., Abd-El-Khalick, F., Bell, R.L., & Schwartz, R.S. (2002). Views of nature of science questionnaire: toward valid and meaningful assessment of learners' conceptions of nature of science. *Journal of Research in Science Teaching* 39, 497-521.

Liu, X. (2004). Using concept mapping for assessing and promoting relational conceptual change in science. *Science Education* 88, 373-396.

Losh, S.C., Travani, C.M., Njoroge, R., Wilke, R., & McAuley, M. (2003). What does education really do? educational dimensions and pseudoscience support in American general public, 1979-2001. *Skeptic Inquirer* 27, 30-36.

Mintzes, J.J., Wandersee, J.H., & Novak, J.D. (2000). *Assessing science understanding: a human constructivist view*. San Diego, CA: Academic Press.

Mintzes, J.J., Wandersee, J.H., & Novak, J.D. (2001). Assessing understanding in biology. *Journal of Biological Education* 35, 118-124.

Modell, H., Michael J., & Wenderoth, M.P. (2005). Helping the learner to learn: the role of uncovering misconceptions. *The American Biology Teacher* 67, 20-26.

Morrison, J.A. & Lederman, N.G. (2003). Science teachers' diagnosis and understanding of students' preconceptions. *Science Education* 87, 849-867.

Palmer, D.H. (1999). Exploring the link between students' scientific and nonscientific conceptions. *Science Education* 83, 639-653.

Palmer, D.H. (2003). Investigating the relationship between refutational text and conceptual change. *Science Education* 87, 663-684.

Posner, G., Strike, K., Hewson, P. & Gertzog, W. (1982). Accommodation of a scientific conception: toward a theory of conceptual change. *Science Education* 66, 211-227.

Sinatra, G.M., Southerland, S.A., McConaughy, F. & Demastes, J.W. (2003). Intentions and beliefs in students' understanding and acceptance of biological evolution. *Journal of Research in Science Teaching* 40, 510-528.

Vosniadou, S. & Brewer, W. (1992). Mental models of the earth: a study of conceptual change in childhood. *Cognitive Psychology* 24, 535-585.

Wandersee, J.H., Mintzes, J.J. & Arnaudin, M.W. (1989). Biology from the learner's viewpoint: a content analysis of the research literature. *School Science and Mathematics* 89, 654-668.

Wandersee, J.H., Mintzes, J.J., & Novak, J.D. (1994). Research on alternative conceptions in science. In D.L. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 177-210). New York: MacMillan.

Wilson, J.A. (2001). Pseudoscientific beliefs among college students. *Reports of the National Center for Science Education* 21, 9-13.

## Reflection

### **The Student / Teacher Partnership**

**Geoff Currie**

School of Clinical Sciences

Charles Sturt University

Wagga Wagga , New South Wales, Australia

For those of you who have seen the movie 'Jerry Macquire' you'll know that Tom Cruises' character had a flood of reflective thoughts about his profession and career that he felt compelled to put in writing. Obviously Jerry's thoughts were discordant with those of his employers and he found himself unemployed and our story developed from there. I guess it is one thing to have a reflective thought and it's another to commit it to print. A permanent record of your thoughts requires some degree of fortitude – or stupidity! Once his thoughts were in print and circulated, Jerry found himself torn between feeling brave or stupid.

As a relatively new academic still on the steep face of the learning curve, I thought it was important to commit some of my thoughts to text and as I write, I too find myself torn between keeping my thoughts private for self reflection or making them public, committing myself to my convictions. In the case of the latter, I hope I don't find myself with an invitation to afternoon tea at a crowded café with one of the Profs!

We often hear discussion that many academics are not equipped with the personality traits to satisfy the attribute expectations of the students. It is often suggested that, by the nature of the type of work undertaken by many teaching academics, that they tend to be extraverts while research academics tend to be introverts and, thus, precluding them from exhibiting many of the attributes desired or expected by students. It is my belief that each of us has the full gamut of personality traits; it is just that each of us has a unique balance of trait manifestation. I can't imagine, however, that you could be successful in either role without a good balance of all traits.

How do we want to be perceived by our students? What descriptors would we, as teachers, like to be identified with? It brings me back to Jerry Macquire. After a lot of hard work and 'commitment,' Jerry secured a great deal for his client. The celebratory scene displayed a strong relationship which was looked on with jealousy by a competing agent/client. As lecturers, we may see similar disparities in relationships with our students. Some of us may not care, as long as they learn. I think learning is facilitated by strong lecturer/student relationship but it must have the key ingredient that can't be bought, sold or introduced one day – respect! Jerry Macquire had earned respect and in turn had developed respect for his client – then the relationship moved to a whole new level of productivity. It is only when we truly respect our students that they can come to respect us and then we create a fascinating and mutually rewarding learning environment.

So, are we different from our students? As academics we spend a lot of time illuminating the inadequacies of students and the difficulties they present when we teach; late assessment items, need for 'spoon feeding', complaints about workload, tardiness, students who don't participate, disruptive students etc. These obstacles to learning, I think, are also displayed when we as lecturers become the student (eg. staff development workshops etc). I think the lesson is that we should have greater understanding of these obstacles and become more flexible / tolerant. It is interesting

that, as a group, our expectations of students are higher than the expectations we impose on ourselves.

I think it is interesting to hear how each of us sees ourselves in relation to our students. Are we empowered? Many see students as subordinate and you hear phrases like “my way or the highway” or “there is one way to do it and that’s my way” type comments. What model do we apply to our class dynamic?

In health we traditionally have a delegated decision making model for doctor/patient relationships where the doctor is the authority and the patient plays a passive role in their own health management. In recent years, I guess in part as a consequence of the information age and our expectations and the advantages of patient education (eg. compliance), the health model has moved away from this to one where the patient plays an integral role, as an informed party, in their health management. Education is or should be undergoing similar transitions - empowerment of students.

Clearly, there are many strategies that can be employed in teaching/learning but there should be an appropriate balance. I teach students to challenge authority to gain a deeper understanding of key concepts and utilise student driven learning strategies. Quality assurance and quality improvement programs are a valuable tool in any process, but their usefulness is limited if the process is not continuous. Continually striving to improve and increase quality provides a mechanism for ongoing competitive advantage.

So, back to Jerry Macquire. No movie is complete without a love story and Jerry falls for his trusty side kick. It is here I find my final thought. It should be us, as career educators, that say to our students (and thus define the dynamics of our relationships):

**“You complete me”**

## Reflection

### **Copper-hued, not white: An ethnic minority educator in New Zealand**

Edwina Pio  
Faculty of Business  
Auckland University of Technology  
Auckland , New Zealand

Seagulls calling. A breeze in the pohutukawa trees. Breathtaking cloud formations that transform dawn into the moth hour of eve, and I am a part of it. Copper-hued, not white, an ethnic minority educator in New Zealand. A migrant, here to stay, and New Zealand is now my home.

I stand in front of my university students, and encourage them to look deeply into the nuances of diversity, into the lived-in and lived-through lives of women and minorities, and challenge them to develop strategies to maximize the potential of this diverse group. The tiny island nation of New Zealand with its population of four million has people from more than 200 nations represented. A country built on immigration, primarily from Britain and Europe, in the last fifteen years it has started accepting people from non-traditional source countries. And as I facilitate the movement of my Master of Business Administration and Bachelor of Business students, hopefully leading some to the threshold of their minds, I know that the assignments on diversity, which I have inbuilt into the Human Resources Management curriculum, are an acknowledgement of my grief, ambivalence, hope and healing in my journeying in my new homeland.

Yes, extraordinary mistakes by an ordinary person, for when I saw the students shock as I entered the class, I mistakenly thought my expertise would get through. But I tasted the bittersweet communication of student's disbelief in wrestling with my diversity...who is this little third world person? Early days and I was tongue tied. In my internal meanderings, I acknowledged the gift of mistakes. So holding to my heart my copper sheened credentials, I inscribe my calligraphy in the first class of the next semester. I unwrap who I am, what I bring to the class and why I am in education. I breathe lighter, and so do they. It is a defining moment for a petite woman from a developing country.

Refusing to be sucked into powerlessness and the sapping of my strength, I seek acknowledgement of the gifts that I, like other migrants, bring to this country. The gift of different perspectives; of international travel, teaching in Universities in Asia, Europe and America, a rich heritage and a wealth of experience. In my restlessness and refusal of stasis, I enter the portals of a university and learn to transmute the often unintentional, though fairly regular, stereotyping of what I am perceived to represent externally – copper-hued. I develop a subterranean survival culture to enfold my daily existence, as inch by inch I carve my space within the scholarship of teaching and learning.

I make a stern commitment to myself to smudge colours and a fierce will to hold onto the dream of softer silhouettes in a multicultural workforce. I gradually develop a sophistication to crisscross the gossamer borders of difference that can be bands of steel. I laugh about my use of phrases and accents and ease my student's and colleague's transition to exploring a copper phenomenon. I seek to walk intelligently by quoting research and international statistics and gradually tint the experience of learning. Fluidity, interdependence and a gradually developing wonderful community of colleagues sustains me in my life patterns. For I realise that I have no choice but to



engage fully in unravelling the knots created by past mental models or stereotypes, for my history is also our common history.

So when I touch my bruises, I touch my strength and forge assignments and research projects that will subconsciously and consciously facilitate constructive overtures towards peoples of all hues. I go through equity training and become an interview panellist for our university, and publish work on my copper-hued sisters. "Go by data" I tell my students, "research local, national and international scholarship on diversity". For the students who grace my classes - just like other students in far flung corners of the globe - are the future CEO's, leaders, police force, judges, ecological activists and the implementers of policies on diversity.

I look at my scars, and know that as I make meaning for my students, so too does my life become more meaningful. As a knowledge-maker, encapsulated in the actions and images of my every day, I shake loose my fears of being different, of being an ethnic minority, and give voice to my difference. I seek to play a part to ensure fewer victories for stereotypes of the copper-hued, and in so doing perhaps embroider my tiny pattern in the fabric of humanity. And as my students get excited about their progress in the diversity literature, a quietness enters me, and I lift my face towards a future of hope, miracles and possibility. Seagulls call and take my prayer to the skies.

## Reflection

### Why Do I Teach?

Bruce Saulnier  
Professor of Computer Information Systems  
Quinnipiac University  
Hamden , Connecticut, USA

“Why do you teach?” A simple enough question, but an incredibly challenging one to answer.

At the 2002 Lilly Conference on College Teaching I was fortunate to meet Peter Beidler, the Lucy G. Moses Distinguished Professor of English at Lehigh University and the Carnegie Foundation for the Advancement of Teaching 1983 U.S. Professor of the Year. As a result of that award, the editors of *Alumni Magazine* invited him to write a short essay, which they published as “Why Do I Teach?”

In Beidler’s essay, he writes about lifelong learning through teaching, innovative teaching methods, and how teaching is rewarded continuously as former students go on to do good and useful things. Yes, teaching does indeed provide us with, as Beidler says, “... many nectars to taste, many books to read, and many ivory and real-world towers to discover. Teaching gives (me) pace and variety and challenge and the opportunity to keep on learning.”

Like Peter Beidler, I teach for all of those reasons – but those are not the most important reasons why I teach!

A few years ago I met a fellow teacher on-line and we became good cyber-friends. I invited him to attend and make a presentation at the annual meeting of the International Society for Exploring Teaching and Learning (ISETL). Upon meeting him in person, our initial exchange of pleasantries took the usual academic spin. In short order I asked him, “What do you teach?” His answer – “Students!” As one of his musings so eloquently puts it, “If you want to be a teacher, you have to fall in love each day. If you want to be a teacher, you have to put aside your formal theories, intellectual constructs, axioms, statistics, and charts when you reach out to touch that miracle, called the individual human being.”

Parker Palmer, in his classic *The Courage to Teach* (1998), postulates, “If we want to improve the quality of college teaching, a million workshops on methodology will not be enough. Good teaching does not come from technique. It comes from the identity and integrity of the teacher.” Indeed, most teachers, most of us, choose our vocation for reasons of the heart. We care deeply about our students and our subjects. But the demands of the professoriate cause too many of us to lose heart. So for Palmer the essential question is how to continue to do what good teachers always do – give heart to their students.

In his more recent work, *Let Your Life Speak: Listening for the Voice of Vocation* (2000), Palmer builds on his theme of personal integrity. He urges each of us to find our life’s true calling by listen to our inner voice, our inner teacher if you will, and follow its teachings to a sense of meaning and purpose. He posits that “every journey, honestly undertaken, stands a chance of taking us toward the place where our deep gladness

meets the world's deep need." Palmer feels that cultivating that truth is the authentic vocation of every human being.

So for me the real question is how to be authentic in the classroom and simultaneously reconcile the need to be a scholarly and productive member of the professoriate with my very basic need to connect with my students and my subject. The scholarship of teaching provides me with such a venue, for it allows me to use my chosen vocation as a basis for my scholarship. And the process of studying the scholarship of teaching provides me with the exposure to innovative teaching methods employed by others as well as exposes my own methods to the thoughts and constructive criticism of others. In the process I become a better teacher and in doing so model for my students what it means to engage in and value lifelong learning.

Students are the real reasons I teach, students who grow and change in front of my eyes. As Pete Beidler puts it, "Being a teacher is being present at creation, when the clay begins to breathe. Nothing is more exciting than being nearby when the breathing starts."

Good teaching offers love. Not only the love of learning and of books and of ideas, but also "... the love that a teacher feels for that real student who walks into a teacher's life, begins to breathe, and then walks out." As Beidler says, "I teach because, being around people who are beginning to breathe, I occasionally find myself, quite magically, catching my breath with them."