Preferred Study Resources of Medical Students in a Basic Science Course

Pointers for Future Course Development and Possible Loss of Student-Student and Student-Faculty Interactions

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Abstract

Concern developed due to the continuing trend of reduced student attendance at non-mandatory classes, and we became interested in knowing whether students relied more on web-based resources, or going to the Learning Resource Center (LRC), rather than lectures and labs. Resource availability has made it easier for students to study at convenient times and at their own pace, perhaps leading to reduced attendance at non-mandatory portions of courses. We felt this trait could be detrimental to involvement in team-oriented situations, a major part of the transition from basic science years to clinical years and residency.

We identified study resources most used by first year students (MS1) in histology and cell biology and determined why particular ones were chosen, findings that allowed us to suggest which negative study habits might develop, especially due to a lack of student-student interactions.

Data indicated that when students were given the choice of attendance at lecture, lab sessions and post lab presentations, approximately 50% attended, while others used the LRC and streamed lectures, including old lectures were available, as well as having internet access. The trend strongly suggested that with future technological advances, such as the introduction of hand-held devices, and as students become increasingly technically competent, that they might shy away from lectures and labs to an even greater extent.

We feel that increasing reductions in student-student interaction might produce an environment in which there is a loss of an important part of student development that might lead to a reduced ability to be part of team-oriented situations that will frequently encounter in their clinical study years, residencies and eventual practice.

In conclusion, we think that shrinking student attendance at non-mandatory teaching events, together with the inevitable increasing use of electronic resources, must be considered in curriculum development, particularly in making sure that group-oriented classes and exercises are included and developed. (298)

Keywords

Peer Interactions; Study Resources; Medical Education; Course Development

Introduction

Many universities and colleges have carried out major curriculum renovations to accommodate an increasing use of innovative resources and study tools, in an effort to continue to fulfill the objectives, goals and aims of their courses in an efficient, integrative and interesting manner, while providing a quality product. Small group sessions/team-based learning [TBL] have been beneficial inclusions [1, 2], as has problem-based learning [PBL; 3, 4, 5], as well as program and course integration [3, 6]. Due to the reported benefits of TBL, it has been introduced into a number of individual courses at the University of Texas Medical School at Houston (UTMSH) including histology, immunology, physiology and graduate molecular pathology [7, 8, 9], while PBL sessions are an integral part of the second year program [10, 11, 12, 13].

The histology and cell biology course that was the focus of this study is obviously heavily dependent upon visualization, both by and with students, while the use of microscopes has become less well accepted by students in favour of atlases, searchable internet images, Wikipedia and interactive image sites such as Virtual Slidebox (http://www.path.uiowa.edu/virtualslidebox/) and Blue Histology (http://www.lab.anhb.uwa.edu.au/mb140/). We too, like other schools, have incorporated interactive images in our course(s) (http://www.uth.tmc.edu/pathology/histology/index.html; http://histology.med.umich.edu/schedule/medical).

A previous study has looked at lecture attendance and the use of electronic resources [14], while our study focused on determining which study resources were
preferred by students, thus allowing us to tentatively identify future changes that might result in an even greater loss in student attendance at lectures. We must ask ourselves questions as to future course needs some of which must address, and attempt to overcome, further losses of student-student and student-faculty interaction. In this context, there was a nice editorial piece by Dr. Steven Kanter [15] who opined that much of the loss seen in attendance results in a less enticing and fulfilling environment for the faculty and, as is well known, a quality environment is a must for the overall happiness of faculty and their retention. He concludes with, “And so, I believe it will become clear that podcasting has its place but will replace neither classroom learning nor the need for high-quality time in the context of learner-teacher relationships (LTR). If we do it right, ultimately, both learner and teacher will derive new and richer benefits from and improved LTR”.

In 1994 Guskin [16] wrote an insightful piece concerning the ever changing role of faculty in teaching. In the second part of his article he noted “……….major changes that education may undergo in the next five to ten years……….an emphasis on student learning outcomes, and the power of new electronic technologies to enhance student learning”.

Changes have become more and more evident and the use of online education has seen an incredible surge. “Are MOOCs the future of medical education”, asks an article in the British Medical Journal, MOOCs being Massive Open Online Courses [17], while another recent paper discussed some pros and cons of online education, and the fact that large audiences could be reached [18].

It is hoped that this study gives some guidance for future ways that a rewarding learning environment can be achieved, without unsatisfied and disgruntled faculty, and with students who appreciate the diversity of the learning tools at their disposal.

**Methods**

A simple questionnaire was distributed to first (n=65) and second (n=14) year medical students requesting their input as to i) their use of study resources, ii) their resource preference(s) and iii) their opinions and suggestions, if any, as to resource needs. Feedback enlightened us as to the number of students who did attend the non-mandatory lectures, post labs and labs (TBL exercise labs are mandatory), with all the returned questionnaires remaining anonymous. Those returns that contained inappropriate language and comments were discarded (n=4; Table 1).

The questionnaire was constructed for easy and rapid completion, as we know that many students are averse to being required to complete ‘extra’ assignments. Having a simple questionnaire and easy return, facilitated the collection of data and rapid interpretation. Multiple return sites for questionnaires were available in an effort to increase the number completed. Input was collated and reported as a percentage of the number of returned questionnaires.

**Results**

Seventy three percent (73%) of returned questionnaires indicated that some students had had previous experience with using a microscope, with 21% stating that their microscopy experience had been extensive. Seventy two percent (72%) stated that they were visual learners, with 16% auditory and 12% tactile. Fifty percent (50%) attended lab sessions and those who did not most frequently used online sites for image study. There were a quite a few comments stressing that lab sessions were the ideal times and

<table>
<thead>
<tr>
<th>RESOURCE</th>
<th>% OF RESPONDENTS</th>
<th>RANK</th>
</tr>
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<tbody>
<tr>
<td>LECTURES</td>
<td>19.12</td>
<td>RANK 2</td>
</tr>
<tr>
<td>POST-LAB SESSIONS</td>
<td>13.44</td>
<td>RANK 4</td>
</tr>
<tr>
<td>BLOCK REVIEWS PRIOR TO EXAMS (POSTED ON BLACKBOARD)</td>
<td>16.25</td>
<td>RANK 3</td>
</tr>
<tr>
<td>SYLLABUS (available as hard copy, on web page and on blackboard)</td>
<td>33.99</td>
<td>RANK 1</td>
</tr>
<tr>
<td>STREAMED LECTURES</td>
<td>7.68</td>
<td>RANK 5</td>
</tr>
<tr>
<td>OLD-STREAMED LECTURES (Previous year)</td>
<td>4.78</td>
<td>RANK 7</td>
</tr>
<tr>
<td>HISTOLOGY ATLAS</td>
<td>3.58</td>
<td>RANK 8</td>
</tr>
<tr>
<td>UTMESH PATHOLOGY WEB PAGE</td>
<td>0.81</td>
<td>RANK 11</td>
</tr>
<tr>
<td>LAB</td>
<td>4.99</td>
<td>RANK 6</td>
</tr>
<tr>
<td>ONLINE SITES</td>
<td>1.74</td>
<td>RANK 9</td>
</tr>
<tr>
<td>OTHER BOOKS</td>
<td>0.19</td>
<td>RANK 12</td>
</tr>
<tr>
<td>FACULTY INTERACTIONS (Outside of lab, lecture, post labs)</td>
<td>1.35</td>
<td>RANK 10</td>
</tr>
</tbody>
</table>
place to ‘corner’ faculty and ask questions, something the instructors themselves stress throughout the course. Some students who did attend lab sessions stated that they liked the space and relaxed atmosphere that resulted from only partial attendance, advantages that would obviously be lost with a full class in labs. There were a number of comments that students did not go to labs as they found the lab sessions “unhelpful”, but this begs the question, how do they know if they did not go? Finally, there were a few humorous answers, the pick of the crop being “I am scared of microscopes” and, “Looking through a microscope makes me dizzy”. Both these students did not attend lab needless to say.

In a previous, unpublished study we found that providing the students access to multiple resources (>6) was unnecessary and that a need for a concise number of specific resources was best. In this basic study, students stated that they required lectures, a visual aid (atlas or online slides), and some study help resources (practice tests and practice exams for example), pertinent to that course and that anything beyond this they considered superfluous to their needs and that a glut of resources tended to deflect their attention away from information that they actually see in their course instruction. Multiple resources also introduced a “confusing variety of answers” and “highly useless” readings. Due to these findings, as well as this current study, histology course resources are concise and the number of ‘study links’ has been reduced from more than forty (6 years ago) to three.

Over the past few years, clinical correlates have been introduced, and the students have overwhelming stated that these are helpful in understanding the role of functional histology in diseases that are common to Texas. They did however state that exam questions based on the correlates were not welcome.

**Conclusions**

Outcomes from this initial, small study revealed the preferred study resources/method(s) of first year medical students at the University of Texas Medical School at Houston in a basic science course and gave us solid indicators that further work is necessary to achieve the desired balances between student attendance and the type and availability of learning resources. It is also important to understand that study methods and undergraduate exposures, prior to medical school, almost certainly affect study habits in at least the first year of medical school, and that this too should be taken into account in the inevitable more clinically based, module curriculum that is appearing, and is established, in many colleges and universities. (See Kansas University Medical School–http://www.kumc.edu/school-of-medicine/office-of-medical-education/phase-i-curriculum and Georgetown University School of Medicine –http://som.georgetown.edu/medicaleducation/curriculum/FirstYearModules/ for examples).

Finding an appealing and accepted balance between true and tried teaching methods and more progressive and newer innovations is a goal for all schools, and it will be of great importance in medical schools where high student satisfaction is a major target, if not a need, to yield a quality ‘product’ for want of a better word [19]. The relatively recent finding that an integrated curriculum is best suited for future physicians strongly suggests that we embrace a learning environment that encompasses all aspects of present and future medical arenas, including such diverse topics as complementary and alternative medicines, global health, legal knowledge, nutrition, etc [20]. These areas are now being included in the modular curriculum, for example, global health at Ben Gurion University of the Negev, in collaboration with Columbia University (http://www.cumc.columbia.edu/dept/bgcumd/md/ps/orientation.html).

It was a little surprising to us that so many students had an extensive history of microscope use, possibly indicating good undergraduate programs, but directing us to ask if this makes students want to attend lab more for histology and pathology, or have they decided that they have had enough? We also wondered if students who use microscopes through their undergraduate and graduate years become pathologists, or microbiologists? [22]. This is apparently not the case, so further research is required to suggest the availability of histology to undergraduates, and possibly other first year courses, via online resources, which might lead to better, future course structuring including the incorporation of self-study learning opportunities for students who are interested in particular areas of medicine.

Internet searches regarding the general preparedness of students entering medical school are often tongue-in-cheek, or are strictly limited to a more factual report as to what courses candidates should take, references they should get, their volunteer history and similar factual information. It is somewhat
difficult to discover resources and information that might help a student offset some of their study load, and thus anxiety, resources they could utilize prior to being accepted into medical school. The basis for this is evident in pre reading and pre viewing inclusions in PBL, and modular courses.

It is known that not all students who go to medical school are science majors, and there are blogs that suggest to them how to cope with the huge amount of information that has to be absorbed, dissected and applied. But, study practices and study methods are very diverse and each student usually finds their way rapidly or will seek advice as to the best study strategy, usually with the support of upper class student mentors and faculty advisors [23, 24]. However, even with all the resources available it is inevitable that some students will struggle [25, 26] and with so much to do, it is of no surprise to see opinions from medical students that they “never went to lecture”, or “never went to lab”, when so much is readily available online. This knowledge can and should be used to ready a student for medical school and direct them to self learning when in medical school. Such study needs to be rewarded.

Our study shows that our student population is diverse in their likes and dislikes as to how they study, and this is not surprising however, it is evident that the bulk of the histology class use the syllabus (hard copy and online) as their first source of study, while lectures, post-labs and reviews are frequently used, with infrequent use of course online resources and other books. This study is limited to histology and cell biology, a course that is very visual in nature with online images, image exams and image tests for the students to use. Therefore, a loss of students for in-lab studies, given the resources available online, is not unexpected and does not result in lower grades. This again points to the benefits of incorporating pre-exposure to topics that will appear in curriculum modules, especially as the number of resources that students want available to them is small.

The responses showed us that a syllabus of some sort is necessary, with many students wanting a hard copy or a source from which printed information can be downloaded. Fifty percent thought that going to lab was beneficial, 50 percent did not. Most students used the provided resources, many did not, raising some concerns as to the usefulness and appropriateness of the available information. Once again, these are findings that must be considered in course design.

It also was shown that the addition of a study guide to the course, something we thought would be of benefit, was a resource seldom used, until a student asked a member of faculty the best way to study, and the advice given often involved the suggestion of using the study guide which succinctly lists key words and topic objectives, goals and aims.

Summary

It is evident that many students do not attend portions of the course that are non-mandatory and with the ever increasing use and acceptance of ‘remote’ teaching this decline is likely to continue [27], along with student-student interactions. Our previous thoughts regarding developments in first year histology and cell biology were based on the premise that stronger students might improve outcomes of weaker students because of interactions, a premise based on our observations and a previous report [28]. This led to the inclusion of team based learning (TBL) in the course. However, an earlier publication [29] suggested that positive peer effects might not be that profound, especially in all teaching modalities, and that class diversity improved medical school experiences and student development [30].

However, with the inclusion and development of module based curricula in medical schools, the aim of medical educators must be to achieve a balance, currently thought to be a mix of didactic, written and electronic resources [31]. Too much technology takes students away from the environment that they need to be in much of the time, the medical school, even though there are now initial plans for a virtual medical school [30]; (http://www.imhotepvirtualmedsch.com/; http://news.bbc.co.uk/2/hi/uknews/Scotland/1607780.stm).

Harden and Hart [32] state the need for “…a flexible curriculum which meets the needs of different students…..”, and this has to be a major goal of medical education and curriculum development, with care being taken against technological overload, despite the obvious advantages of such resources as previously suggested. Construction of medical curricula must address the development of medical student abilities in integration, clinical correlation and skills, rather than being more concerned with education correctness [33].

There are obviously drawbacks to this study, but important points were noted that directly influence
the construction of a new modular curriculum that is to be in place within the next two years. The number of students is relatively small, and this is only one of a number of basic courses studied and required at UTMSH.

Of great importance is the need to avoid the loss of student-student interaction and, maybe more importantly, retaining faculty-student interactions that are required for the satisfaction and happiness of both students and faculty. It is important to take the study preference findings, attendance numbers and a number of other outcomes of this study, and put them into the bigger picture and use them as the basis for structuring and including specific elements of new teaching methods.

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QUESTIONNAIRE USED IN THIS STUDY

This questionnaire is provided as part of ongoing efforts to improve this (Histology and Cell Biology) and other courses at the University of Texas Medical School at Houston (2011) and provide resources that are of most value to first year medical students. Data from these questionnaires will be compiled and a manuscript will be prepared for publication in a peer-reviewed education journal. No participant identifiers will be used in any part of this study. The questionnaires do not require a name or signature and therefore the participants will remain anonymous. Your participation is greatly appreciated.

Roger J. Bick, Director, Histology and Cell Biology for MSI’s, Associate Professor of Pathology and Laboratory Medicine. MSB 2.288, 713-500-5406

In recent years the use of technically advanced and superior electronic resources has become a familiar part of medical school studies. However, despite these dramatic improvements, course evaluations have shown that the diverse needs of students for their studies has not been met. Of the many resources available, not all are used by all the students and certain preferences prevail. Findings from this study will hopefully direct us as to which resources would benefit from upgrades, which resources should be added, and which resources have become redundant. It is hoped that conclusions from these data will helped other courses in this medical school.

WHICH OF THE FOLLOWING RESOURCES DID YOU USE FOR STUDY AND REVISION? Mark all that apply with an X please. Then rank the marked resources in the next column, with 1 being the most used resource. In the third column note the approximate percentage of time that these resources are used in your studies and for your understanding of the course material. Please make sure that the total percentage adds up to 100%.

<table>
<thead>
<tr>
<th>RESOURCE USED (Mark with X)</th>
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<th>% OF TIME</th>
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<tbody>
<tr>
<td>LECTURES</td>
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<td>POST LABS</td>
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<td>REVIEWS</td>
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<td>STREAMED LECTURES</td>
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<td>‘OLD’ STREAMED LECTURES</td>
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<td>HISTOLOGY ATLAS</td>
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<td>HISTOLOGY WEB PAGE</td>
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<td>MICROSCOPY LAB</td>
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<tr>
<td>ONLINE HISTOLOGY (Such as Blue Histology)</td>
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<td>OTHER HISTOLOGY PUBLICATIONS</td>
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<tr>
<td>FACULTY INTERACTION</td>
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If you USE ANOTHER RESOURCE, PLEASE DESCRIBE below:

Please comment on the resources available for your use and why you chose specific resources for your study. Please be aware that unsavory comments and inappropriate language will result in your completed questionnaire being removed from the study.

What other resources do you consider would be useful for this course and, possibly, other basic science courses?

1. Resources (Circle which statement/word best applies)
   - I think that a variety of resources is preferable for my learning style
   - I think that one or two resources is preferable for my learning style

2. Learning styles
   - Generally speaking, I am a ________ learner (Circle one of the following descriptive terms)
     - Auditory
Visual Tactile

3. How much experience using a microscope did you have as an undergraduate? Please circle one

None    Very Little    Moderate    Extensive
(Once or twice for a class) (Worked in a lab/used microscope often)

4. Has your previous experience with a microscope helped you in Histology lab? Please circle one

Yes    Somewhat    No    I don’t go to lab

5. Did you generally attend Histology lab during this course? Please circle one

Yes    No

6. If No, which of the following do you agree with. Please circle your most appropriate answer

I didn’t find lab helpful.
I preferred to look at images in an atlas.
I preferred to look at images on my computer.
I didn’t look at images when studying for histology.
Other: __________________________________

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