

A Learner-Centered Teaching Model Integrating Undergraduate Research and Service Learning

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Abstract

Learner-centered teaching is an approach that engages students through active learning strategies including service learning, problem solving exercises, collaboration, undergraduate research and capstone experiences. These strategies have been shown to improve critical thinking skills, retention and post-graduate success. This article introduces a successful learner-centered approach to teaching undergraduate nutrition students through an integrated undergraduate research and service learning (UR-SL) project. Students in a sports nutrition course participated as small groups in a semester-long service learning project culminating in a research-based fitness trail proposal. At the end of the project, 63 of the 77 students in the class (82%) completed a brief survey on their project experiences. The majority of students reported their project planning, team building, interpersonal communication and professional proposal skills were enhanced through this experience. On a scale of 1-7 (7=incredibly important), students rated the importance of real-life applications in college coursework as 6.45 ± 0.80 and interacting with a peer team as 5.61 ± 1.38 . Students recognized that solving problems in a group is an effective way to learn and that group decisions are often better than individual decisions. The majority (93%) of students participating in this learner-centered project recommend this UR-SL activity to their peers.

Introduction

A learner-centered teaching approach engages students through active learning strategies including service learning (SL), problem solving exercises, collaboration, undergraduate research (UR) and capstone experiences (Wright, 2011). These high impact experiences enhance academic and personal growth, career development and a wide variety of desired learning outcomes (Kelly, 2011). In addition, learner-centered techniques teach students how to think, solve problems, evaluate evidence, analyze arguments and generate hypotheses (Weimer, 2012). These are all skills necessary to master discipline-specific content.

Numerous examples from multiple disciplines, including those in colleges of agriculture, support learner-centered approaches to teaching at all levels of education. In elementary schools, students enrolled in classrooms engaging in scientific practices through a student-centered approach showed enhanced learning when compared to those in traditional classrooms (Granger, 2012). Pharmacy students reported increased motivation and enhanced ability to learn material and obtain a desired course grade when enrolled in a pharmacotherapy course using a learner-centered approach (Cheang, 2009).

Learner-centered teaching encourages collaboration and building a community of learners (Weimer, 2012). Such collaboration is particularly important for dietetics

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and human nutrition students who often work in interdisciplinary healthcare teams. Inter-professional relationship skills can be enhanced through innovative and targeted undergraduate student experiences, such as interdisciplinary communication and ethics coursework (Whelan et al., 2005). Small group work often facilitates interdisciplinary relationships and collaboration.

Service Learning

Service learning promotes student learning through a mutually-beneficial activity that relates a community service activity to course or program learning activities (Anderson et al., 2011). Such activities build strong community and campus relationships while enhancing student learning and skill sets (Ross, 2012). Service learning is a well-recognized teaching approach across a wide variety of disciplines, including landscape design (Hansen, 2012), pharmacy (Falter et al., 2011; Kearney, 2008) and human nutrition and dietetics (Stephenson, 2012). Colleges of agriculture are leading efforts to develop and offer well-designed SL projects.

Educators must distinguish between SL and community service activities. While both are of value to students, SL applies course content and results in a deliverable outcome, such as a community proposal. In addition, successful SL activities force students to reflect on and generalize about their learning (Estep and Roberts, 2011). Self-reflection fosters critical thinking skills, relates the SL activity to a student's future career and provides a means for students to communicate feelings about the educational and emotional aspect of a project (Ash, 2003; Bonnette, 2006). Students engaged in meaningful SL followed by thoughtful reflection are more committed to lifelong civic engagement and personal growth (Ash, 2003).

Undergraduate Research

Undergraduate research experiences attract students to the sciences, providing a strong foundation for professional development and personal growth (Villarejo, 2008). According to Lopatto (2003), UR enhances professional credentials, clarifies career paths, facilitates learning, promotes a continuing relationship with faculty, introduces students to obstacles faced in the research process and teaches students how professionals work on real problems. Students engaged in UR have a more sophisticated understanding of the process of scientific research, particularly if the UR experience is multi-year (Thirty, 2012).

How a college, course, or professor engages students in undergraduate research significantly influences the degree of project ownership expressed by students (Hanauer, 2012). Undergraduate research takes on many

forms in higher education. For example, at the course level student-centered course activities can foster the delivery of high-quality research designs while engaging students to become self-directed and critical thinkers (Wiegant, 2011). On a smaller scale, faculty may be mentoring an individual student or small group of students. Six students in agronomy, soils and environmental sciences at Virginia Tech were carefully shepherded through the research experience, culminating with presentation of their results at a professional meeting (Galbraith, 2012). The students reported value to this high-engagement research activity and would recommend the activity to their peers and to faculty mentors.

Undergraduate research is particularly of value to those in the health industry, who are taught evidence-based practice skills. Through research-based coursework, students in nursing and related disciplines learn to integrate previously fragmented research knowledge to understand the relevance of research evidence for providing patient care (Meeker et al., 2008). This ultimately makes these students better practitioners (McCurry and Martins, 2010). A constant challenge for faculty is developing course assignments that engage students in research-based coursework, while teaching concepts necessary for understanding and appraisal (Balakas and Sparks, 2010).

Faculty may express concern over an undergraduate student's preparation to participate in meaningful research as well as the time required for quality mentoring (Coker and Davies, 2006). However, evidence suggests that the majority of undergraduate students do have the skills and capacity to conduct innovative and important research studies (Wiegant, 2011). For time efficient mentoring, faculty should allow the student to brainstorm, hypothesize and perhaps make mistakes before intervening.

Integrating Undergraduate Research and Service Learning

Examples of courses that integrate research and SL are limited and often restricted to graduate-level programs and healthcare-based disciplines. However, evidence from such programs suggests that they both increase understanding of the research process and acquaint students with a community-based issue or goal (Balakas and Sparks 2010; Bouhaimed et al., 2008; Collier, 2012). One example is from third-year nursing students who worked in small groups under the guidance of a nursing instructor to answer clinical questions posed by practice-based community partners (Janke et al., 2012). Through this experience, students developed information literacy skills while also serving the needs of their community. Medical students at the

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University of Texas Southwestern Medical Center had the opportunity to participate in a 9-week summer research training program with a community-based focus (DeHaven and Chen, 2005). Faculty reported that the program accomplished its objectives of increasing students' research knowledge and their awareness of community health needs.

The professional organization for dietetics and human nutrition, the Academy of Nutrition and Dietetics (formerly the American Dietetic Association), supports research as the foundation of dietetics practice (Myers et al., 2003). According to the Academy, research is the basis for education, strengthening and sustaining the knowledge base of the profession and setting public policy (Manore and Myers, 2003). Graduates of accredited dietetics programs are expected to have a basic knowledge of research methodologies, needs assessments and outcomes-based research and a working knowledge of the scientific method and quality improvement method (Vaughn, 2003).

The goal of this project was to provide undergraduate human nutrition and dietetics students with a meaningful undergraduate research experience integrated with a community-based SL project. The student perceived value of learner-centered teaching and group collaboration in an integrated undergraduate research and service learning (UR-SL) project was assessed through an end-of-semester survey.

Methods

Course Description

The first author teaches the course "Sports Nutrition" to sophomore, junior and senior level dietetics and human nutrition students at the University of Kentucky (Lexington, Kentucky). The course is required for human nutrition and optional for dietetics students. The pre-requisite for the course is Introductory Nutrition, a course most often taken by sophomores following completion of pre-major biology and chemistry requirements. Sports Nutrition is a terminal course that can be taken at any point following Introductory Nutrition and prior to graduation. The course is taught as a hybrid course, meeting once per week in-class and supplemented with online activities, real-life case studies and projects. Enrollment in the course is limited for optimal course management, quality assessment and reflection on assignments and instructor-student interaction. Student instruction is enhanced through a course packet and weekly out-of-class graded textbook reading assignments. An UR-SL project called the Legacy Trail Project was integrated as a semester-long project during the spring 2012 semester.

The Legacy Trail Project

The Legacy Trail opened in Lexington, KY in 2010 to provide a safe place for the community to exercise. With four access points, including two located on off-campus UK College of Agriculture land, the 8.5 mile paved trail offers an enjoyable venue for individuals and families to get active. The Legacy Trail Project was a collaboration between students and faculty in dietetics and human nutrition and the University Built Environment Committee to assess trail usage and user opinion about the trail for future trail development and marketing. The project was conducted in three stages: observation, survey conduction and proposal development. Incorporating SL into each of the stages was critical to the projected learning outcome of the project. All activities that involved the Legacy Trail Project were approved by the University of Kentucky Institutional Review Board.

Stage 1 entailed student acclimation to the Legacy Trail and observation of trails users during February and early March. Working in groups of two, students monitored trail use for one-hour periods at the four trail access points. For many students, this was their first time out on the trail and students were encouraged to explore the trail. The students completed a short form that allowed tracking of the date and time that the group was observing as well as the access point where the group was located, a general weather description, temperature and most importantly the gender and the physical activity of each user of the trail. Results of the early spring surveys were utilized in determining Stage 2 surveying days of the week and time of day.

Stage 2 consisted of surveying the users of the Legacy Trail. Supervised by faculty or staff, students gathered at different access points at times determined by the previous observation stage to ensure that surveys were conducted at peak usage times. The students interviewed users upon arrival or departure from the trail or if a user was moving at a pace that made them accessible. The faculty-developed survey contained 17 questions that were used to determine how the trail was used and what improvements could be made. Specifically, users were asked if they would use fitness equipment or read health tips posted on signs along the trail. Each interview took approximately five minutes to complete. Data from 136 trail users was collected and analyzed.

The last stage of the Legacy Trail Project was development of an evidence-based trail proposal, which provided students with an opportunity to reflect upon the information gathered from the surveys in addition to their own experiences out on the trail. Each group was asked to develop a full proposal for improvement and expansion of the Legacy Trail to include outdoor

fitness equipment. Students were randomly assigned budgets ranging from \$25,000 to \$100,000 and given information regarding possible equipment choices. All groups were asked to account for 25% of the given budget for any installation and maintenance costs to simulate true budgeting. The groups turned in a proposal that included the goals and objectives for the project, a map of the Legacy Trail demonstrating where the proposed improvements would be made, a description and justification for all improvements and lastly the budget. Proposals were submitted to the Built Environment Committee who utilized the proposals and collected data in project presentations for the Lexington Fayette County Urban Government and the Bluegrass Community Foundation. Both organizations have used this information in future community development and trail planning. There are also plans to continue surveying trail users at the Legacy Trail, but also at other fitness trails in the community.

Student Evaluation

Student perception of the UR-SL project was assessed in a two-page written survey at the end of the spring 2012 semester. Anonymous surveys were distributed to all students enrolled in the sports nutrition course. Sixty three surveys were completed and returned, an 82% response rate. The committee-developed survey evaluated students’ perceptions of the UR-SL project. The quantitative component of the survey assessed student interest in the project, skills enhanced and the value of working in a peer team. Qualitative questions evaluated knowledge gained and most and least favorite aspects of the UR-SL project. This study was deemed exempt by the University of Kentucky Institutional Review Board.

Results and Discussion

Students representing three different academic classes completed this project - sophomore (40%), junior (11%) and senior (49%). Eighty percent of the students were human nutrition students taking the course as a major requirement and 20% were dietetics students taking the course as an optional elective. Sports nutrition is a growing field making the course a sought-after elective course for dietetics students. Consistent with the overall demographics of students in the human nutrition and dietetics majors, the majority of participants (73%) were female.

One-third of the students reported that this was the first college course they had taken that had real-life, student-centered learning, activities. Thirty-two percent of students had taken one course,

21% two courses and 14% three or more courses, that had real-life applications. These results are consistent with national averages of students participating in such learning opportunities only once or twice in their college careers (Kelly, 2011).

On a Likert-like scale of 1-7 (7=incredibly important), students rated the importance of real-life applications in their college coursework as a 6.45 ± 0.80 . Others have also found that students value working with a community partner to learn course content as a meaningful experience (Balakas and Sparks, 2010; Holston and O’Neil, 2008). Many medical schools are now training physicians through innovative teaching techniques, including community-based research addressing the needs of the underserved through community partnerships (DeHaven et al. 2011).

Students were asked to rate their overall interest in the project at the beginning and end of the semester using a Likert-like scale of 1-7 (Table 1). Student interest in the project was enhanced ($p < 0.05$) during the course of the semester. Ninety-three percent of students would recommend this, or a similar, UR-SL project to their peers.

Table 1. Students overall interest in the UR-SL project at the beginning and end of the semester (n=67).

Interest Rating	Average \pm SD
On a scale of 1-7 (7=incredibly interested), how would you rate your overall interest in the recipe project at the beginning of the semester?	4.61 \pm 1.56
On a scale of 1-7 (7=incredibly interested), how would you rate your overall interest in the recipe project at the end of the semester?	5.16 \pm 1.39 *

The results of the skills enhanced questions are presented in Table 2. Overall, the majority of students reported enhancement in each of the skills. Thirty-eight percent of surveyed students reported that all six of these skills were enhanced. The greatest enhancement in skills was for project-specific knowledge related to fitness trails and the Legacy Trail itself. The majority of students were unfamiliar with the Legacy Trail at the beginning of the semester. Based on student feedback on skills enhanced, in future UR-SL projects we recommend placing more emphasis on interpersonal communication skills, both within the dynamics of a team as well as during trail user surveying. Only two-thirds of students felt this skill was enhanced through the Legacy Trail Project.

Table 2. Student-reported enhancement of skills through the UR-SL project (n=67).

Skill	Percentage Responding Skill Was Enhanced
Knowledge of the location and layout of the Legacy Trail in Kentucky	92%
Project planning on a fixed budget	87%
Knowledge of the roles of fitness trails in community development	85%
Team building	68%
Preparation of a professional project proposal	65%
Interpersonal communication skills	63%

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Table 3. Student reported attitudes about working with a team in the UR-SL project (n=67).

Rate the following about working with a team on this project.	Average ± SD (Scale of 1-7, 1=completely disagree, 7=completely agree)
The ability to work with my peers is a valuable skill set.	6.53 ± 0.65
The ability to collaborate with my peers will be necessary if I am to be successful as a student.	6.23 ± 1.05
I have a positive attitude about working with my peers.	6.16 ± 1.01
Solving problems in groups is an effective way to learn.	6.12 ± 0.89
Group decisions are often better than individual decisions.	5.28 ± 1.46

Students recognized the importance and value of team work in a large-scale research project and proposal. Working in groups of 6-7, students completed all aspects of the project as a team. Student attitudes towards team work are shown in Table 3. On a Likert-like scale of 1-7 (7=completely agree), students rated “The ability to work with my peers is a valuable skill” as a 6.53 ± 0.65 . Sixty percent of students completely agreed (score=7) with this statement. Students also recognized the value of group problem solving to enhance learning (6.12 ± 0.89). While the majority of students reported a positive attitude towards group work, 7% of students scored this statement at or below 4 (7= completely agree).

These results mirror what we and others have found related to group work; the majority of students appreciate group learning, but not all (Stephenson et al., 2012). Three of four pharmacy students reported working with other students on a patient case study reinforced the material more than completing case studies independently (Cheang, 2009). Group size is an important factor to consider. While our UR-SL project teamed students in groups of 6 or 7, ideal team size has been found to be 3 or 4 students (Holston and O’Neil, 2008). If we completed this project again we would strive for the smaller group sizes. One issue with smaller groups is the need for additional course management due to the larger number of groups to monitor and mentor.

Students were asked to identify their “favorite” and “least favorite” aspect of the UR-SL project. Over 60% of students provided open-ended responses indicating their favorite aspect of the project was learning about and visiting the Legacy Trail. Students favorably reflected that going to an off-campus trail was a positive experience. Many students responded that they enjoyed walking the trail with their teams and doing something “different.”

For 19% of the students, their favorite part of the project was surveying Legacy Trail users. Interestingly, 21% of the students described the surveying as their least favorite aspect of the project. It was evident during the surveying that some students felt much more comfortable with surveying the trail users than others. While students were trained and supported at all times

by project faculty or staff, personality differences between the students showed through in this aspect of the project. Eleven students did not like surveying strangers and felt they were interrupting the individual’s workout. Although the surveying took some students out of their comfort zone, student participation in subject recruitment and collection of data are important and necessary skills to enhance a student’s understanding and appreciation of the research process (Vaughn, 2003). For our project students were assigned to work in pairs, attempting to match students based on interviewing experience and confidence.

Students were also split on their open-ended responses towards working in a team. Ten percent of students described this as their favorite and 12% as their least favorite aspect of the project. For those students who rated group work as their least favorite part of the project, the majority (7 of 8) provided statements directly related to the challenges of coordinating schedules with group members. Only one student provided an open-ended response of simply not enjoying working in a group. A separate student reported enjoying “Working with select members from my group.”

These results are consistent with what others have identified as strengths and challenges of group work.

Summary

College teachers do not just teach content, they teach students how to become critical thinkers and contributing members of society (Doyle, 2012). Learner-centered teaching benefits not only students, but increases job satisfaction for teachers (Wright, 2011). While a well-recognized teaching technique, most college professors are hired for their expertise in a discipline, not in teaching. Professors benefit from guidance and hands-on assistance in developing learner-centered courses and activities. Estep et al. (2012) provide college of agriculture instructors with such an experiential learning model, detailing three key stages - planning, delivery and evaluation.

Our project and student feedback validate the merit of a SL project that integrates UR. Human nutrition and dietetics students learned the value of research in developing evidence-based proposals. If the students had developed a Legacy Trail proposal without first seeking the input of the fitness trail users, their proposals would have been significantly different and mis-represented the needs and desires of the trail users. For example, through surveying the students learned that trail users are less interested in fitness equipment and more interested in better trail signage (e.g. finding the trail and mile

markers), more restrooms, water fountains and benches. Many of the trail users were training for endurance events, such as half or full marathons and would not stop during their run to use the fitness equipment. Trail users also suggested adding a playground area to one or more of the trail entrance points for family-friendly activities.

Evidence-based, learner-centered, models for teaching are shaping the education of students (Smith-Strom and Nortvedt, 2008). The Legacy Trail Project provided college of agriculture students with an opportunity to engage in UR while having a positive impact on their community. This community partnership also opened the doors for a second UR-SL project related to the Legacy Trail as well as the UK Arboretum, which includes a 2-mile paved fitness trail.

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