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Integrating Online Genetics into Existing Physician Assistant Curriculum –The Experience at Nova Southeastern University

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Abstract

The study of genetics is a required standard for the accreditation of physician assistant programs. Nova Southeastern University instituted an online genetics course for the four physician assistant programs in the College of Health Care Sciences to be delivered asynchronously. Although there were a few technical issues, the student satisfaction levels and student performance levels demonstrated a successful implementation of the online course into an existing physician assistant curriculum.

Introduction

Nature of the Problem

Learners enrolled in physician assistant (PA) training programs need to have a basic understanding of medical genetics in order to successfully transition from students to clinicians. The field of medical genetics is advancing at a fast pace and is becoming increasingly integral to all aspects of medicine. This facilitates the need for every practicing clinician to develop an in-depth knowledge of the principles of human genetics, since they are applicable to such a wide variety of clinical presentations. Effective September, 2006, the Accreditation Review Commission on Education for the Physician Assistant, Inc. (ARC-PA) required that medical genetics be included in the curricula of every PA program (ARC-PA, 2005). The experience of implementing an asynchronous online medical genetics curriculum for 239 students at enrolled in four PA programs at Nova Southeastern University will be described.

Institution and Programs
Nova Southeastern University is the largest independent not-for-profit university in the Southeast with an enrollment of approximately 26,000 students. Originally established in 1964 as Nova University, the institution merged with Southeastern University of the Health Sciences in 1994 creating Nova Southeastern University. The university is fully accredited by the Commission on Colleges of the Southern Association of Colleges and Schools and awards numerous degrees from associate’s level to doctoral level encompassing a wide range of fields including education, computer and information sciences, marine sciences, psychology, social sciences, business, law and the health professions. The degree programs are available through 16 academic centers or regional campuses ranging from the main campus in Ft Lauderdale, FL to other locations throughout Florida, and at international sites in Mexico, Europe, Central and South America, the Pacific Rim, and the Caribbean.

The Health Professions Division has seven colleges with more than 5,800 students including the College of Osteopathic Medicine, College of Pharmacy, College of Optometry, College of Medical Sciences, College of Dental Medicine, College of Nursing, and the College of Health Care Sciences, which is home to the four physician assistant programs. The Health Professions Division provides an interdisciplinary approach to medical education to prepare the student to be part of tomorrow’s dynamic health care team and houses the Health Professions Division Library, 20 outpatient health centers, and a pharmaceutical care center.

There are four separately accredited physician assistant programs within the College of Health Care Sciences located at the main campus in Ft Lauderdale, Jacksonville, Ft Myers, and Orlando. The first physician assistant class graduated from Nova Southeastern University Ft Lauderdale Campus in 1995 with the Southwest Florida Program in Ft. Myers enrolling its initial class in 2005, the Orlando program followed in 2007, and the Jacksonville program in 2009.
Physician assistant alumni from the NSU programs number approximately 2,000 and the majority of graduates practice within the state of Florida. All four programs are accredited through the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) and award a Master’s of Medical Science to Bachelor’s prepared candidates after successful completion of the 27 month curriculum which includes 15 months of didactic education and 12 months of clinical rotations for a total of approximately 152 credit hours. There are approximately 50 full time faculty and administrations across the four PA programs with extensive experience in PA education and a large diversity of clinical practice experience from a variety of different specialties.

A critical analysis of this experience provides an opportunity to examine the institution, the population served, a review of the literature, discussion and recommendations. The goal of the overall experience allows faculty to

1.) Evaluate an existing PA program curriculum.
2.) Develop the skill to produce recorded lectures.
3.) Develop learning activities that are self-paced and learner directed.
4.) Understand how to integrate new material into existing curriculum
5.) Identify external resources to assist PA students in medical genetics.
6.) Utilize online technology and experiences to enhance learning.

**Review of the Literature**

**Integrating New Information**

The incorporation of medical genetics into medical education and residency training programs continues to be underway (Burke et al., 2002; Harris et al.; Riegert-Johnson et al., 2004). However, because the understanding of genomics is relatively new, a gap exists in the
education and training of those practicing clinicians and the new information (ASHG, 2001; Burke, Stone, Bedward, Thomas, & Farndon, 2006; Guttmacher, et al., 2007). To assist in closing this gap, the ASHG, in conjunction with the Association of Professors of Human and Medical Genetics, has developed the “Medical School Core Curriculum to provide guidance to deans and curriculum committees regarding medical genetics knowledge, skills, and behaviors that all current medical students will need during their careers as physicians” (ASHG, p.1). In addition, the National Coalition for Health Professional Education in Genetics (NCHPEG), has published recommended core competencies in genetics for all health professionals with the goal of integrating genetics “effectively and responsibly into current clinical practice and education of health professionals”, which will result in the delivery of “effective and comprehensive services to individuals and families” (NCHPEG, p. 4).

In a survey of genetics education among PA programs, Goldgar and Rackover (2007) found that the majority of respondents expressed the need for improvement in their existing medical genetics curricula. A majority also indicated that they were in the planning process of making those changes at the time of the survey (Goldgar & Rackover). While the methods of delivery varied widely among PA programs, respondents reported similar needs (Goldgar & Rackover). “Centrally developed” curriculum resources, lectures with slides, case studies, Web-based resources, self-instructional materials, and problem-based materials were ranked to be very helpful for both PA faculty and students (Goldgar & Rackover, 2007, p. 59).

Aspinall and Hammermesh (2007) suggest that the focus of genetics curricula should be on the “importance of accurate diagnosis and the science of diagnostics” (p.7). These authors also underscore the importance of students understanding the “underlying science and its application to diagnostic and therapeutic tools” (Aspinall & Hammermesh, p.7). Finally, the
primary learning objectives and curriculum content incorporated into PA education should resemble that of their physician counterparts (Association of American Medical Colleges, 2004; Burke et al., 2006; Riegert-Johnson et al., 2004).

According to Maslow’s hierarchy of needs (as cited in Hutchinson, 2003), certain basic needs must be met before optimal learning and development can take place. Within the program planning, this will be the first consideration. The second step in program planning is to develop and state the learning objectives in the areas of knowledge, skills, and attitudes (Bloom, Mesia, & Krathwohl, 1964). This facilitates the transfer of learning since students have a clear end point when they begin the program (Caffarella, 2002). It is important to incorporate the learners’ previous experience and knowledge into the program by asking questions that lead them to a conclusion via the Socratic Method (Oh, 2005).

The principles of adult learning theory include: (a) adults learn best when new information builds on past knowledge and experience, (b) adults want to apply their learning to real life situations, (c) adults want to be actively involved in the learning process, and (d) adults learn best when in supportive and safe learning environments (Cafferella; Kaufman, 2003). Specific to medical genetics, surveys of prospective learners indicate that clinical relevance of genetic concepts is of key importance (Burke et al., 2006; Riegert-Johnson et al., 2004.)

On-line Delivery

Since the concepts and principles of medical genetics are multidisciplinary and complex, it is especially important to consider the most efficient and effective methods of delivery during the program planning. As stated in the preamble of the ASHG’s Medical School Core Curriculum in Genetics guidelines (ASHG, 2001):

“Medical genetics can be taught effectively by a variety of methods and in various formats……… and it involves integration of skills and knowledge from many fields.
Genetics can also be taught in various clinical contexts and at different points in clinical training. Specific clinical examples are important, but the focus of the curriculum must be on medical genetic principles illustrated by the examples (p.1).”

According to Cook and Dupras (2004), it is possible to integrate many of the traditional applications of effective learning in the Web-based format. The important steps in this type of program planning include: (a) performing a needs assessment; (b) developing specific outcome goals and objectives in the areas of knowledge, skills and attitudes; (c) taking an inventory of the technical resources available relative to the programs needs and goals; (d) evaluating any preexisting software; (e) obtaining a commitment from all participants; (f) identifying and addressing potential barriers to implementation; (g) developing content in close coordination with Website design; and (h) establishing a timeline for development and implementation (Association of American Medical Colleges, 2004; Cook & Dupras).

Within the curriculum and the program learning activities, the developer should strive to encourage active learning by utilizing methods such as: (a) self-assessment, (b) reflection, (c) self-directed learning, (d) learner-learner interaction, and (e) feedback (Cafferella, 2002; Hutchinson, 2003; Kaufman, 2003; Oh, 2005). The roles of both the learner and facilitator should be clearly defined, allowing the facilitator to encourage learner participation (Cook & Dupras, 2004). This can be accomplished by making the Website accessible, making it simple and user-friendly, providing time for active learning, providing resources and interacting in a manner that is motivating to the learners (Cook & Dupras). The facilitator is also responsible for evaluating the learners’ progress and the program content including monitoring of on-line communication and maintenance of the site (Cook & Dupras).

As suggested by Riegert-Johnson et al. (2004), in addition to the specific learning objectives, the program should include an appreciation of the rapid advances in genetics, the
need for lifelong learning, the need for referral, and the role of genetic counselors and medical geneticists, as well as developing the ability to construct and analyze a three-generation pedigree. This can best be accomplished by using a variety of teaching methods such as didactic lectures, interactive multi-media devices, clinical case presentations, standardized patients and ethical dilemmas (Association of American Medical Colleges, 2004; Riegert-Johnson et al.). Medical genetics should also be incorporated into the curriculum throughout all phases of training (Guttmacher et al., 2007; Riegert-Johnson et al.).

Distance education, as defined by Knebel (2001), is the teaching and learning relationship in which the facilitator is physically separated from the learners. In this format, the instruction is delivered by alternative methods that replace the face-to-face model of the traditional classroom, to include on-line discussions and Web-based instructional materials and evaluations. This method requires a self-directed learner and a facilitator that is efficient and available (Knebel; Sandars & Walsh, 2005).

Successful programs delivered in this format were noted by Knebel (2001) to have some similar characteristics. First, limited contact between the learner and facilitator will force the learner to be more self-reliant. The condition of this precept is that a reliable method of communication must be established between the two parties. As noted by Knebel (2001), the facilitator must be available on a regular basis for guidance and provide “timely and constructive feedback” (p.6). As for the learning materials themselves, the use of mixed media may address variable learning styles inherent to diverse adult learner populations (Knebel, 2001). The learners must have instructional and supportive materials that are easily accessible such as hyperlinks, tutorials, or other Web resources (Knebel; McKimm, Jollie & Cantillon, 2003).
In accordance with the American Distance Education Consortium’s (ADEC) guiding principles for distance teaching and learning (ADEC, 2002), the following questions can be used as a check list to develop and evaluate Web-based courses:

1.) Are there a clear purpose, outcome, and objective(s) to the course or program?
2.) Are the learners motivated, engaged, and interested?
3.) Does the lesson plan utilize a variety of media?
4.) Does the lesson plan include both problem-based and knowledge-based learning?
5.) Does the lesson plan include an interactive component?

When the targeted audience is working, professional, adult learners, the advantages of on-line learning are a perfect fit. As noted by McKimm et al. (2003), the unlimited availability of resources, universal access to materials, and environment of independent and active learning are appealing qualities of this format.

Blackboard and Moodle are examples of commonly used Web-based learning management systems within PA programs. These systems allow student-student and faculty-student interaction during the didactic and clinical phases of the program via the World Wide Web. The learning process often involves the use of tools such as narrated PowerPoint presentations, threaded discussions, interactive chats, and electronic examinations.

Knebel (2001) noted that Web-based instruction requires more faculty time and can be limited by both the facilitator’s and student’s knowledge and skill. As reported by Cook & Dupras (2004), successful instructors of Web-based courses have proficiency in self-assessment, reflection, curriculum design and learner interaction. This format also requires that technical resources and software needs and compatibility be determined in the initial stages of planning (Cook & Dupras).

Summary
The literature concurs with the idea that the subject of medical genetics may be best delivered to the proposed audience of adult learners in an on-line format based on the following: The audience of adult learners is a good fit for the on-line format since the resources are perpetually available, the course can be self-paced, and self-directed, and active learning can be easily integrated (McKimm et al., 2003).

The on-line method of delivery has well-established guidelines that will serve to facilitate the development and evaluation of the course (ADEC, 2002). This format can accommodate many of the methods consistent with the principles of adult learning, such as the use of mixed media, and methods of providing feedback (ASHG, 2001; Knebel, 2001).

The principles of adult learning theory follow the precept that optimal learning occurs when new information builds on past knowledge and experience, and there is a need for real life application of the new knowledge or skill. Adult learners have a strong desire to be actively involved in the learning process itself, but require supportive and safe learning environments (Caffarella, 2002; Kaufman, 2003). Existing guidelines for the medical genetics curriculum can serve to facilitate and standardize the course content to achieve the desired outcome (ASHG, 2001; NCHPEG, 2007).

The content should focus on the underlying science of genetics, accurate diagnosis, the science of diagnostics tools, and therapeutic tools (Aspinall & Hamermesh, 2007). This information should be reinforced with clinical case studies designed to demonstrate the principles of medical genetics (ASHG, 2001; Caffarella, 2002; Kaufman, 2003).

The online format supports a variety of teaching methods such as didactic lectures, interactive multi-media programs, clinical case presentations and ethical dilemmas (AAMC, 2004; Riegert-Johnson, et al., 2004).
The on-line curriculum is flexible, allowing it to be integrated at any point in time in existing PA curricula (ASHG, 2001; Guttmacher et al., 2007; Riegert-Johnson et al., 2004). The dynamic nature of genetics requires continuous updates and changes to the curriculum. This can be accomplished efficiently in an online format as new information, diagnostic technologies and required skills emerge in the field of medical genetics (Cook & Dupras, 2004; Riegert-Johnson et al., 2004).

The curriculum meets the needs of the PA faculty because it meets a requirement for accreditation, requires minimal time and effort to implement, and reinforces current curriculum concepts by employing a case-based format (Goldgar & Rackover, 2007).

**Activities**

The overall goal was to learn how to implement a medical genetics curriculum into the existing PA curricula at four distinctly separate NSU campuses. This was initiated in two parts by a comprehensive evaluation of the existing curricula and revision and implementation of the genetics curriculum.

The assessment of the existing PA curricula at NSU began with a review of all course syllabi and learning objectives. For each course within the PA program curriculum, there are numerous modules. Each module has a separate set of learning objectives comprised of the knowledge, skills and attitudes that should be designed to assure competency in those topic areas. The method of delivery and learning activities were optimized to support this outcome. All learning activities were specifically structured and implemented for the audience of adult learners to ensure that they linked the new information to clinically relevant knowledge and required critical thinking through the use of case studies and asynchronous discussions.
Instead, an overall summary of activities was obtained by discussion with the program directors and core faculty. The majority of time and effort remaining was exerted in the conversion and implementation phase of the experience. Upon review of all clinical medicine sections within the didactic curriculum, the list of modules within each course was utilized to identify the logical location for each genetics topic. Previously, we developed a medical genetics curriculum as a practicum a health professions doctoral program. This existing curriculum was modified for online delivery and self-paced learning by narrating the presentations and providing instructions for related learning activities. To prepare to narrate the lectures, speakers and microphone settings were adjusted according to the recommendations. After each narrated lecture, I reviewed the recording for accuracy and quality. These eighteen (18) narrated lectures were then inserted into modules over the ten week course. Each module contains a 15-20 minute lecture as well as a follow up activity related to the topic and 2-3 multiple choice questions follow each presentation. The first slide of the lecture lists the learning objectives and the last slide of each presentation includes additional resources for the self-directed learner such as Web-based tutorials and Internet resources. The modules for each course are loaded into Blackboard and are password protected. The assignments were not given a specified due date and were set up for unlimited accessibility. There are two examinations comprised of 50 multiple choice questions each. The first examination covers materials from Module 1-5 and the second examination covers materials from Modules 6-10. The examinations are given in a live proctored testing center via the Blackboard learning management system utilizing the respondus lock down browser. All examinations begin at the same time and all students allotted 1 minute per questions unless they have an ADA requirement allowing additional time. At the conclusion of each submission, students are permitted to review their examination in the proctored room.
Results

Sample Description

All study participants (n=239) were students in the Class of 2015 in the four physician assistant (PA) programs of the College of Health Care Sciences at Nova Southeastern University. The students were geographically separated at four campuses across the state of Florida; including the Ft Lauderdale campus (n=70), the Ft Myers campus (n=57), the Orlando campus (n=61), and the Jacksonville campus (n=52). The course was offered in the 4th semester of the didactic curriculum for all students.

Student Evaluations of Course

All students had the opportunity to complete the student evaluations with the exception of the students from the Ft Lauderdale campus (n=70) due to a clerical error when the student evaluations were constructed for the term. There was a 100% participation rate in completing the student evaluations (n=169) from the remaining campuses.
Table 1

*Student Evaluations of Course – mean score for each parameter (r=1-4)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>JAX</th>
<th>FTM</th>
<th>ORL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Organization of course</td>
<td>3.17</td>
<td>3.48</td>
<td>3.42</td>
</tr>
<tr>
<td>2. Course relevance</td>
<td>3.29</td>
<td>3.47</td>
<td>3.44</td>
</tr>
<tr>
<td>3. Course activities</td>
<td>3.15</td>
<td>3.42</td>
<td>3.35</td>
</tr>
<tr>
<td>4. Grading</td>
<td>3.14</td>
<td>3.47</td>
<td></td>
</tr>
<tr>
<td>5. Course resources</td>
<td>3.23</td>
<td>3.45</td>
<td>3.44</td>
</tr>
<tr>
<td>6. Instructional design</td>
<td></td>
<td></td>
<td>3.46</td>
</tr>
<tr>
<td>7. Instructor Preparation</td>
<td>3.14</td>
<td>3.49</td>
<td>3.52</td>
</tr>
<tr>
<td>8. Instructor Presentation</td>
<td>2.99</td>
<td>3.43</td>
<td>3.41</td>
</tr>
<tr>
<td>9. Assessment of student</td>
<td>3.15</td>
<td>3.42</td>
<td></td>
</tr>
<tr>
<td>10. Student-instructor interaction</td>
<td>3.01</td>
<td>3.41</td>
<td>3.48</td>
</tr>
<tr>
<td><strong>11. Overall satisfaction</strong></td>
<td><strong>3.14</strong></td>
<td><strong>3.45</strong></td>
<td><strong>3.44</strong></td>
</tr>
</tbody>
</table>

Table 2

*Student Evaluations of Course – mean score for each question (r=1-4)*
The majority of the written comments about the course were complimentary, however, there were a few comments, mostly from the Jacksonville program, pertaining to a perceived lack of appropriate communication from the instructor. These comments do correlate to the lower scores on the students evaluations completed by the Jacksonville campus.

**Student Performance**

All students (n=240) completed the same online 50-question multiple-choice written examinations simultaneously on two occasions for a total of two written examinations. All students also completed a family pedigree project and graded discussion board postings. There was a total of eight exam failures but no course failures. There was no statistical difference between the student performances at each campus (r=90.3-92.4).

Table 3

*Student Performance per Campus*

<table>
<thead>
<tr>
<th>Campus</th>
<th>Number of Exam Failures</th>
<th>Average course grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacksonville (n=52)</td>
<td>3</td>
<td>90.68</td>
</tr>
<tr>
<td>Ft Lauderdale (n=70)</td>
<td>1</td>
<td>92.37</td>
</tr>
<tr>
<td>Ft Myers (n=57)</td>
<td>2</td>
<td>90.30</td>
</tr>
<tr>
<td>Orlando (n=61)</td>
<td>2</td>
<td>91.16</td>
</tr>
</tbody>
</table>

Table 4

*Mean exam score for each campus*
Discussion, Conclusions and Recommendations

The overall goal of this experience was to implement an online medical genetics curriculum for use within the advanced didactic phase of the NSU PA programs. This involved the initial evaluation of the existing curricula by assessing three general areas: (a) the curriculum materials, (b) the students and, (c) the faculty. The remaining effort was in the conversion and implementation of a traditional medical genetics curriculum. This experience supported the mission and vision of the institution by demonstrating innovations in teaching and in learning, growing the academic community among peers in our profession and supporting collaboration among four programs. Specifically, this experience fostered academic excellence, intellectual inquiry, leadership and research while underscoring the importance for life-long learning among students and faculty alike.

PA educators should be required to receive formal instruction and training in clinical genetics and in medical genetics education. PA organizations and academic institutions should serve as clearinghouses to provide more resources and access for updated information in the area of medical genetics. The importance of a standard curriculum in PA education for medical
genetics cannot be overstated considering the clinical importance and rapid changes in this dynamic field.

Within the four NSU programs, specific competencies in medical genetics should be added to the existing program list of competencies for the PA graduate. Existing learning activities should be restructured with a genetics perspective and added where applicable. NCCPA style review questions should be rewritten or developed to include pertinent genetic information. A medical genetics resource list should be made available to students in preclinical and clinical training years to augment their present list of clinical medicine resources available. Patient-student encounters should incorporate the genetic basis of any illness, disease or condition experienced by the learner. This should be reflected in their history and physical exams and progress notes (SOAP notes).

Further, the recommendation is made that this curriculum be periodically evaluated in relationship to effects on Physician Assistant National Certification Examination (PANCE) scores, student performance in the clinical year, post graduate clinical acumen and professional attitudes concerning genetics. This should assist in the task of keeping curriculum information current and improving efficacy in the curricula over time.
References


