INSTRUCTIONAL DESIGN AND ASSESSMENT

An Elective Course on Dermatological Topics and Cosmeceutical Compounding

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Objective. To implement and assess a pharmacy dermatology and cosmeceutical compounding elective course and its impact on graduates' careers.

Design. A 3-credit elective course that incorporated classroom lectures on ambulatory dermatologic diseases and cosmeceutical products with case studies, weekly quizzes, and a comprehensive business plan project was implemented in a doctor of pharmacy (PharmD) program in 2010.

Assessment. Assessment instruments including weekly quizzes, a business plan project, and pre- and post-course tests were used to evaluate course content. Across 3 offerings of the course (2010, 2011, 2012), pre- and post-course test scores improved. Results of a postgraduate survey showed that 54% of respondents worked at a pharmacy offering compounding services, and 57% felt that the course played a significant or very significant role in their counseling on dermatologic conditions.

Conclusions. Assessment methods revealed student learning of course content and the course appeared moderately beneficial to graduates' early careers. A more longitudinal analysis is needed to assess the course's impact on long-term career choices, particularly those dealing with compounding of cosmeceutical products.

Keywords: dermatology, elective course, cosmetics, compounding

INTRODUCTION

Pharmacists are consulted by patients for guidance on an increasing array of topics as the number of regulated and nonprescription products expand and commercial advertising creates greater awareness of treatment options. One such rapidly growing market is dermatologic care products. Sales of these agents, which include the expanding group of products known as cosmeceuticals, are projected by industry sources to increase by 4.8% to 7.7% per year for at least the next 5 years from a base of \$30 billion in 2012.¹⁻³ The term "cosmeceutical" is not recognized by the Federal Food, Drug, and Cosmetic Act. According to this act, "a product can be a drug, a cosmetic, or a combination of both, however, the term cosmeceutical has no meaning under the law."⁴ Additionally, the American Academy of Dermatology states that more studies on cosmeceutical ingredients are needed. While early studies on cosmeceutical ingredients have shown promise, a comprehensive scientific

analysis of these products does not exist.⁵ Despite the lack of regulation and widespread acceptance, reports have suggested that at least one third of dermatologists in the United States dispense cosmeceuticals in their practices, and many of the corporate entities engaged in research and development of cosmeceuticals are aggressively marketing these products through mass advertising and promotion.⁶ The widespread use and marketing of such products can lead patients to consult with their pharmacists, who must be knowledgeable regarding the major product segments as well as the key cosmeceutical product ingredients.

Dermatologic therapeutics, including cosmeceutical products, is a compelling area of study for many pharmacy students because of the increasing probability of patient inquiries and counseling opportunities. Unfortunately, this is often an area of deficiency in pharmacy curricula, appearing in colleges and schools of pharmacy programs only as a brief lecture series or occasional elective course offering. A thorough literature review did not find any similar course offerings of dermatological care and cosmeceutical products at colleges and schools of pharmacy in the United States. Additionally, personal phone calls to each college and school of pharmacy listed on the American Association of Colleges of Pharmacy

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(AACP) website as well as an e-mail inquiry sent through the AACP curriculum listerv confirmed that few teach the topic of cosmeceuticals and none have a standalone elective course on this topic. In reaction to this curricular deficit, an elective course entitled “Dermatological Therapeutics and Topical Delivery Systems” was created in 2009 and implemented at Duquesne University Mylan School of Pharmacy in the spring semester of 2010.

The student learning objectives were designed so that after successfully completing the course, students would have the knowledge and skills necessary to: (1) recognize dermatologic disease states commonly encountered in the ambulatory setting; (2) recommend appropriate treatment or referral for dermatologic conditions; (3) apply cosmeceutical compounding principles to prepare products that meet specific patient dermatologic needs; and (4) create a business plan proposal for a cosmeceutical product. The research objectives of this study were to determine: (1) the effectiveness of a new dermatology and cosmeceutical course on student learning outcomes, and (2) the effect of the course on graduates’ careers 1 year after graduation. This manuscript both describes the course implementation and presents the findings of the research objectives.

The Mylan School of Pharmacy offers courses that follow accreditation criteria as outlined by the Accreditation Council for Pharmacy Education (ACPE) and the Center for the Advancement of Pharmacy Education (CAPE). The ACPE and CAPE guidelines were incorporated into the “Dermatological Therapeutics and Topical Delivery Systems” curriculum, including the most recent elements of the ACPE guidelines, effective February 14, 2011.⁷ These included a focus on improving medication safety and patient outcomes, developing lifelong learning skills, improving communication capabilities, and preparing pharmacy students for their role as members of a healthcare team. Additionally, a number of the concepts defined in the subdomain goals in the recent CAPE Education Outcomes 2013 report were also found to be included in the course, specifically: (1) a focus on patient-centered care; (2) the ability to identify and analyze emerging theories and information; (3) innovation and entrepreneurship; and (4) ensuring that instructional content contains the most current information relevant for the intended audience.⁸

DESIGN

The elective course was offered to second- and third-year pharmacy students, and its structure included 3 hours of lecture per week (two 1.5 hour class sessions), weekly written quizzes, participation in class discussions and case studies, and a comprehensive final group project

that required application of materials discussed in lecture. Table 1 lists the lecture topics covered in the course each semester. Several assessment strategies designed to evaluate student comprehension of the covered topics were used to influence future course offerings.

A new topic was introduced in each class session, which resulted in at least 2 dermatologic or cosmeceutical topics being taught each week. Administered at the beginning of class once weekly, quizzes were primarily short answer and covered topics learned the previous week. The weekly quizzes rather than periodic examinations provided the instructor with a methodology to maintain the base of course work on schedule. Student performance on the quizzes and its relation to changes in the course design were assessed. Class participation was monitored extensively throughout the semester because the value of this course was directly dependent upon it. The instructors used assessments of the quantity and quality of each student’s participation as a basis for periodic feedback concerning progress in the course. Students received points for participation based on classroom discussions and homework assignments. To facilitate class discussions, students were often required to prepare for class through assigned readings posted on Blackboard (Blackboard Inc., Washington, DC). Class sessions devoted to case studies were held twice during the course

Table 1. Lecture Topics in Dermatological Therapeutics and Topical Delivery Systems

Dermatologic disease states
Skin anatomy
Fungal and viral skin infections
Wounds, burns and scars
Acne
Rosacea
Psoriasis
Atopic dermatitis
Drug-induced dermatologic reactions
Bacterial skin infections
Pediculus humanus capitis
Skin cancer
Dermatologic over-the-counter products and counseling
Cosmeceuticals and compounding
Basic calculations in compounding
Overview of topical delivery systems
Compounding techniques and terminology
Quality and safety
Industry views on cosmeceuticals
Common ingredients in cosmeceuticals
Cosmeceuticals in practice (guest speaker)
Regulatory issues
Entrepreneurship and marketing

semester to provide students with the skills necessary to appropriately evaluate and treat an individual patient's condition in a thorough and comprehensive manner. To illustrate the complexity that can be present in real-world patients, the case studies integrated several topics learned to date into 1 case. Students were divided into small groups (approximately 3-4 students per group) and given 1 case to complete. Each case contained open-ended questions to facilitate the students' thought process and promote discussion within the group. Although several different cases were distributed, at least 2 groups were given the same case. Recognizing that there is often more than 1 correct approach in treating a patient, the 2 groups with the same case were then asked to present and defend their treatment approach. Students were assigned to different groupings for each case study class. The case studies used in this course were not evaluated for research purposes but rather were an integral part of the active-learning design of the course.

Students were expected to complete a final group project by the end of the semester. For this project, students were assigned to groups and required to propose a formulation of an appropriate cosmeceutical product for the treatment of a given dermatologic condition. Students submitted a written paper describing their project, including its formulation, compounding instructions, and quality-testing procedures. Emphasis was placed on integrating principles of therapeutics with patient-specific dosage form design. Students submitted a written copy of their marketing plan and made an oral presentation to the class. The final 2 class meetings of the semester were devoted to laboratory time during which students had the opportunity to compound their proposed formulation. The

project rubric was used in conducting a descriptive preliminary analysis of students' strengths and weaknesses. This study was approved by the Duquesne University Institutional Review Board.

The course had 4 primary student-learning outcomes: (1) recognize dermatologic disease states commonly encountered in the ambulatory setting; (2) recommend appropriate treatment or referral for dermatologic conditions; (3) apply cosmeceutical compounding principles to prepare products that meet specific patient dermatologic needs; and (4) create a business plan proposal for a cosmeceutical product. These outcomes were met through various student-learning assessment strategies, including pre- and post-course tests (student learning outcome 1), weekly quizzes (student learning outcomes 1 and 2), case studies (student learning outcomes 1 and 2), and a business plan project with compounding activity (student learning outcomes 3 and 4). To answer the research questions regarding the effectiveness of the course on student learning outcomes, 3 of the assessment strategies were analyzed and used to modify future course offerings (pre- and post-course tests, weekly quizzes, and business plan project). Additionally, a postgraduate survey instrument was used to answer the second research question of determining the effectiveness of the course on graduates' careers 1 year after graduation. A summary of the course student learning outcomes, research questions, and assessment strategies is presented in Table 2.

EVALUATION AND ASSESSMENT

The primary purpose of the course evaluation was to modify and improve future course content based on student learning outcomes. Additionally, assessment of

Table 2. Association of Research Questions to Learning Outcomes and Assessment Strategies

Research Questions	Student Learning Assessment Strategies	Weight of Student Learning Assessment in Final Grade Calculations, %	Student-Learning Assessment Strategy Link to Student Learning Outcome (SLO) ^a	Research Evaluation
To determine the effectiveness of a new dermatology and cosmeceutical course on student learning outcomes	Pre- and post-course tests	N/A	SLO 1	Yes
	Class participation	20	N/A	No
	Case studies	10	SLO 1 and 2	No
	Weekly quizzes	30	SLO 1 and 2	Yes
	Business plan project and compounding activity	40	SLO 3 and 4	Yes
To determine the effect of the course on graduates' careers 1 year after graduation				Yes, via postgraduate survey

^a Student Learning Outcomes (SLO): (1) recognize dermatologic disease states commonly encountered in the ambulatory setting; (2) recommend appropriate treatment or referral for dermatologic conditions; (3) apply cosmeceutical compounding principles to prepare products that meet specific patient dermatologic needs; (4) create a business plan proposal for a cosmeceutical product.

the value of the course on students' postgraduate careers was performed to meet the faculty's long-term goal of preparing students for not only today's pharmacy workplace environment but also a successful and marketable pharmacy practice in the future.

A 32-question, multiple-choice pre- and postcourse test, given on the first and last days of the course, asked questions relating to each topic presented throughout the semester. Student responses indicated the degree to which an individual student had increased his/her knowledge and comprehension of course topics. The comparison of pre- and post-course scores on this test served as a fundamental test for the effectiveness of the course each year. Assuming the course was effective in meeting the objectives of the curriculum, the expected outcome would be an improvement in final score compared with that of the

initial pre-course assessment. The use of quantitative scores with a consistent scale from year to year permitted a test of this hypothesis using standard statistical methods. Although the score earned on these tests was not used in final grade calculations, it served as a benchmark for each individual student to measure his/her learning progress in the course as well as an instrument for faculty members to use in measuring areas of obvious content deficit.

The hypothesis that the improvement in scores was consistent from year to year was tested by analyzing the differences between pre- and post-course scores as a 1-way analysis of variance using Minitab, version 16 (Minitab Inc, State College, PA). Calculating the differences between scores permitted a more sensitive assessment of improvement by letting each student serve

Table 3. Responses to Demographic Portion of Postgraduate Survey Instrument

Survey Item	Response Option	Response, No. (%)
In what type of pharmacy setting do you currently work?	Retail-chain grocery	5 (14.3)
	Retail-chain, nongrocery	18 (51.4)
	Independent	0
	Mail order	1 (2.9)
	Hospital	5 (14.3)
	Long-term care	1 (2.9)
	Industry	0
	Postgraduate work (residency, fellowship, graduate school)	4 (11.4)
	Other	1 (2.9)
What type of pharmacy internship did you have at the time you took the dermatology course at Duquesne?	Retail-chain grocery	10 (28.6)
	Retail-chain, nongrocery	19 (54.3)
	Independent	1 (2.9)
	Mail order	1 (2.9)
	Hospital	1 (2.9)
	Long-term care	3 (8.6)
	Did not have an internship	0
	Other	0
Do you currently own, or co-own, a pharmacy?	Yes	0
	No	35 (100)
Do you provide compounding services in your current practice? ^a	Yes	19 (54.3)
	No	16 (45.7)
Approximately how many compounds does your pharmacy prepare per month? ^a	0	10 (28.6)
	1-5	14 (40)
	6-10	5 (14.3)
	>10	4 (11.4)
	Unsure	2 (5.7)
Do you currently offer any type of cosmeceutical compounding?	Yes	1 (2.9)
	No	34 (97.1)

^a Many respondents indicated that while they did not consider their place of employment to be a "compounding pharmacy," they still offered some basic compounding services, such as magic swizzle. This accounts for the discrepancy in responses between the questions "Do you provide compounding services in your current practice?" and "Approximately how many compounds does your pharmacy prepare per month?"

as his/her own control. The average postcourse test scores improved by at least 8.5 points each year. This score difference was significant at the $\alpha=0.05$ level ($p=0.018$). The minimum sample size required to make statistical comparisons at the $\alpha=0.05$ level of subject-matter knowledge improvement was based on the prediagnostic test scores from 2010, which were available at the onset of the study. The base statistics for pre-course scores in 2010 gave estimates of the mean and standard deviation of 14.3 and 3.39, respectively. Assuming that the standard deviation for paired differences would be equal to this estimate, a power curve was generated to determine the minimum sample size that would detect a difference equal to 10% of the mean (1.5). The resulting power curve predicted that a sample of 56 would provide 90% power. This study included analysis of 83 student pre- and post-course tests that provided an adequate sample size to show significance. An analysis of the weekly quiz topics was conducted for all 3 years (2010, 2011, and 2012). The scores for individual topics for all classes were combined and analyzed to determine whether there were any differences. The analysis was performed using the analysis of means procedure. An alpha value of 0.05 was specified as the level for significance.

The results of this analysis suggested that 2 topics were significantly below the average score of 8.7/10, whereas 4 were significantly above average. The average score for "Common Ingredients in Cosmeceuticals" was the lowest, with a group mean of 5. The average score for the topic "Compounding Techniques and Topical Delivery Systems" (7.6) was also low compared with the average. Scores significantly higher than average were observed for the topics "Compounding Calculations and Skin Cancer," "OTC Counseling and Atopic Dermatitis," "OTC and Wounds, Burns, and Scars," and "Entrepreneurship and Marketing."

The group project rubric was used to provide student groups aggregate feedback on their projects and, therefore, was not practical for individual student performance evaluation. Categories of the rubric included: Level of Writing and Organization (5 points), Spelling and Grammar (5 points), Introduction and Conclusion (10 points), Discussion of the Disease State (20 points), Description of Similar Services/Products (10 points), Product Descriptions (10 points), On-Site Testing (20 points), Legal Implications (10 points), Marketing Strategy (20 points), and Supportive Documents (flyer and brochure) (10 points). The rubric is available from the author upon request.

A preliminary descriptive analysis of student strengths and weaknesses for the business plan project was conducted. Fifteen business plan rubrics from the course offerings of 2010, 2011, and 2012 were combined and analyzed. The overall average score on this project was 101.75/120 (84.8%). The most common content area for point losses was the "Product that is Being Marketed" section. Specifically, average group scores for this section were: product description, 7.80/10; on-site testing, 19/20; and legal implications 8.15/10. Results of this analysis were used to improve the teaching of this content area in future course offerings.

The postgraduate survey instrument was provided to students 1 year after graduation. The survey was sent to 63 graduates who had completed the course and had 1 year of experience in the workplace. Thirty-five graduates returned a survey instrument, for a response rate of 55.6%. Student demographics are presented in Table 3. The results of the survey, which are provided in Table 4, showed that approximately 54% of course graduates were employed at a pharmacy that provided compounding services; however, only 1 of those pharmacies provided cosmeceutical compounding. While this dermatological elective

Table 4. Responses to Rating-Scale Portion of Postgraduate Survey Instrument Regarding Impact of Course

Survey Item	Not Significant, No. (%)	Somewhat Significant, No. (%)	Neutral, No. (%)	Significant, No. (%)	Extremely Significant, No. (%)
How great of an impact did the dermatology elective course have on your postgraduate career plans?	13 (37.1)	3 (8.6)	15 (42.9)	4 (11.4)	0
How important was the information you learned in the dermatology elective course to your current career?	3 (8.6)	9 (25.7)	12 (34.3)	11 (31.4)	0
What role did this course play in your ability to confidently counsel patient on dermatologic conditions?	2 (5.7)	7 (20)	6 (17.1)	14 (40)	6 (17.1)
What role did this course play in your ability to recommend appropriate OTC products for dermatologic conditions?	1 (2.9)	7 (20)	9 (25.7)	13 (37.1)	5 (14.3)
What role did this course play in your interest in providing compounding services?	10 (28.6)	5 (14.3)	13 (37.1)	7 (20)	0

Abbreviation: OTC=over the counter (nonprescription).

had had little impact on their postgraduate career plans at the time of the survey, 57% of survey responders said the course played a significant or very significant role in their ability to confidently counsel patients on dermatologic conditions. Additionally, 51% responded that the course played a significant or very significant role in their ability to recommend appropriate nonprescription products for dermatologic conditions.

DISCUSSION

The course, which was entitled “Dermatological Therapeutics and Topical Delivery Systems,” was created to increase students’ knowledge of dermatologic conditions and cosmeceutical products. Each year, course faculty members used several assessment strategies to gain insight into course effectiveness and make appropriate changes for improvement in outcomes. For example, there were 2 topics on which participants scored well below average in the weekly quizzes: “Common Ingredients in Cosmeceuticals” and “Compounding Techniques and Topical Delivery Systems.” Students also scored lowest in the group project rubric section describing their proposed cosmeceutical products. To address this deficiency, the course offering in 2013 was modified to spend more time on these topics. Specifically, a local pharmacist who owns and operates a cosmeceutical compounding pharmacy was brought in as a guest speaker for 2 lectures. She spoke to the students about the most commonly used cosmeceutical ingredients and products as well as pertinent counseling for patients using these products. She also served as a resource for advice and feedback for students when developing cosmeceutical products for their business plan project. To address the lower scores in compounding and topical delivery systems, a faculty member who teaches pharmaceutical compounding at the school was added to the elective course faculty.

One of the primary purposes of this course was to increase student knowledge of dermatologic topics and cosmeceutical products, thus enabling them to better counsel and treat patients in practice. As a result, this elective course may present these graduates as more marketable to pharmacies who are engaged in dermatologic compounding activities or even expanding into cosmeceuticals. While the results of the postgraduate survey showed little impact on these graduates’ career plans at the time of the survey, over half (57%) said the course played a significant or very significant role in their ability to counsel patients on dermatologic conditions. According to the survey results, 65.7% of respondents were working in community pharmacy (eg, retail chain grocery or nongrocery). This number is slightly lower

than average for the study pharmacy school, wherein approximately 82% of graduates enter some form of community pharmacy setting. Given that these graduates were in the early stage of their careers, their responses on the postgraduate survey likely reflect limited experience.

Although this is an elective course, there has been strong and positive feedback from the students. Each year prior to graduation, students in the Mylan School of Pharmacy complete a survey instrument regarding the pharmacy curriculum. Based the student feedback received, 4 hours of dermatologic course work has been added as a requirement for second-year PharmD students at Duquesne University. The authors are gratified by this development and confirmation of the value of this course.

The authors intend to do an additional survey 5 years after graduation to determine the potential longer-term relevance and benefit of the course, and to examine the outcome of the forecasts for growth in the cosmeceuticals market. It is anticipated that market growth and an increase in consumer awareness of cosmeceuticals in the next few years may encourage more pharmacies – particularly at the retail level – to include cosmeceutical compounding in the services they provide. If that is the case, these graduates will be prepared to use the knowledge and skill developed in this course.

SUMMARY

The course was effective in meeting its stated student learning objectives. The value of teaching student pharmacists about dermatologic conditions was recognized by the school and resulted in its content delivery within the required classroom curriculum. The elective course was moderately beneficial in improving confidence in dermatologic counseling in newly licensed pharmacists. An impact of the course on pharmacists’ roles with regards to cosmeceutical compounding remains to be seen.

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