Effective Modification of a Nonprescription Medicines Course to Optimize Learning of Millennial Generation Students

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Abstract
Objective: *To describe examples of effective teaching strategies utilized within a required nonprescription therapeutics course, in order to accommodate learning characteristics of Millennials.*
Case Study: *Instructors identified unique characteristics of Millennial generation students through literature review and focused educational workshops. These characteristics include the desire for active learning where didactic lectures make a connection to life, the incorporation of technology, and assignments that focus on team work. Course modifications were then made based on these characteristics including redesign of large group course lectures with incorporation of patient cases, inclusion of a variety of online components including the opportunity to provide course feedback, and active learning small group projects within workshop sections.*
Evaluation: *Student evaluation of the course and instructors significantly improved after introducing changes to the course compared to previous years. Each component of the student evaluation resulted in a statistically significant change in mean score. Verbal and written evaluations indicated a very positive learning experience for students. Grade mean (3.3 vs. 3.8, p<0.001) and range (0.00-4.00 GPA in 2007 vs. 2.00-4.00 GPA in 2008, p <0.001) also improved compared to previous years.*
Conclusions: *By identifying characteristics of Millennial generation student learners, traditional teaching methods can be modified in order to enhance retention of material and optimize their learning process. Course changes improved the learning experience for students and instructors. Instructors' willingness to evaluate generational differences and adapt teaching enhances the learning experiences in the classroom for both students and instructors.*

Introduction

Generational categories are commonplace descriptions for people tied together by their years of birth along with events, experiences, and attitudes that have shaped their lives. Generations are grouped together over a fifteen to twenty year time span and share similar personal characteristics. Although a variety of references may classify these generations slightly differently, the general characteristics remain the same. The Silent Generation members were born between 1925 – 1945 and make up 11% of our existing US population.[1] Members of this generation fought in World War II and tend to have faith in institutions and respect for authority.[2] Baby Boomers were born between 1946 – 1964 (26% of population) and are best known for their workaholic tendencies and questioning of authority. [1,2] Those born between 1965 – 1981 (20%) are known as Generation X and they tend to be independent and self-reliant. [1,2] They distrust institutions and are sometimes skeptical.[2] Those from the

Millennial Generation were born between 1982 – 2002 (28%).[1] The Millennial Generation are primarily the offspring of the Baby Boomers and are considered to be the most affluent and most highly educated generation. They are known for being civic-minded, following rules, and being part of one of the most sheltered generations.[3]

The Millennial generation is the most current generation to be named (those born after 2002 have not yet been grouped into a generation), with the majority of this generation now in their 20s. In 2009, over 59% of pharmacy students in the college classroom were composed of learners born into this generation.[4] By 2020, the youngest of the Millennial generation will enter college and thus may lead to a further increase in the percentage of Millennial learners in the college classroom.[4,5]

General Personal Characteristics and Traits of Millennial Learners

Millennials have been dubbed the "Sunshine Generation" because as a group they are optimistic, happy, and hopeful about the future.[6] They are described as rule followers who respect authority but are not in awe of it. An important characteristic to remember about Millennials is their expectation of having access to anything they need twenty-

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four hours per day, seven days a week. They have been brought up in an era of convenience, whether it applies to withdrawing money from an automated teller machine, getting food through a drive-through window, or being able to communicate with college instructors through online chats, blogs or via electronic mail (email). The Millennial generation student multitasks in most facets of life. Picture your average college student in the evening, listening to a podcast of today's lecture while checking email, updating their Facebook™ profile, watching television, and answering texts on their cellphone.

Millennial generation experts and authors, Neil Howe and William Strauss classify the seven key traits that differentiate this generation from previous generations. They identify these traits as special, sheltered, confident, team-oriented, achieving, pressured, and conventional.[3] Table 1 details these key traits of Millennials.

Faculty teaching Millennial generation students are likely to be of a different generation. Consideration of these Millennial personal characteristics and key traits may help to bridge differences in learning styles between Millennial generation students and previous generations. They may also offer information on teaching strategies that will be most effective for this generation of students. A review of the literature shows that the three main learning characteristics of Millennials include: desire for active learning with hands-on application of the material, incorporation of technology with a choice of formats for learning the material, and activities that enable students to learn through projects involving team work.[7-12]

Nonprescription Therapeutics Course
In our required nonprescription therapeutics course, which is taught in the third year of our four year post-graduate Doctor of Pharmacy program, we sought to enhance the learning and teaching process and improve the long term retention of self-care therapeutics in all of our students, many of whom are Millennial generation students. Our class demographics included a class composed of 49% Millennial students (based on year born) in 2007-2008 and 69% Millennial generation students in 2008-2009, so targeting this population seemed like a logical step in course re-design. Faculty self-assessments and student course evaluations with students in the 2007-2008 class illustrated successful academic outcomes, but not the personal desired outcomes related to classroom dynamics or classroom satisfaction for either faculty or students. Faculty perceived resistance by students to assignments, the examination process, and to the format of didactic lectures. Students' verbal and written feedback to course faculty did not demonstrate personal satisfaction or

excitement for learning about self-care based on the teaching methods employed in the course. Our nonprescription therapeutics course is the primary exposure that our students get to over-the-counter products in the pharmacy curriculum. Approximately 58% of our graduates accept positions in community/ambulatory pharmacy upon graduation, and 79% of patients seek self-care options found in those community pharmacies; we wanted to ensure an improved educational process in the nonprescription therapeutics course so that our students were prepared for practice.[13,14] In self-examination of areas for change, the instructors explored differences in learning styles and expectations of the educational process due to generational characteristics, specifically focused on the Millennials. Course instructors then planned to make changes in the course by targeting Millennial learning characteristics.

Case Study
Objectives
The purpose of this project was to describe examples of effective teaching strategies utilized within a required nonprescription therapeutics course, in order to accommodate learning characteristics of Millennials.

Design
In order to improve the course for the 2008-2009 academic year, the two faculty course coordinators attended a faculty workshop offered by the Ohio State University's Center for the Advancement of Teaching on general teaching strategies for Millennial generation students.[15] Additionally, these course faculty performed an assessment of the literature about this generation of learners searching key words including Millennial generation, Millennials, generational learning, Generation Y, Net Gen, and teaching Millennials. Through these resources, course instructors learned about many of the traits and characteristics previously defined. In addition to the general learning characteristics of active learning, incorporation of technology, and team work, the instructors also identified additional specific learning desires of these students including the need for explicit guidelines for assignments, wanting to provide and receive constant feedback, and learning best when didactic lectures make a connection to real life through the use of case studies.[7,15] The course instructors made significant modifications to the existing required nonprescription therapeutics course based on a number of these personal and learning style characteristics.

The learning objectives for the nonprescription course that were articulated in the syllabus and were the underlying tenets of teaching and evaluation of instructional effectiveness included students' ability to: 1) determine

appropriate nonprescription recommendations for common self-care conditions, 2) identify appropriate treatment counseling recommendations for common nonprescription medications, and 3) identify appropriate nonprescription medication recommendations for common self-care conditions in special patient populations.

The nonprescription therapeutics course was taught as a quarter long course that met twice weekly for one hour and eighteen minutes as a large group lecture (approximately 125 students) and once weekly for forty-eight minutes as small group workshop sections (approximately 30 students). The course is co-facilitated by two faculty members who had been teaching the course for approximately seven years. These faculty members provide approximately 85% of the large group didactic lectures and develop the corresponding course material for the lectures and the workshops. The recommended text for the course is the *APhA Handbook of Nonprescription Drugs*, which is supplemented with review and research articles from the primary literature.

The primary purpose of the nonprescription therapeutics course, as articulated in the course objectives, is to produce student pharmacists who can effectively use patient assessment skills to triage a patient that is eligible for self-care and determine appropriate nonprescription recommendations for common self-care conditions. Lectures generally provide the foundation for the self-care topic and workshops are intended to be used as a means for students to apply information using patient cases and nonprescription products.

Overall goals for the 2008-2009 course offering were to incorporate active learning, more effectively utilize technology, and facilitate team work inside and outside of the classroom. Adjustments were made to provide students the ability to give and receive frequent feedback, make a connection between material presented in the course and real-life patients they were likely to encounter in practice, and facilitate interaction between faculty and students in all aspects of the course. We wanted to see if these adjustments to the course resulted in improved student and faculty perceptions of the course and had a positive impact on student learning.

Active Learning
We deliberately re-designed the course to emphasize active learning in both the large classroom lecture as well as in the smaller workshop sections. To get students involved in the large lecture, instructors incorporated patient cases that were designed to simulate real-life patient care encounters. Students worked on the cases in the large lecture and

discussion occurred as to why specific product choices were better for specific simulated patients than others. Instructors brought commonly used products (e.g. common cough and cold agents, unique delivery mechanisms such as thin strips, unique dosing devices such as Reliadose®) into the large lecture and students were given the opportunity to examine the products in class. Workshops introduced new and unique products with hands-on opportunities to practice explaining product use to a patient. Product examples included those with unique dosing or administration requirements, such as Prilosec OTC® with a limited 14 day dosing duration, Murigate® otic irrigation, Netipots®, and Thermacare®, as well as product comparisons such as Tylenol® Arthritis, Advil Migraine®, and Excedrin PM®. Each workshop had guided worksheets that students received in advance. Tailored to the self-care topic, these worksheets often required students to reflect on the self-care condition and possible exclusion criteria, review existing treatment options, determine a specific treatment recommendation, and provide rationale for the selected treatment modality.   The worksheets were then used in class along with examples of common nonprescription products, and students worked in groups to compare information and complete the worksheet.

Additionally, two workshop sessions were dedicated to point of care and home diagnostic devices that emphasized hands-on activity in a scavenger hunt format, meaning students were asked to find and record specific product and patient counseling information using the product package inserts, patient instructions found on the label, and supporting information found on the product website or in the pharmacy literature.

Technology
An emphasis on technology was implemented throughout the course. All didactic lectures were delivered in class and recorded using lecture capture software and posted after class to a secure course management tool available online through the university. The course management tool was utilized for providing additional material, such as self-care product updates as well as for posting workshop handouts. Within the course management tool, faculty hosted a discussion board where students could post questions about course material or questions about self-care that the students may have encountered in practice. Lectures themselves were redesigned so that each one hour and eighteen minute lecture stressed 3-5 key learning points that were presented as didactic information and reinforced in mini-cases that utilized audience response technology. One workshop session incorporated dermatology pictures of common conditions, including contact dermatitis, wounds and scars, warts, and fungal infections. Students viewed the images on laptops,

identified the condition, reviewed the nonprescription product choices, and developed self-care therapeutic plans for each patient case scenario. Another workshop session utilized the Jeopardy™ game show format to assist students in learning about herbs and dietary supplements.

Worksheets for workshops that focused on building upon didactic lectures were assigned credit and were required to be turned in either in person at the end of the workshop or, for those that liked using the available technology, students also had the option to turn worksheets into an online dropbox at the conclusion of class. The worksheets were not graded for content, but rather evaluated for completeness to serve as a guide for students to practice applying didactic information to patient case scenarios.

Team Work and Collaboration
The assignments were converted from largely individual assignments to more team-based case assignments that focused on being able to make recommendations for self-care products. To facilitate increased faculty-student interaction outside of the classroom, faculty hosted specific office hours rather than having office hours by appointment only. Office hours were held during student breaks on the days that students were in the pharmacy building for the nonprescription therapeutics course. Students were able to talk to faculty during the college designated professional hour (same time everyday), in the forty-five minutes prior to the start of class and immediately after class. Faculty were also available in the hour between workshop sections which were held on a different day.

Feedback
Students were given opportunities to provide online feedback, known as "Feedback Fridays" four times during the 10 week course. These periodic feedback surveys provided students a mechanism to give student evaluation of recent lectures, suggestions for course enhancement and the opportunity to clarify previously presented material. We also used the surveys to identify the information students wanted to know about a specific topic and methods to get more students to participate in the course itself. A small point value was assigned upon completion of these surveys to demonstrate the importance of this assignment.

Other Course Changes
To accommodate the desire for explicit directions, the course syllabus and schedule were revised. Table 2 compares course topics taught during the course in 2007-2008 vs. 2008-2009. Students received a structured syllabus that highlighted assignment instructions in a step-wise model and provided

multiple mechanisms for assignments to be turned in by the students.

All completed assignments large and small were assigned credit. Once students perceived that the assignment had value and understood how it linked to professional practice, they were more likely to complete the assignment and learn from it.

Student Learning Assessment
This work was determined to be exempt by The Ohio State University Investigational Review Board. The OSU Center for Biostatistics performed statistical analyses to assist in determining the effectiveness of the changes. Difference in grade comparisons, course evaluation scores, and student evaluation of instructors were compared using Kruskal-Wallis tests. Follow-up Wilcoxon Rank-Sum tests were performed between each pair of years when the Kruskal-Wallis test indicated significant differences. All tests were evaluated at the $\alpha=0.05$ significance level. No adjustments were made for multiple comparisons.

Graph 1 compares the overall grades between 2007-2008, 2008-2009, and 2009-2010 with significant improvement seen in median score as well as improved variation for the range from 2007-2008 to subsequent years once changes were implemented. The grading on examinations did not change significantly within these academic years with three examinations of approximately the same weight toward the total grade. In 2007-2008, there was an emphasis on communication exercises and in 2008-2009 quizzes over workshop materials were included in place of the communication exercises. This constituted about 10% of the course grade. This improvement has been maintained in subsequent years as indicated by the overall mean grade data for the 2009-2010 year. Although there was grade variability in the number of students who received As vs. Bs (B+, B, or B-), the overall mean was significantly improved in both 2008-2009 and 2009-2010 vs. 2007-2008.

Long-term Retention
Historically the self-care course at our university is the only required nonprescription products course that students are offered. As a result, course faculty had made it a very intense course that focused on as many self-care topics as possible. In 2007-2008, students had difficulty with long term retention of self-care even as early as one quarter later. In that academic year, the nonprescription therapeutics course was followed by a capstone course. When presented with an OTC cough case and asked to select a product, only 2% of students answered the scenario correctly. The difficulty in answering correctly may be due to retention of self-care material or

possibly due to a lack of awareness in the change in national cough treatment guidelines. The following year, after course changes went into effect, the same OTC cough case was presented, and 30% of students answered the question correctly.

Changes made within the course to help with the potential difficulty with long-term retention included streamlining lectures and exams. Course faculty focused on just 3-5 key learning elements per lecture that all practicing pharmacists should know and consequently the examinations also focused on the same 3-5 key learning concepts in a primarily case-based format. Core learning elements, such as self-care product indications, exclusions to self-care, major adverse effects, and major drug interactions, were retained and focus was placed on learning key information necessary for practice.

In addition, instructors incorporated the same number of examinations during the course, but adjusted the timing of the exams so that the amount of material covered on each exam was more evenly distributed, with content from approximately six to seven lectures assessed on each exam.

Other college level courses are also building on the nonprescription materials taught so that students can continue to integrate nonprescription and prescription therapeutics. Future direction for integration includes OSCE assessments within the curriculum that would have some focus on nonprescription products.

Evaluation
Table 3 illustrates a comparison of the course evaluations from 2007-2008 to 2008-2009 to 2009-2010. Each component of the course that was measured by this evaluation resulted in a statistically significant change in mean score. Key findings in this data show that student expectations of the course were met, interactive teaching methods were conducive to learning, and students reported improved comfort making OTC recommendations to patients highlighting connections from the classroom to real life practice.

Table 4 includes overall student evaluation of instructors, showing statistically significant improvement for all evaluation measures. Highlights of this evaluation include improvements in instructor interest in teaching, creation of learning atmosphere, and overall rating of both instructors involved with teaching this course.

Verbal and written evaluations of the course, as well as anecdotal comments made to faculty other than the course instructors, indicated a positive learning experience for students. In 2007-2008, student comments on strengths of the course were limited, but included comments that the course discussed a variety of topics and gave a broad overview of nonprescription products. The 2008-2009 class indicated a number of course strengths, including the organization of the course, the applicability of the material to real-life patient care, the workshop structure, and the variety of products utilized as examples in class.

Discussion
Curricular changes, both at a macro and micro level, are often driven by faculty who are composed of generations other than Millennials. However, the learning personality characteristics and related learning styles, as highlighted in the article by Borges and colleagues, must be taken into consideration as these curricular and course-level changes are made.[17] Through the authors evaluation of medical students, group learning, communication styles, and feedback (both giving and receiving) were identified as key considerations for Millennial students as compared to other generations. [17] Similarly, in preparing nursing educators for the changing learning needs of their Millennial students, Mangold reviews Millennial characteristics and highlights key teaching methods that faculty should incorporate in the classroom. [18] Her suggested changes for nursing student curricula include the incorporation of technology, active-learning that simulates real-life experiences, the need for both giving and receiving immediate feedback, the incorporation of collaborative work, and mentoring by faculty. [18]

Our pharmacy course revisions parallel the suggested changes for other health care professional students. [17-20] The revisions focused on the three key learning elements of active learning, incorporation of technology, and collaboration and teamwork. Consideration of the more specific elements of explicit instruction, opportunity for feedback, and connection to real life situations also complemented these course changes and presented tangible differences in the course from 2007-2008 to 2008-2009. Throughout these course changes, the instructors for the course, topics taught in the nonprescription course, and the overall objectives of the course remained the same. The student evaluations of the course and the instructors, as well as overall grades improved from the 2007-2008 to the 2008-2009 academic year and were maintained in the 2009-2010 academic year.

Specific Course Level Changes
The incorporation of patient cases in a large group lecture, which was historically didactic, was well received by students as evidenced by their feedback. In addition, this technique

for presenting a patient case mimicking real-life experiences helped to make the material more meaningful and reinforced the students' learning and retention of the material. Patient cases and examinations were used to assess learning objectives. Examinations were historically structured using similar patient cases to assess student learning, but only in the 2008-2009 and later course offerings were these patient cases discussed in detail during lecture and workshop with opportunities for debate about incorrect answers to better articulate rationale.

Teamwork and collaboration were also underlying tenets of course improvement, producing a better connection between students and instructors again as evidenced by student feedback related to instructors' interest in teaching and in helping students. In order to facilitate the sense of community and collaboration, we restructured the office hours to specific times that students were not in any required courses and provided the structure of specific meeting times vs. having an open-ended appointment based schedule as in years past. Anecdotally, this seemed to lead to more students visiting faculty and teaching assistants during those designated times than in the past, resulting in improvements in faculty and student dynamics. Students were also still able to come visit us outside of the office hours, and occasionally did so.

Giving the students a structured opportunity to provide feedback about the course and their learning through "Feedback Friday" was perhaps one of the most impactful changes made to the course. Instructors provided a summary of the students' responses to "Feedback Friday" survey questions in the subsequent class session and identified changes and enhancements to the course that were made or going to be made based on students' suggestions throughout the quarter. For example, students were surveyed on what herbs and dietary supplements patients were asking questions about and ones that they wanted us to cover during the class.

Subsequently, additional didactic information was included within the herb and dietary supplement lecture to accommodate the questions that students had. "Feedback Fridays" also allowed instructors to clarify learning points as the course was evolving and prior to examination. Because the surveys were conducted anonymously and data reported in aggregate, students were able to comment more freely about learning points that were unclear to them, as well as structural issues about the course that made learning less conducive. Instructors were then able to utilize the student feedback to enhance small elements of the course (e.g. reviewing both correct and incorrect answers to simulated

patient cases) to improve overall learning and course satisfaction. This opportunity for faculty and student dialogue demonstrated to students that their voices were being heard, while instructors were able to periodically assess where minor improvements could enhance student learning and overall satisfaction with the course.

The changes we made at the course level as well as our method for implementing these changes complement the models described in the approaches other health care professional faculty are taking to meet the needs of their Millennial learners.[17-20] Borges and colleagues highlight the curricular changes as a future area of study.[17] Skiba and Barton describe changes of simulation, active-learning, digital incorporation, and student connectivity as methods for enhancing nursing education.[20] This approach of Millennial characteristics followed by changes in learning needs were validated by our experiences with pharmacy students. Following our recent transition to semesters and curricular mapping related to accreditation, we intend to reevaluate continued changes we have made to the course. We will utilize the Millennial traits that we have identified as apparent in our students (e,g, the need for technology and teamwork) with specific learning outcomes (e.g. targeted topic assessments, overall grades, and student feedback). We also will continue to share our feedback with colleagues and teaching assistants with the hopes of overall continued quality improvement and generation of ideas for future research.

This article is meant to illustrate the impact of changes within a nonprescription therapeutics course for the Millennial learner at one college of pharmacy. It is limited to two years of data and by broader range assessment tools such as examinations and patient case assessments. In this preliminary report, we did not assess long term measures such as application of knowledge once the pharmacy students enter the workforce.

Conclusion
In order to enhance their retention of material and optimize their learning process, Millennial generation student learners may require modifications to traditional teaching methods. Making changes to our self-care course improved the learning experience for both students and instructors. As new generations of learners enter college, faculty have the option to ignore and resist change, to adapt to change or to learn to lead change by making necessary changes to ensure optimal learning without losing core concepts.[16] Our self-care course will continue to adapt and adjust with the needs of our student learners, to enhance the education experience for all of us.

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Table 1. Key Traits of Millennial Generation[3,15]

Key Trait	Description
Special	Family values was key political initiative; children key component to parents' lives and nation's No Child Left Behind Act of 2002 – notion that children and their education were nation's top priority and that curricula would be adjusted to their learning needs
Sheltered	Columbine school shooting and 9/11 key historical events "Baby on board" signs, age restrictions at movie theaters, technology to keep children safe developed
Confident	Primarily lived in period of economic growth and stability Seen growth of technology and believe it is key to success No recollection of Cold War Optimistic, close to family and overall positive look to future
Team-Oriented	Indoctrinated into team sports at a young age with all recognized for team participation regardless of who "won" the game Used to working in group environments and feel a strong connection with their peers Maintain constant contact with friends and peers through electronic mail, instant messaging, and use of cellular phones
Achieving	Goal oriented Used to standardized testing and focusing on testing pass rates Accustomed to curricula being changed or being adjusted to meet their learning needs. 60% reported feeling comfortable challenging a grade. Focus on grades, community service, and extra-curricular involvement in order to succeed
Pressured	Feel anxious and want to do well Will accomplish tasks when they have clarity on what outcomes the task will accomplish
Conventional	Desire to follow the rules and return to tradition Obey rules but not afraid to challenge them

Table 2. Topics Covered in Nonprescription Therapeutics Course

2007-2008 Didactic Lectures	2008-2009 Didactic Lectures
OTC Process	OTC Process
Emerging Issues in Self-Care	References and Resources
Pain and Fever	Pain and Fever
Cough, Cold, Allergies	Cough, Cold, Allergies
Otic, Oral, and Ophthalmic Disorders	Otic, Oral, and Ophthalmic Disorders
GI Disorders	Dermatology
Herbs and Dietary Supplements	Women's Health
Vitamins and Minerals	Infant Care
Weight Loss	Herbs and Dietary Supplements
Dermatology	Vitamins and Minerals
Women's Health	GI Disorders
Infant Care	
Tobacco Cessation	

* In 2008-2009 Tobacco Cessation was covered in other courses in the pharmacy curricula so was removed from the nonprescription course; a full lecture time was given to Women's Health and Infant Care instead of combining the two topics into one lecture as was done in 2007-2008.
^In 2008-2009 one less lecture period due to holiday vs. 2007-2008.

Table 3. Course Evaluation Scores

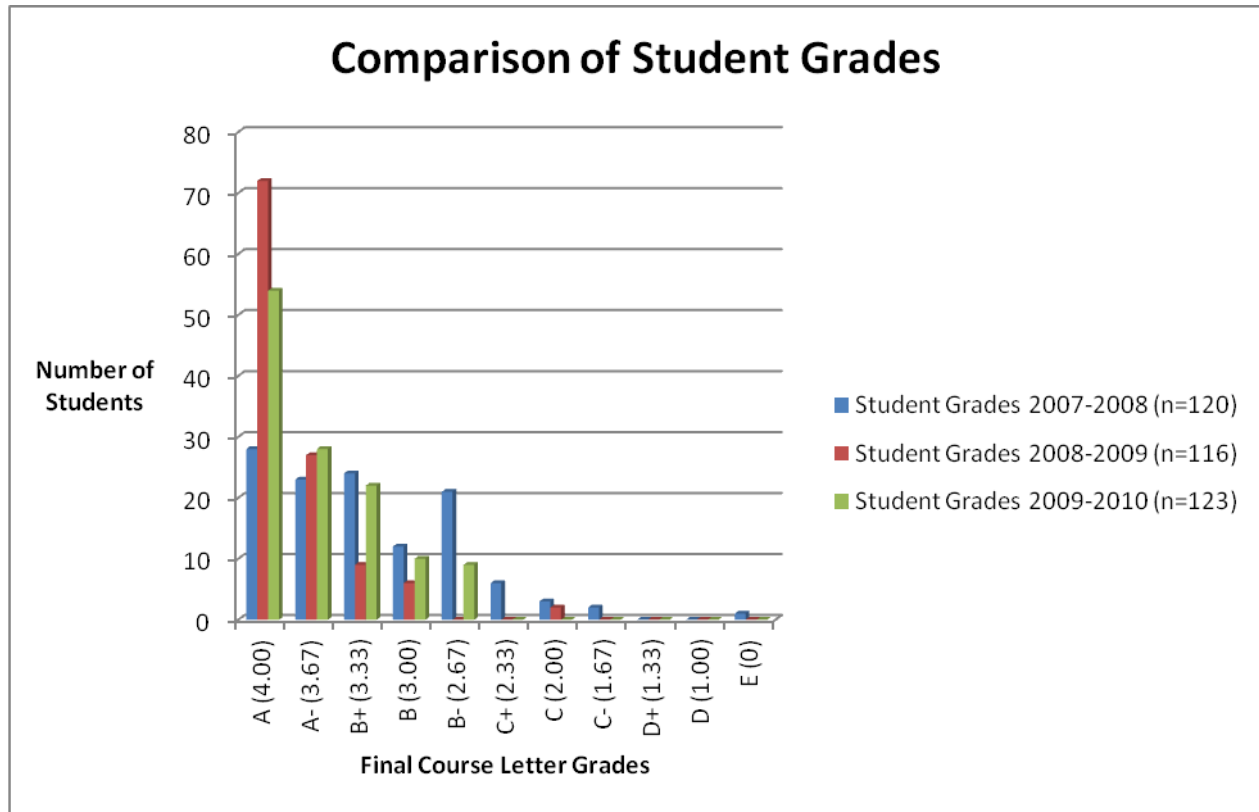|	2007-2008 N=114 Score [+] (range of 1-5; 5 being the highest)	2008-2009 N=116 Score [+] (range of 1-5; 5 being the highest)	2009-2010 N=117 Score [+] (range of 1-5; 5 being the highest)	p-value[1]
The overall course met my expectations.	3.4	4.5	4.6	<0.001[2]
The course provided me with new knowledge about OTC products.	4.0	4.7	4.7	<0.001[2]
The course provided me with new knowledge about OTC counseling techniques.	3.8	4.3	4.6	<0.001[3]
Now that I have taken this course, I will feel more comfortable making OTC recommendations to patients in the pharmacy.	3.7	4.5	4.6	<0.001[3]
The interactive teaching methodology was conducive to learning.	3.6	4.4	4.4	<0.001[2]
The pace of lecture was conducive to learning.	3.3	4.3	4.4	<0.001[2]
The amount of material covered during lecture was conducive to learning.	2.9	4.3	4.5	<0.001[2]
The material presented in workshop enhanced my learning of the didactic material from lecture.	3.4	4.4	4.4	<0.001[2]

[1] Kruskal-Wallis test for differences across years

[2] 2008-2009 and 2009-2010 significantly greater than 2007-2008 ($p<0.001$); no significant difference between 2008-2009 and 2009-2010

[3] 2008-2009 and 2009-2010 significantly greater than 2007-2008 ($p<0.001$); 2009-2010 significantly greater than 2008-2009 ($p<0.05$)

[+] Evaluation Scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Graph 1 Grade Comparisons

Comparison of Student Grades

Number of Students — Final Course Letter Grades

Legend:
- Student Grades 2007-2008 (n=120)
- Student Grades 2008-2009 (n=116)
- Student Grades 2009-2010 (n=123)

Kruskal-Wallis p<0.001
2007 vs. 2008, p< 0.001
2007 vs. 2009, p< 0.001
2008 vs. 2009, p= 0.001

Grades were significantly higher in 2008 than in 2007 or 2009.
Grades were significantly higher in 2009 than in 2007.

Table 4 Student Evaluation of Instructors

Instructor A

	2007-2008 Instructor A (n=84) Score* (range of 1-5; 5 being the highest) (SD)	2008-2009 Instructor A (n=87) Score* (range of 1-5; 5 being the highest) (SD)	2009-2010 Instructor A (n=74) Score* (range of 1-5; 5 being the highest) (SD)	p-value[1]
Well organized	3.5 (1.2)	4.6 (0.6)	4.7 (0.5)	<0.001[2]
Intellectually stimulating	3.5 (1.1)	4.4 (0.6)	4.5 (0.7)	<0.001[2]
Instructor interested in teaching	3.7 (1.1)	4.6 (0.6)	4.7 (0.5)	<0.001[2]
Encouraged independent thinking	3.7 (1.1)	4.4 (0.7)	4.5 (0.8)	<0.001[2]
Instructor well prepared	3.9 (0.8)	4.6 (0.6)	4.7 (0.5)	<0.001[2]
Instructor interested in helping students	3.5 (1.1)	4.6 (0.6)	4.7 (0.6)	<0.001[2]
Learned greatly from instructor	3.5 (1.2)	4.5 (0.6)	4.6 (0.6)	<0.001[2]
Created learning atmosphere	3.4 (1.2)	4.4 (0.7)	4.5 (0.7)	<0.001[2]
Communicated subject matter clearly	3.4 (1.2)	4.5 (0.8)	4.6 (0.6)	<0.001[2]
Overall rating	3.4 (1.1)	4.5 (0.6)	4.5 (0.7)	<0.001[2]

Instructor B

	2007-2008 Instructor B (n=85) Score* (range of 1-5; 5 being the highest) (SD)	2008-2009 Instructor B (n=57) Score* (range of 1-5; 5 being the highest) (SD)	2009-2010 Instructor B (n=75) Score* (range of 1-5; 5 being the highest) (SD)	p-value[1]
Well organized	3.9 (1.0)	4.7 (0.5)	4.6 (0.7)	<0.001[2]
Intellectually stimulating	3.9 (1.0)	4.6 (0.5)	4.5 (0.7)	<0.001[2]
Instructor interested in teaching	4.1 (0.9)	4.7 (0.5)	4.8 (0.5)	<0.001[2]
Encouraged independent thinking	3.9 (1.0)	4.5 (0.7)	4.6 (0.7)	<0.001[2]
Instructor well prepared	4.2 (0.8)	4.7 (0.5)	4.8 (0.4)	<0.001[2]
Instructor interested in helping students	3.9 (1.1)	4.6 (0.5)	4.8 (0.5)	<0.001[2]
Learned greatly from instructor	3.8 (1.1)	4.6 (0.6)	4.7 (0.5)	<0.001[2]
Created learning atmosphere	3.7 (1.0)	4.5 (0.6)	4.6 (0.7)	<0.001[2]
Communicated subject matter clearly	3.7 (1.1)	4.6 (0.5)	4.8 (0.5)	<0.001[3]
Overall rating	3.7 (1.1)	4.6 (0.5)	4.7 (0.5)	<0.001[2]

SD: standard deviation

[1] Kruskal-Wallis test for differences across years

[2] 2008-2009 and 2009-2010 significantly greater than 2007-2008 (p<0.001); no significant difference between 2008-2009 and 2009-2010

[3] 2008-2009 and 2009-2010 significantly greater than 2007-2008 (p<0.001); 2009-2010 significantly greater than 2008-2009 (p<0.05)

*Evaluation Scale: 1= Strongly Disagree, 3=Neutral, 5=Strongly Agree (2 and 4 are assumed to be 2=Disagree and 4=Agree); Scale for question #10 (Overall rating) is 1=Poor and 5=Excellent