Comparison of dissection-based vs. internet-based pelvic anatomy education for 3rd year medical students

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Abstract

With the inclusion of various technologies, teaching anatomy to medical students is in the midst of a transition in medical schools. The traditional anatomy curriculum based on topographical structural anatomy taught by didactic lectures and complete dissection of the body with personal instruction, has been replaced by a multiple range of special study modules, problem-based workshops, computer based education, plastic models, just to name a few of teaching tools employed. Most new tools in the literature are descriptive and lack efficacy data.

In this study we compared an internet-based anatomy module with traditional methods taught to the 3rd year medical students.

During 2008-2014, pelvic anatomy was taught to 3rd year medical students using dissection-based (DB) and internet-based (IB) methods. This module was composed of 30 minutes of a lecture with PowerPoint, 30 minutes of anatomy videos, 30 minutes of dissection lab, and a post-test at the conclusion. The 30 min of anatomy video course consisted of 30 minutes session designed to address the perineal external and internal anatomy, perineal muscles and neurovasculature, caudad view of levator ani muscle, lateral view of pelvic organs and vasculature, cephalad view of pelvic organs and nerves, and cephalad view of the levator ani muscle. The same course material and the PowerPoint presentations used were converted to digital format and taught as an internet-based (IB) module without inclusion of a dissection lab. We compared the students' performance at final assessment between DB vs. IB groups.

Comparison between DB and IB groups revealed significantly ($P<0.0001$) higher mean score for the IB group in all learning objectives except perineal Internal Anatomy ($P= 0.431$).

3rd year medical students demonstrated higher pelvic floor anatomy scores after completing an internet-based module compared to a traditional dissection based course.

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Introduction

The training of physicians has changed drastically with time. Medical education has evolved into a highly structured, regulated, and focused system imparting a vast amount of knowledge in a short amount of time[1,2]. There is increasing pressure on medical educators and administrators to teach a large number of students in an environment of increased cost and fewer numbers of teaching faculties. Anatomy, one of the pillars of medical education, historically involved experienced faculty, small class sizes, and cadaveric dissections. These issues combine to make anatomy instruction one of the more costly portions of medical education[3,4]. Medical schools have been attempting to design anatomy education to better fit a 21st century model of teaching. A survey in 1994 by the University of Texas – Galveston showed that at least 20% of medical schools in the U.S. and Canada were modifying their anatomy curriculum to include more problem-based learning and computer assisted teaching[5].

Computer based anatomy programs are finding a commonly accepted role in medical education. An overview of the available literature revealed a variety of tactics used to incorporate computer-based learning into anatomy teaching. In some cases it substituted traditional anatomy teaching and in other cases it is simply used as an adjunct teaching modality[4,6]. Many anatomists and clinicians alike are unsure about the trend in how anatomy is taught and argue that the traditional cadaver dissections are an irreplaceable experience of physician education[4,7].

Nonetheless, medical educators have experimented with the incorporation of technology into anatomy teaching. Many studies in this area use student survey or satisfaction questionnaires to assess the efficacy of computer-based anatomy learning[8]. Few studies have looked at objective academic outcomes such as test scores. Those studies find some modest benefit in the use of computer-based videos[9].

Studies show that using multiple modalities enforces learning in an efficient manner. Conflicting data on the effectiveness of new styles of learning and combinations of different styles raises the question "What is the best way to evaluate new educational modalities?"[9-11] The current study compares performance of teaching anatomy to 3rd year medical

students using an internet-based learning module to a traditional dissection-based course.

Materials and Methods

Study Participants and Module Course: 745 third year medical students who were rotating through the Obstetrics and Gynecology rotation were taught pelvic anatomy. The anatomy course was taught as part of the orientation to Ob/Gyn to groups of 15-20 rotating third year students at our institution. During 2008-14, anatomy was taught to 211 (28.3%) students using a traditional model of DB teaching, which included cadaveric dissection and a post-dissection test. All participants had previously completed the lecture and dissection course of female pelvis as part of the standard 1st year curriculum. This training module was composed of 30 min of lecture, 30 min of dissection lab, and a post-test. Post-test was the same for the both groups regarding questions' number and content. The same course material and the PowerPoint presentations used were converted to digital format and posted as a module on the internet (www.urogynecologist.com/education). 534 (71.7%) students were taught pelvic anatomy using a new IB course. The IB training module had the same lecture as the DB course, but included an internet-based anatomy module instead of the cadaveric dissection. Each student completed the learning course in 30 minutes and they had access to review/ rewind the study materials during 30 minutes. They took the quiz right after they finished their learning course.

In the DB course, before performing the cadaveric dissection, students were given a 30-minute video introduction, which covered the topics that would subsequently be pursued in the dissection laboratory. The same anatomy video was also used in the IB course and consisted of 30 minutes session designed to address the perineal external and internal anatomy, perineal muscles and neurovasculature, cauded view of levator ani muscle, lateral view of pelvic organs and vasculature, cephalad view of pelvic organs and nerves, cephalad view of levator ani muscle. All studying materials were available for the same amount of time for both groups. In the DB course, students observed the dissection of one female pelvis. They were assisted by one faculty member who performed the dissection and explained anatomical details when necessary. Institutional Review Board (IRB) exemption was obtained prior to analyzing the data.

Data Collection: The database was constructed using EXCEL (Microsoft Corporation, Redmond, WA). The DB paper quiz contained no subject identifier such as name, date of birth, or social security number. IB quiz results were automatically emailed to the primary investigator in a blinded manner and stored in a secure location.

Statistical Analysis

Statistical analysis was performed using SAS v9.2 (SAS Institute, Cary, NC). Summary statistics calculated for the patient population. Means and standard deviation are reported for all of the grouped data. Paired t-test and Student's t test for independent samples were used for data analyses. A p- value <0.05 was considered significant for all analyses.

Results

Table 1 and Fig. 1 summarize the results of the training module assessment scores regarding the pelvic floor anatomy learning objectives. Comparison between DB and IB groups revealed significantly higher mean scores in all learning objectives of the IB group except for perineal internal anatomy (p<0.0001). Perineal Internal anatomy quiz result showed no significant differences between DB vs. IB groups (1.97±0.20 vs. 1.92±0.71, p: 0.431). (Table 1) Lateral view of pelvic floor vasculature learning objectives` quiz showed higher rise after IB teaching module in contrast to other learning objectives (6.98±1.2 vs. 4.52±1.92, p:<0.0001). (Fig. 1)

Table 1: Comparison of quiz scores for nine domains between IB and DB groups after training course

Domain	Score	IB Post-Test	DB Post-Test	p
Perineal External anatomy	9	8.84±0.67	7.54±1.33	<0.0001
Perineal Internal anatomy	3	1.97±0.20	1.92±0.71	0.431
Perineal muscles	7	6.84±0.55	4.03±1.90	<0.0001
Perineal neurovasculature	4	3.73±0.59	1.46±1.09	<0.0001
Levator ani caudad view	3	2.81±0.53	1.39±1.25	<0.0001
Lateral view of organs	5	4.96±0.33	4.72±0.60	<0.0001
Lateral view of vasculature	8	6.98±1.27	4.52±1.92	<0.0001
Cephalad view of internal organs	4	3.84±0.42	3.63±0.56	<0.0001
Cephalad view of pelvic nerves	2	1.99±0.14	0.80±0.78	<0.0001
Levator Ani cephalad view	3	2.84±0.47	1.37±1.25	<0.0001
Total score	48	45.86±2.10	31.58±6.72	<0.0001

IB: Internet-based
DB: Dissection-based

All data are presented in Mean±SD

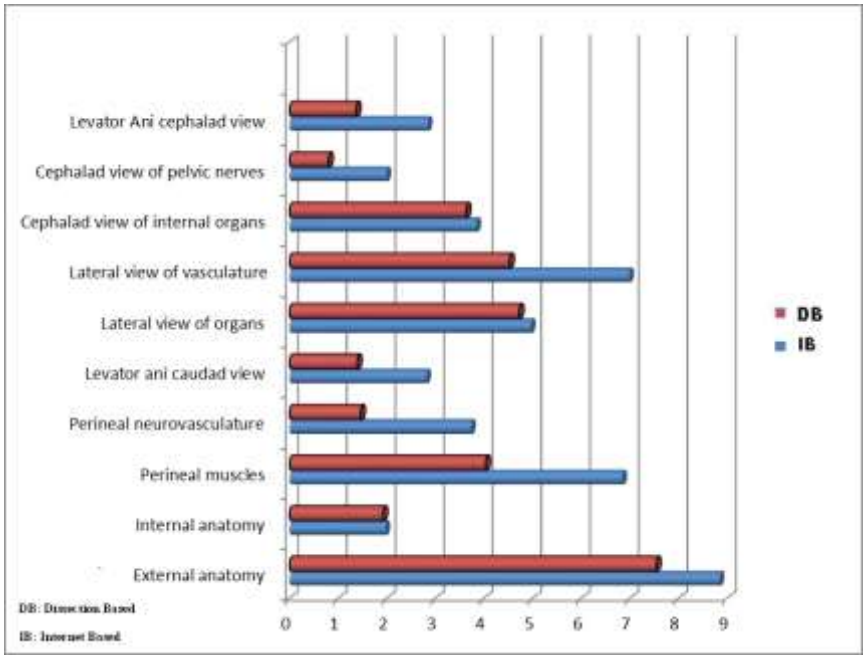

Fig. 1: Demonstrates post-test comparison of the IB vs. DB course

Discussion

Many medical educators are increasingly using e-learning and information technologies to support their curriculum design, delivery and evaluation. The use of multimedia in computer-based education has shown to improve a learner's ability to tailor their experience to desired learning needs[12-14]. Moreover, computer-based training can potentially help faculty to implement a better educational program with more personalized, efficient, effective, up-to-date, and accessible instruction. The IB module used in this study demonstrates how medical student learning of pelvic anatomy can be automated to minimize instructor's time spent to prepare the material. Although the up-front time investment required to create an internet-based course is greater, once accomplished and validated it can be used anywhere in the world with minimal costs.

The current study addressed the question of whether there was significant difference in academic achievement between IB and DB training modules. Students who were given the IB training module could achieve academic scores significantly higher than students who were given the traditional course. Furthermore, the course directors ultimately decided to completely replace the DB module with the IB based on student input. In our opinion, the IB module is a feasible replacement for the conventional DB learning module, as was affirmed by significant improvement in test results in the IB group (Table 1). It must be emphasized that IB modules may not fully replace traditional educational tools[15] even if they appear to be superior. The personal interaction between teachers and the students is valued by both the teachers and the learners. Currently, our IB module is used locally as a learning source for students along with reinforcement of learned anatomy in the surgical suites. For situations where the organization of proper lectures and laboratories remain a problem, it may be a useful[16], but then hardware costs may dramatically increase, contradicting the aim of economy.

Anatomy courses in US medical schools are evolving towards problem-based learning and systems-based learning[17]. The importance of students' learning styles and teachers' teaching styles to educational outcomes has been known for many years. There are several reasons to develop non-traditional methods of teaching human anatomy. Some areas of anatomy - including pelvic floor anatomy - are intrinsically more difficult for students to study than others and IB training may give students the opportunity to focus and learn at their own leisure rather than when they are mentally exhausted. Computer-based educations tools help improve understanding of complex anatomy structures. The modules that teach pelvic anatomy have been shown to improve better visualization and teach anatomical structures as reflected by improved resident performance on anatomy exams[16-18]. The internet-based or computer-based modules allow continuous return to material throughout medical training. In agreement with our results, research has shown that medical students who use computer-based instruction score significantly higher on anatomy examinations, independent of computer literacy[13]. Modules with a self-directed pattern of use allow one to over-learn certain cognitive skills until they become automatic.

This type of self-guided learning could make up for decreased contact hours and work-hour restrictions, enabling students and residents to acquire new knowledge outside of the classroom and clinical environment.

While it has been noted that use of computers during patient interaction can cause decreased empathy[19], technology should be embraced for medical education. As evidenced by our students, the students today are technologically savvy. Today's students may not be satisfied with computer-based learning which ties them down to a physical location. The students of today are relying on the web for daily functioning and although not formally assessed in the study, our students were grateful for the ability to complete the modules from a location of their choosing. As such, a limitation of our study may have been the absence of post-module qualitative feedback to survey on how the students responded to the IB module, which could better help us on evaluations of the usefulness of the IB module by the direct students` observations.

In conclusion, this large multi-year study demonstrated the importance of considering the IB pelvic floor anatomy module as an effective teaching tool for 3rd year medical student instruction. Given the widespread use of technology, ease in development of IB material, and the change in the way new generations are learning, IB methods will play increasing roles in teaching and assessment of medical trainees. Ongoing studies are warranted to critically assess the utility of each IB module that will be designed to replace or augment a traditional educational tool.

Contribution to authorship

Javadian P: Manuscript writing/editing, **SA Shobeiri:** study design, manuscript writing/editing, oversight of the study

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