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## WEB PAPER

# Anatomy teaching assistants: Facilitating teaching skills for medical students through apprenticeship and mentoring

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## Abstract

**Background:** Significant increase in the literature regarding “residents as teachers” highlights the importance of providing opportunities and implementing guidelines for continuing medical education and professional growth. While most medical students are enthusiastic about their future role as resident-educators, both students and residents feel uncomfortable teaching their peers due to the lack of necessary skills. However, whilst limited and perhaps only available to select individuals, opportunities for developing good teaching practice do exist and may be identified in courses that offer basic sciences. The Department of Anatomy, College of Medicine, Mayo Clinic offers a teaching assistant (TA) elective experience to third- and fourth-year medical students through integrated apprenticeship and mentoring during the Human Structure didactic block.

**Aim:** This article, aims to describe a curriculum for a TA elective within the framework of a basic science course through mentoring and apprenticeship.

**Results:** Opportunities for medical students to become TAs, process of TAs’ recruitment, mentoring and facilitation of teaching and education research skills, a method for providing feedback and debriefing are described.

**Conclusion:** Developing teaching practice based on apprenticeship and mentoring lends to more accountability to both TA’s and course faculty by incorporating universal competencies to facilitate the TA experience.

## Introduction

The perception that “medical students represent medicine’s future teachers” (Pasquinelli & Greenberg 2008) preludes today’s expectation that residents and attending physicians are required to teach (Amorosa et al. 2011). While the expectation remains a reality, for most clinicians, having the ability to translate important learning points in an effective way, remains a challenge (Sturman et al. 2011). McDougall and Drummond (2005) reiterate that although doctors are experts at *what* they teach, they lack the expertise on *how* to teach and often continue to depend on personal experience rather than educational skill.

Current medical curricula focus on peer learning through team-based activities (Vasan et al. 2008, 2011), and the observation that learning incorporates elements of teaching reinforces the premise that teaching fosters learning (Merglen et al. 2008). While most medical students are enthusiastic about their future role as student/resident-educators (Bing-You & Sproul 1992; Peluso & Hafler 2011), both students and residents feel uncomfortable teaching their peers due to the lack of necessary skills (Merglen et al. 2008).

As reported in the past (Ocel et al., 2003) and still the practice today, more than 80% of United States medical schools depend on some form of teaching assistance from senior medical or post-graduate students (Rosalind Franklin University; St. George’s University; University of Maryland;

## Practice points

- Residents reports show that a significant portion of their knowledge-based understanding is gained through the peer teaching interaction.
- Opportunities for developing good teaching practice do exist and may be identified in courses that offer basic sciences.
- The TA elective is designed to incorporate ACGME competencies.
- Objectives for a TA elective within the framework of a basic science course

University of Utah, Michigan State University). The effectiveness of using teaching assistants (TAs), the supplemental support they provide to faculty and the strengths they bring to a course have been well established (Ocel et al. 2003; Knobe et al. 2010; Cheng et al. 2011; Rashid et al. 2011). A student placed in the position of a teacher is said to initiate an inherent drive that enhances self determination, confidence and intellectual competence (Azevedo 1990; Ten Cate & During 2007). However, few studies have considered the impact of the TA experience on TAs themselves or the effective facilitation of the experience. Studies have shown that both senior and junior residents agree that a significant portion of their knowledge-based understanding is gained through the peer teaching

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interaction (Dewey et al. 2008; Post et al. 2009; Swainson et al. 2010). The significant increase in the literature regarding “residents as teachers” (Mann et al. 2007; Dewey et al. 2008; Post et al. 2009) highlights the importance of providing opportunities and implementing guidelines for continuing medical education and professional growth. However, while residents look forward to their roles as peer teachers, many express views on the importance of providing teaching opportunities to students *during* medical school (Mann et al. 2007). In the current learning environment, dedicating time for an elective in teacher education would appear unrealistic, and the majority of medical students do not receive formal training in this area (Peluso & Hafler 2011). Peluso and Heffler (2011) also suggest that even without formal teaching education program, students can train themselves to develop basic teaching competencies. These opportunities involve peer-teaching, participation in course design and reviews, and participation in national/international medical education meetings (Peluso & Hafler 2011). However, while limited and perhaps only available to select individuals, opportunities for developing good teaching practice do exist and may be identified in courses that offer basic sciences.

The purpose of this article is to demonstrate a system for designing a teaching experience for senior medical students through apprenticeship and mentoring in order to stimulate early teaching and research skills within the framework of a basic science course.

## Context

Through the Human Structure course at Mayo Medical School, the Mayo Clinic incorporates a three-tier teaching model that involves: learning through faculty-driven activities, near-peer teaching (Bulte et al. 2007; Evans & Cuffe 2009), and peer teaching (Krych et al. 2005; Bentley & Hill 2009). The course is run over seven weeks (120 hours) and employs modified team-based exercises in both classroom and laboratory to meet clinical anatomy and radiology learning objectives (Hofer et al. 2011) that concentrate on building knowledge of gross, developmental, and radiologic anatomy and skills in the personal/interpersonal arenas. Successful demonstration of competencies is determined by self evaluations, formative feedback, peer evaluations, laboratory practical testing, written examinations, and written evaluation by the teaching faculty (Camp et al. 2010). In addition to the requirement of core knowledge of basic human structure and function and its application to patient care, students are also expected to demonstrate aspects of professionalism, effective communication, teamsmanship, and leadership (Chen et al. 2009; Gregory et al. 2009).

## Opportunity for TAs

The gross anatomy course (the Human Structure didactic block) at Mayo Medical School is designed as an interactive, student-centered, team-based learning activity addressing all six ACGME competencies outlined in the Accreditation Council for Graduate Medical Education Outcome Project (ACGME 2007) with extensive, small group laboratory

component (Gregory et al. 2009). It has been restructured from a traditional format lecture/laboratory course, which in the past, in addition to laboratory dissection, utilized gross anatomy, embryology, and radiology lectures. In current design, lectures have been replaced by short-briefing sessions (in gross anatomy) and students-led presentations (in embryology) that enables students to spend more time in the gross anatomy laboratory, where the highest quality of learning takes place. In addition, the use of educational and informational technologies such audience response system (ARS) (Alexander et al. 2009), web-based portals (Wiki), (Durosaro et al. 2008), interactive programs displaying CT scans of dissected cadavers in combination with student-generated content (Philip et al. 2008), and peer- and self-evaluations (Bryan et al. 2005; Chen et al. 2009), allow students to monitor their own progress, receive feedback on their performance as well as have combined hands-on cadaver dissection with medical imaging technology experience. While such a method of delivery places the responsibility on the learner to prepare for laboratory experience and team-based activities, it also places a higher demand on group facilitation by faculty (Michaelsen et al. 2007; Vasan et al. 2011).

## Recruitment of TAs

In the last 10 years, majority of TAs (98%) were recruited from the class of third-year medical students with a few from the MD/PhD program (participated during their research years). Mayo Medical School curriculum has a dedicated flexible research time (seven weeks) that can be rearranged to coincide with the timing of the first-year Human Structure block. Students are invited to submit applications for a total of six TA positions. Applications consist of a letter of intent with a brief motivation, followed by an opportunity to meet with faculty in order to understand expectations and responsibilities. In addition, candidates need to propose and prepare short outline for their potential research project in medical education that can be evaluated by the anatomy teaching faculty. Potential candidates are then reviewed by faculty based on their motivation statement, personal interviews, and performance during their anatomy course from first year, and originality of the research proposal. The best scored candidates are offered the TA position. Once positions have been accepted, the TA group meets with faculty to define roles, responsibilities and expectations. The objectives for TA elective are embedded within ACGME core competencies and assessed through student and faculty evaluation, (Table 1). Expectations of TA performance are viewed in three major categories: anatomical knowledge, teaching skills, and medical education research. At the initial meeting students are assigned an anatomy mentor to guide them in the process of obtaining education resources as well as in developing a research proposal for IRB submission and approval. The expectation is that TAs will finish their preliminary data collection during the course and present their findings in the form of poster or platform presentation during one of the anatomy or medical education meetings.

**Table 1.** ACGME aligned TA objectives.

ACGME competency	TA objectives
Demonstration of professional and ethical behavior	<ul style="list-style-type: none"> <li>• TAs are evaluated by students and faculty.</li> <li>• TAs are expected to uphold professional values when interacting with students and faculty.</li> <li>• TAs need to understand the responsibilities and honor their positions as part of the faculty team.</li> <li>• TAs are involved in assessing student projects/presentations, creating test questions and assisting students in their learning process.</li> </ul>
Effective interpersonal and communication skills	<ul style="list-style-type: none"> <li>• TAs present briefing sessions, provide feedback to students and faculty.</li> <li>• Learn how to assess difficult situations, identify students who need additional tutoring.</li> <li>• Provide written and oral communications to students – provide instructions for lab work (daily dissector).</li> </ul>
Understanding of application of basic science knowledge to patient care	<ul style="list-style-type: none"> <li>• Direct students on clinical assignments and bedside presentations.</li> <li>• Facilitate clinical embryology discussions.</li> <li>• Provide commentary during briefing sessions relating to their experience in the clinics.</li> </ul>
Display of effective teamwork and leadership	<ul style="list-style-type: none"> <li>• Work within the teaching team with faculty and other TAs.</li> <li>• Participate in shared research projects</li> <li>• Rotate leadership amongst TAs responsibility for specific course segments.</li> <li>• Preparing dissections and leading students through dissection.</li> <li>• Direct Radiology laboratory exercises.</li> <li>• Mentoring students and providing support during a challenging course</li> <li>• Relating to students during the block from their own experience and also reinforcing the importance of basic science application to patient care.</li> </ul>
Demonstration of lifelong learning and self awareness	<ul style="list-style-type: none"> <li>• Reviewing own understanding of anatomy – learning through teaching. Learning anatomy from a different perspective guided by teaching objectives.</li> <li>• Input on research projects and conference presentation and publication.</li> <li>• Recognize one's own conflict-resolution styles and vulnerabilities, Reflects on personal performance, identifies errors and areas of weakness, seeks help or advice, and takes steps toward improvement.</li> </ul>

## TA mentoring and facilitation of teaching and research skills

While the ideal elective would provide basic teaching instruction on key skills and educational theories, objectives for a TA elective within the framework of a basic science course are best achieved through a system of apprenticeship. Faculty is primarily responsible for facilitating this process with additional *ad hoc* mentoring from past TAs and clinical staff involved in the course.

In preparation for their roles, TAs are provided with a folder consisting of a collection of relevant references regarding key and current medical education concepts and practices (Table 2). TAs are encouraged to read through the material and integrate their learning points during their teaching experience. Opportunities for further discussion and follow-up are provided through weekly TA/Faculty meetings and individual TA/Faculty meetings as desired.

In addition to teaching, TAs are encouraged to participate in medical education research projects. TAs may choose to work on research initiated by faculty, through their own areas of educational interest or on on-going studies. They may embark on individual projects or work in teams through faculty supervision. TAs are given the opportunity to complete an application for Institutional Review Board approval and formulate a study design. Outcomes are assessed through conference presentations and subsequent publication of results.

During the teaching block, each TA is assigned responsibility for a briefing session based on their preference. Under guidance of designated faculty, TAs prepare presentations based on course-defined objectives. TAs are encouraged to express their personal style when presenting, include

innovative ways of explaining more challenging concepts and are given the flexibility of including additional images and key points with an emphasis on clinical application.

Within the laboratory, TAs share responsibility for guiding students with their dissection and study of radiology images on cadaver scans. At the same time, they are able to interact with, learn from and confer with invited clinical faculty from various departments within Mayo Clinic who voluntarily participated in the anatomy laboratory sessions. A large part of the laboratory preparation is taken on by TAs, who work within their team to share responsibilities for prosection of material to be covered for the next lesson. During faculty-supervised prosections, TAs make notes on important structures to locate and provide tips on exposure and dissection that is subsequently communicated via e-mail to students. Electronic communication enabled students to prepare in advance for the upcoming dissection and to develop team-based strategies in order to better facilitate their dissection experience. In addition, prior to the start of the anatomy laboratory, teams' representatives were once again instructed on dissection procedure by TAs using a prosected specimen.

## Feedback and debriefing

TAs are provided feedback through a three-tier evaluation system.

- (1) Weekly one hour debriefing sessions are facilitated by core faculty and include a recap of the week's activities, including discussions relating to individual student and group performances at regular intervals within the block. TAs are given the opportunity to assess how students are working within teams and individually in order to implement interventional strategies.

**Table 2.** Key references for current medical education concepts and practices.

Resource title	Educational theme	Key learning point
Medical students as teachers: How preclinical teaching opportunities can create an early awareness of the role of physician as teacher (Amorosa et al. 2011).	Residents and clinicians in teaching roles and the importance of maximizing opportunities to develop teaching skills.	<ul style="list-style-type: none"> <li>Understanding how to connect the role of being a teacher with that of being a physician.</li> </ul>
Twelve tips for teaching reflection at all levels of medical education. (Aronson 2011).	Review of different educational approaches and goals related to teaching reflection.	<ul style="list-style-type: none"> <li>Awareness of diverse learning environment and the relationships that occur within the teaching and learning spectrum and the value of effective use of reflection as a learning tool.</li> <li>Understanding the role of the near-peer teacher within the peer teaching framework.</li> </ul>
Dimensions and psychology of peer teaching in medical education. (Ten Cate & Durning, 2007).	Rationale behind the use of peer teaching medical education.	<ul style="list-style-type: none"> <li>Understanding how to process information during teaching preparation and delivery of information.</li> </ul>
Medical students-as-teachers: A systematic review of peer-assisted teaching during medical school. (Yu et al. 2011). Additionally, Peer-teaching: an effective learning experience? (Correa et al. 2009) and Peer instruction: Ten years of experience and results (Crouch & Mazur 2001).	These three papers summarize and critically analyze peer-teaching effectiveness and its impact on learning outcomes for medical students.	<ul style="list-style-type: none"> <li>Understanding how to process information during teaching preparation and delivery of information.</li> </ul>
Twelve tips for preparing residents as teachers. (Mann et al. 2007)	Formulating medical education electives for residents seeking opportunities to teach.	<ul style="list-style-type: none"> <li>Appreciating the importance of continuing medical educational interests in clinical years.</li> </ul>
The development of medical teachers: An enquiry into the learning histories of 10 experienced medical teachers. (MacDougall & Drummond 2005).	Exploration of different ways in which doctors have learned to teach and train.	<ul style="list-style-type: none"> <li>Understanding teacher development and reflecting on personal accounts of apprentice learning from experienced clinical teachers.</li> </ul>
The new face of gross anatomy. (Reidenberg & Laitman 2002).	Perspective on current trends in anatomy education with integration of core knowledge and value of integrated teaching and learning.	<ul style="list-style-type: none"> <li>Understanding the role of TAs in an integrated curriculum.</li> </ul>
Restructuring a basic science course for core competencies: An example from anatomy teaching. (Gregory et al. 2009).	Review of the ACGME core competencies and their application for anatomy education.	<ul style="list-style-type: none"> <li>Understanding how ACGME competencies may be incorporated into the medical curriculum.</li> </ul>
The anatomy of anatomy: A review for its modernization. (Sugand et al. 2010).	Review of new trends in anatomy teaching.	<ul style="list-style-type: none"> <li>Maintaining balance between general practice and current trends in anatomy education</li> </ul>
Demystifying the Millennial student: A reassessment in measures of character and engagement in professional education. (DiLullo et al. 2011).	Perspective on current generation of students and their learning styles within the current environment.	<ul style="list-style-type: none"> <li>Understanding how current generation of students think, work and assimilate information.</li> </ul>
A practical guide for medical teachers. (Dent & Harden 2009).	Aims primarily at providing health care/medical educators perspective on understanding the contemporary educational principles and learning environment.	<ul style="list-style-type: none"> <li>Understanding how theoretical aspects of medical education and practical delivery of teaching are connected.</li> </ul>

In addition, TAs are able to reflect on their personal experiences, strengths and areas for improvement.

- (2) Upon completion of the course, TAs are evaluated by faculty through an integrated scheduling and evaluation system. Core competencies are graded according to (1) Effectiveness within the faculty team (2) Effectiveness of presentation of material (3) Overall contribution to course. TA's receive direct feedback through the system and are invited to meet with faculty for further discussion of individual strengths and areas for improvement.
- (3) Student evaluations submitted as part of the course assessment are specifically designed to comment on the effectiveness of each TA and the impact they have had on the individual student. TAs receive this feedback through the standard grading system and are encouraged to meet with faculty for further discussion if required.

## Discussion

Historically within the medical school environment, it remained an accepted norm for TA positions to be sought

after *by* student volunteers with an interest in opportunities to join a teaching team, primarily to enhance their exposure to anatomy for future career pathways. This TA group invariably included students with an interest in surgery or a clinical specialty requiring more in-depth understanding of anatomy. Ocel et al. (2003) reinforced this notion by pointing out that most TA respondents at Mayo Medical School strongly agreed that the TA experience was of most benefit during their clinical subspecialties and in particular, their surgery rotation. While this motivation still appears to be a strong influence amongst students wanting to serve as TAs in the anatomy course, today, there appears to be an even greater influence by medical students' need to explore roles as future teachers of medicine. Data obtained through feedback from structured questionnaires sent out to past Anatomy TAs, now in residency programs, indicate that opportunities to teach, faculty mentoring, and introduction to educational research improved TAs interest and ability to teach (Erie et al. 2012). In addition, results obtained from current medical student TAs confirms the perception of learning through apprenticeship and mentoring is an effective way to learn *how* to teach (Erie et al. 2012).

With limited opportunity, TA positions have become more competitive and with more defined responsibilities students



have become more committed. Indeed, the bar has been raised as medical educators tap in to the potential for medical students to initiate teaching skills in early medical education (Dandavino et al. 2007). Peluso and Hafler (2011) point out that despite the lack of requirement by the Association of American Medical Colleges for medical students to be exposed to some level of teaching responsibility, the ACGME strongly advocates that residents be involved in teaching roles during their clinical training. For medical students, the TA experience has become more than an informal, improvised exercise. It has become an important training ground for the early acquisition of teaching skills within a familiar setting that provides a sheltered mentoring milieu. Recognition of these early teaching skills is evidenced in student-provided TA feedback.

- *His strongest skill was his ability to read the personalities of every individual who he was teaching and find out how best to help them understand the material; I witnessed several occasions in which he changed his approach to trying to explain a concept in order to help students understand better.*
- *I really appreciated when she would come to each lab group during dissection and ask us about a clinical scenario testing our knowledge about both the anatomy, possible tests for diagnosis, and treatments. I also appreciate her effort to help us practice critical thinking on the clinical level through the clinical assignments we received each week.*
- *She was very knowledgeable, but often came across as a little abrasive or condescending. I am sure that she did not mean to, but I know that this made a lot of students avoid asking her questions.*
- *He clearly knew a lot about anatomy. Sometimes his quizzing style could be a little aggressive. It would be nice if he could listen to students' concerns before making suggestions or explaining something.*

In addition, students critically evaluate TAs performance, which was used at the end of the course to direct TA-Faculty discussions on educational outcomes from the teaching experience. In our learning environment a five-point Likert scale students' evaluations of TAs' performances in the three categories were as follow: (1) ability to establish a good learning environment ( $4.31 \pm 0.51$ ), (2) delivery of course material ( $4.2 \pm 0.47$ ), and (3) facilitation of learning activities ( $4.24 \pm 0.43$ ).

Structured TA experiences are not uncommon. University programs, both nationally and internationally, have implemented and continue to provide established opportunities for undergraduate and postgraduate students to develop teaching skills (St. George's University 2011; Michigan State University 2011; Rosalind Franklin University 2011; University of Maryland 2011). A very few are associated with medical schools (University of Utah 2011). However, due to the nature of the undergraduate medical curriculum, there is neither sufficient time nor an abundance of opportunity for medical students to develop teaching skills. Therefore, learning through apprenticeship and mentoring provides a good alternate. In a study exploring the development of medical teachers, McDougall and Drummond (2005) underline the

complexity of the process within a curriculum that lacks formal training courses. They continue to emphasize the importance of the on-job learning experience through apprenticeship while others reaffirm the value of mentoring and its role in shaping the development of medical teachers (Elton 1998; Orlander et al. 2000). Shiozawa et al. (2010) further demonstrate the value of providing structured training for tutors in gross anatomy. Their results showed positive impact of such a training curriculum on tutor skills when compared with tutors who received little or no didactical training. In the absence of a nationally defined set of competencies, integrating the learning domains that target student development, coaching, assessment and evaluation, mentoring and scholarship, as outlined by Peluso and Hafler (2011), strengthen the philosophy behind using the apprenticeship model in training students at an early stage in their careers to develop competencies that will enable their future roles as medical teachers.

In this article we have shared a teaching practice that lends more accountability to both TA's and course faculty by incorporating ACGME competencies in order to facilitate the TA experience. For students with the motivation to become future teachers, finding opportunities within basic science courses remain their best option. In a system where medical curricula provide limited opportunity for teaching education, integrating elements of good teaching practice within a given learning environment can serve to reinforce the importance of critical skills for future professional development.

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