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The Satisfaction of Shophoremore Dental Students Towards Using Light Microscopy and Virtual Microscopy

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Abstract

The visual aids for learning advanced over the last several decades. With the approach digital slice imaging, there is an opportunity to complement the way of teaching and learning histology. The aim of this study was to assess the opinion of sophomore dental students of the use of digital microscopy, in the Oral Biology course, in comparison with light microscopy. It was designed practical classes about virtual slides, which and those involved adapting computer rooms as a Virtual Microscopy Laboratory. Students had practice with traditional microscopes in Biological course and virtual microscopy in the Oral Biology course. Student satisfaction was assessed using 14 questions survey with five possible answers (Likert scale). Wilcoxon signed-rank test was used to compare differences between traditional and virtual microscopy. Statistical significance was defined as $p<0.05$. The survey data indicated that students were satisfied with virtual microscopy. Students pointed out that virtual microscopy allows teacher-student interaction, have the ability to standardize image, allows to work outside the laboratory, facilitates the active involvement in learning, allows understanding concepts and increasing the interest in the subject. Students consider virtual microscopy a significant improvement over the traditional microscopy for the study of histology. As lecturers, we must adapt to new trends and integrate technological innovations into our courses as a means of information, training, knowledge and continuous learning, which could facilitate the teacher-student communication. However, we believe that the students should know traditional microscopy.

Keywords

Light Microscopy, Virtual Microscopy, Dentistry

1. Introduction

Teaching Histology, Organ Systems Histology, Anatomy and related subjects are a fundamental part of human dentistry and medicine curricula. Traditionally, these subjects have been based on lectures and laboratory practice, but since the adaptation of curricula to the new EHEA (European Higher Education Area) new competencies for professional development and educational practice are imposed. The implementation of ECTS credits (European Credit Transfer and Accumulation System) measures the student workload required to complete successfully the degree program (Patel KM and Moxham BJ, 2006). Therefore, academic institutions are looking for ways to integrate news methods into their curricula in order to raise efficiency and student engagement.

In our University, Degree in Dentistry curriculum has two subjects related to Histology: Biology, which is a general cell biology and histology, and Oral Biology, which oral histology and anatomic pathology are studied. Both subjects have practical lessons in a laboratory for 12 students, and a collection of slides is available. Traditional laboratory training is similar to that performed Plendl et al. (Plendl et al., 2009), slides are presented via camera connected to a microscope and explained by a lecturer. After that, each student examined the slides on its own.

Since the invasion of computers in all fields, the use of technology in the classroom has been a subject of great interest to educators of health care (Goubran and Vinjamury, 2007). Hence, some schools of medicine have decided to apply technological advances in their courses of microscopy, such as digital microscopy (Goubran and Vinjamury, 2007; Cunningham et al., 2008). Our University considered incorporating this methodology into the Oral Biology course.

The aim of this study was to assess the students' opinion on the use of digital microscopy in comparison with traditional (light) microscopy to estimate the feasibility of integrating digital microscopy in an oral biology course.

2. Material and Methods

2.1. Development of Digital Microscopy Laboratory

The digital slides were obtained by scanning glass slides available at the Histology Laboratory of the CEU-San Pablo University. All slides were digitized at a magnification of 40x using the slide scanner Leica SNC400. The following digitalization, the slides were stored in a virtual drive hosted at University's intranet.

Every student had access to a desktop computer with the Leica SCN400 Image Viewer installed, and free access to the virtual drive hosted. Furthermore, all students had access to an open computer laboratory and the possibility to copy the image files and the Image Viewer to work at home. The practical session was done after completion of six traditional lectures about histology of the oral cavity; students were divided into nine groups of 12-13 students each due to the size of the computer laboratory.

2.2. Participants

The study was conducted in the Department of Basic Medical Sciences, School of Medicine, CEU-San Pablo University, Madrid, Spain. The action was conducted in Oral Biology subject, which is delivered in the 2nd year from February to May and has 6 European Credit Transfer System credits (Doménech Martínez et al., 2006).

This pilot study was conducted during academic year 2012/2013 to estimate the feasibility of integrating digital microscopy in an oral biology course. At the end of the practice sessions, students were asked to complete a voluntary and anonymous survey. Respondents who indicated no prior experience with light microscopy were excluded, as well as students who retake the course or not answered all the questions. So, for all students surveyed was the first time using this method.

The student survey consisted of 14 questions. Each one with five possible answers: strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, and strongly disagree according to Likert scale (Likert, 1932). They had to answer the same questions for digital and light microscopy.

2.3. Statistical Analysis

A Wilcoxon signed-rank test was used to compare differences between digital and light microscopy. Statistical significance was defined as $p<0.05$.

Data was analyzed by SPSS version 20.

3. Results

All second-year students (105) were surveyed voluntarily, of whom 88 surveys were valid for the study. 17 surveys were excluded for the reasons described in "Material and Methods".

The results obtained in this report (Table 1) are presented as the percentage of students in agreement with a particular question of the survey. All answers were divided into three groups: Agree (agree plus strongly agree), neither agree nor disagree, and disagree (disagree plus strongly disagree).

Table 1. *Student evaluation of light microscopy and virtual microscopy by percentage of total respondents.*

QUESTIONS		% Agree		% Neither agree nor disagree		% Disagree	
		LM	VM	LM	VM	LM	VM
Q1	Access to practice material was easy	67,1	81,8	18,2	1,2	14,7	17
Q2	Using the LM or VM, as the case may be, positively enhanced my motivation in this course	43,2	72,7	17	3,5	39,8	23,8
Q3	The methodology used allowed me to learn about the content of the course	61,4	84	20,4	5,8	18,2	10,2
Q4	The methodology used allowed you to self-learning	59,1	84,1	19,3	2,2	21,6	13,7
Q5	The methodology used allowed me to work in groups	56,8	70,4	19,3	2,3	23,9	27,3
Q6	Comprehension of information was stimulated by this methodology	67,1	80,7	19,2	2,2	13,7	17,1
Q7	Ability to standardize image (all students will study the exact same tissue section)	60,3	80,6	23,8	5,8	15,9	13,6
Q8	Interaction between students was allowed by this methodology	64,7	81,8	18,3	2,3	17	15,9
Q9	Teacher-student interaction was allowed by this methodology	69,4	85,3	19,2	3,3	11,4	11,4
Q10	Storage of slides is easy	63,6	81,8	19,4	4,6	17	13,6
Q11	Can you study the slides out in the laboratory?	46,6	72,7	19,3	2,3	34,1	25
Q12	This methodology allows student orientation within the slide	57,9	79,6	18,2	1,1	23,9	19,3
Q13	Student active learning is easy with this methodology	71,6	84,1	19,3	2,3	9,1	13,6
Q14	This methodology facilitates conceptual understanding	69,3	84,1	18,2	2,3	12,5	13,6

Table 2. *Z and P values of Wilcoxon signed rank test. Each question is comparing between LM versus DM.*

Questions LM vs. DM	*Z* value	*P* value
Q1	-2.031	0.042*
Q2	-4.625	0.000*
Q3	-4.171	0.000*
Q4	-3.627	0.000*
Q5	-1.543	0.123
Q6	-1.527	0.127
Q7	-3.080	0.002*
Q8	-1.718	0.086
Q9	-2.745	0.006*
Q10	-2.960	0.003*
Q11	-3.858	0.000*
Q12	-3.555	0.000*
Q13	-1.287	0.198
Q14	-2.311	0.021*

*Significant level set at $P<0.05$

Wilcoxon Signed Ranks Test showed statistical significant difference between DM and LM (Table 2) in 10 questions: Q1 (Access to practice material was easy); Q2 (Using the LM

or VM, as the case may be, positively enhanced my motivation in this course); Q3 (The methodology used allowed me to learn about the content of the course); Q4 (The methodology used allowed me to work by yourself); Q7 (Ability to standardize image (all students will study the same tissue section)); Q9 (Teacher-student interaction was allowed by this methodology); Q10 (Storage of slides is easy); Q11 (Can you study the slides out in the laboratory?); Q12 (This methodology allows student orientation within the slide); and Q14 (This methodology facilitates conceptual understanding).

81.8% of the responders agreed that the access to practice material was easy in DM versus 67.10% in LM. The questions related to increasing the motivation for the course, and allow to learn about the content of the course was evaluated more satisfactory in DM (72.8 and 84.1%, respectively) than LM (43.2% and 61.40%). 84% of the students considered that DM allows them to work by themselves.

80.6% of the students evaluated positively that the DM permitted them to observe the same section (Ability to standardize image) while 60.3% in LM agreed. When asked if student-teacher interaction is allowed by this methodology, 81.8% agreed in DM and only 69.4% was agreed in LM. The 81.8% in agreement in DM and 63.6% in LM when they asked about slide storability. 72.7% recognize the possibility for studying the slides outside of scheduled laboratory class time, but only 46.6% of the students consider this possibility for LM's slides. The last question was if the methodology facilitates conceptual understanding, 84.1% of the responders agreed in DM and 69.3% in LM.

4. Discussion

Light microscopy is an important and useful tool for studying cell biology and histology, but students often dislike using it. They consider LM is difficult and tiresome, frequently students complain that it is impossible to see through the microscope using both eyes, get dizzy and feel the LM hurts their eyes.

Our results show an overall positive satisfaction of students with DM compared to LM.

Virtual microscopy imitates the use of a light microscope. When we worked on the Virtual Microscopy Laboratory interaction with students was easy, because we could see the same area of the sample on a common computer monitor and it was encouraging the discussion about it. Students and lecturer were sure that they saw the same image. It permits a better conceptual understanding of oral histology. Students emphasized the slides are always in focus, with optimized contrast and adjusted illumination, and they consider that as an important advantage of this technique (Al-Janabi et al., 2012; Pantanowitz et al., 2012).

The virtual microscopy allowed the students to self-learning. It is a reality that our students have undergone a great change because they have developed ways of thinking, expression, and relationship influenced by the dynamics of Information and Communication Technologies (ICTs). Prensky (Prensky, 2001) designed them "Digital Natives". For this reason, they use the computer during the practice session to do an internet search, to take notes, and so on, to complete the practice. VM promotes the self-learning increasing students' independence, responsibility, motivation and expand their knowledge while respecting their different rhythms of learning.

Access to the practice material was available in our computer laboratory and open access computer laboratory. The server was exclusively for oral biology (virtual microscopy) training. Maybe for this reason the connection to the virtual slides were very simple. All students had the possibility to copy the image files and the Image Viewer to work at home; they only needed a hard drive, this allows them to view and review slides at any time.

Another important point for the students was that digital images can be standardized, and all students could study the same tissue section (Foster, 2010), this allowed them a better orientation within the slice. Moreover, the Image Viewer uses a thumbnail image that helps students maintain their orientation when they are examining the image at higher magnification (Pantanowitz et al., 2012; Foster, 2010).

Weaker and Herbert (Weaker and Herbert, 2009) conducted a pilot study at the University of Texas Health Science Center at San Antonio (UTHSCSA) Dental School. They studied the feasibility of integrating virtual microscopy in the oral biology course. The results obtained suggest that virtual microscopy is more interesting and easy than light microscopy for the students. Actually, this new technique is used in oral biology course.

In the author opinion, virtual microscopy has great advantages, as discussed before; however, she believes that students should know to handle the light microscope.

5. Conclusion

In summary, our educational aim of this study was to compare light (traditional) microscopy versus virtual microscopy to present the oral biology successfully to our students. They consider virtual microscopy a significant improvement over the traditional microscopy for the study of histology. We use these results for introducing the virtual microscopy as the election technique in oral biology practice. All our students are delighted with it.

As lecturers, we must adapt to new trends and integrate technological innovations into our courses as a means of information, training, knowledge and continuous learning, which could facilitate the teacher-student communication.

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