BEST PRACTICE IN TEACHING WITH THE VIRTUAL MICROSCOPE

A COMPARATIVE STUDY OF BLENDED AND ONLINE LEARNING

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Virtual Microscopes (VMs): What we know so far…

- Simultaneous viewing and manipulation of the same slide (e.g., biology images) by large number of students.
- High levels of satisfaction and enthusiasm among students and staff for VMs.
- Students do equally well when using either traditional or virtual techniques.
- A combination of virtual and physical microscopy is found to lead to the best learning outcomes.
- Teaching: simple VLE exercises and links to slides sent to students as PDFs.
VMs: What we do not know yet yet

- How students make use of and engage with VMs
- What teaching approaches work better for students who study practical science

Without a good understanding of the underlying pedagogy and simply allowing students access to digitized materials is unlikely to promote learning and lead to enhanced performance (McBride & Prayson, 2008).
Research Questions

• How do students' VM usage patterns compare in blended and online only conditions?

• How do students' perceptions about learning from using the VM compare in blended and online only conditions?

• How do students' perceptions about the VM pedagogical integration into their courses compare in blended and online only conditions?

• Drawing from 1, 2 and 3, what pedagogical conditions better support students' engagement and learning with VMs?
Blended learning

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5 Digital Microscope

To finish off this unit, you should now complete the Digital Microscope activity below. You should have already familiarised yourself with this tool during the Tuberculosis Case Study, but for a reminder of that activity click [here](#).

### Activity 6.3 Digital Microscope ‘Parasites I’ slides

**Allow 30 minutes**

Access the Digital Microscope tool on the module website or access the appropriate part of the module DVD. When you have the application open select the ‘Parasites I’ slide set from the ‘Catalogue’ box at the top right of the screen. This set comprises 12 slides, arranged as two rows of six slides on the right side of the screen.

The top row shows various stages in the life cycle of *Plasmodium* spp. The first slide in this row shows blood from an uninfected individual, while Slides 2–4 show *Plasmodium* parasites in the blood of an infected individual. The last two slides in the top row show *Plasmodium* within the mosquito vector. On the bottom row of this slide set are four slides showing *Trypanosoma* in blood, a faecal sample showing *Entamoeba*, and a calibration slide for measurement purposes.

Work through the slides from top left to bottom right, reading the descriptions of each one. Please feel free to browse around the images too. Where necessary you may wish to review the relevant section(s) of this unit in order to put the microscopy into a broader context.

For the purposes of discussing these slides with your tutor and other students, we recommend that you quote the X and Y coordinates of any objects or features that interest you (these coordinates are shown at the bottom-left of the microscope interface) and the magnification that you are using. This information will allow others to locate the same object(s) as you in a slide, thus facilitating any further discussions.

After viewing the ‘Parasites I’ slides, you should be able to use the Digital Microscope to answer the following questions.
DATA COLLECTION

- LEARNING ANALYTICS
  - Usage patterns for online only settings
- SURVEY
  - 139 undergraduate students
  - year 1 Earth’s Materials (N=66) - blended
  - year 2 Earth Science (N=37) - online
  - year 3 Biology course (N=36) - online
- INTERVIEWS
  - 11 semi-structured interviews (triangulation)
DEMOGRAPHICS

• Gender
  • Blended: 48.5% were male with 37.9% being female (13.6% missing data).
  • Online: 69.9% were female and 30.1% only were male.

• Age
  • Blended: 21 years old or younger (95.5%). Study as their sole occupation.
  • Online: 56.2% of the were 40 years old or older and 37% between 25-39 years old.
Unique students per week (Earth Science)

![Graph showing unique students visiting the VM page across the earth science module presentation.]

- **First introduction**
- **VM activities:** observe minerals, describe samples, explore common textures
- **Prior to final exam**

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CONTROLLING FOR COVARIATES

COVARIATES (explanatory variables)
• Age
• Gender
• Module type
• Previous experience of using a traditional/physical microscope (TM) and a VM,
• Problems encountered when using the VM

Three separate ANCOVAS with DVs:
• Enjoyment: ‘I enjoyed using the VM during the course’
• Teaching approach: ‘I liked the way the VM was integrated into the course’
• Perceived learning: ‘Using the VM improved my observation skills’
ANCOVAs outcomes

• **Enjoyment:** after controlling for covariates, no statistically significant differences between the two groups of students ($F(1, 105)=3.42, p=.06, \text{NS}$).

• **Teaching approach:** significant outcomes ($F(1, 99)=6.40, p=.007$) indicating that blended students are more satisfied ($M=4.19, \text{SD}=.62$) with how the VM is integrated in the module, even after controlling for covariates, as opposed to online students ($M=3.36, \text{SD}=1.16$).

• **Learning - improvement in observation skills:** significant, after controlling for covariates ($F(1, 99)=7.57, p=.003$) suggesting that greater improvement in learning (observation skills) was achieved for the blended learning cohort ($M=4.15, \text{SD}=.68$) as opposed to the online cohort ($M=3.62, \text{SD}=1.18$).
Usage patterns and general perceptions

• All students
  • easy to access the VM (web links or searching the web)
  • visited often the VM webpage.

• Interview data
  • More VM activities are embedded in the blended learning course that require student participation - endorsed by students.
  • Frequency and duration of use depended on the type of learning activities and assessment
    • completing an activity in the VLE,
    • students were asked by their tutor to use the VM,
    • review for the preparation of an assignment.
Learning gains

- Observation and identification skills
- Understanding of what is taught in the course
- Confidence in using the VM
- VM as being important for accomplishing the course aims.

- Blended learning conditions - better support learning through the VM.

- Interview data:
  - Universal preference to use a physical than a virtual microscope due to e.g., engaging with the process of preparing thin sections.
  - Students recognised the merits of using a VM: flexible use and access to samples not available at their institutions.
  - All interviewees: the VM as a tool for training and preparation for using the physical microscope.
Pedagogical integration

Blended learning students: more satisfied with the teaching approach
Why? Interview data…

**BLENDED**

- VM was introduced by their tutors through different activities.
- Various teaching activities (quizzes, assessment, homework), complementary to a physical microscope

**ONLINE**

- Need for a tutor to complement online VM activities, tutorials and videos.
- A tutor could provide guidance when recognising samples and feedback to students' understanding.
- Practise observation and identification of sections, basic means of viewing and understanding images.
Blended vs Online

• Blended learning conditions better support learning with the VM
  
  *Due to…*
  
  • high frequency of using the VM in a course,
  • its complementary use with a physical microscope,
  • the role of tutors in supporting and guiding students' learning.
  • VM is fully integrated to the course and not simply an add-on.

▶ Demographic variables associated with perceived enjoyment only.

▶ Pedagogical implications
  • Need for a more meaningful integration of the VM in teaching and learning
  • Need for more interaction and guidance by teachers when using the VM.
Thank you

• Questions?

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