Teaching and Learning in Plant Pathology for a new century - what has changed?

Associate Professor Vic Galea
The University of Queensland
Critical issues affecting the quality of plant pathology teaching and learning in recent times have been -

- A reduction in student contact hours in many academic programs (from 35 to 20 hrs per week)
- The move towards ‘generalist’ degree programs relying on honours or post graduate programs for development of ‘specialist’ disciplinary knowledge
- The gradual decline in number of plant pathologists teaching in universities
- The challenge to ‘engage’ the current generation of university students to become excited about plant pathology
- The teaching Vs. research conflict
The basic philosophy behind teaching plant pathology

Not dissimilar from the way in which clinical understanding is developed in medical or veterinary science students; plant pathology relies on students developing a range of competencies and a particular logical approach when presented with a plant disease problem to solve. The diagnostic process is the first (key) step in developing a full understanding of a disease problem and the consequent development of a management solution.

Stewart & Galea (2006): Special Report – Plant Disease
The coming of the computer age

In the 1980’s it was generally believed that computers would automate teaching. It was even feared that somehow, technology may even replace the function of academics.
Rather than replacing the role of academics, these technologies have become effective allies in the challenge to engage the current generation of university students.

However, without appropriate pedagogy, communications technologies, like any tool will not improve teaching and learning outcomes for students.

Students will not engage in course material unless good educational design provides the framework.
Using relevant technology is only part of the equation.

Providing relevant learning opportunities is also critical to maintaining student interest.
(From left) bachelor of applied science (horticultural technology) students Daniel Gillinder and Shaun O’Brien monitor lettuce seedlings for Gatton farmers Keith and Hazel Jackwitz.

Program sows career foundations

A dopt-a-crop is the nickname of an innovative proved valuable in providing early warnings of pest and weed out-}

and the past most of the advice farmers had was from representa-

It’s a good dose of reality for the students,” Dr Galea said. “They
Chapter 1: The Virtual Plant Pathology Lab
The Virtual Plant Pathology Lab: a Problem Based Learning Primer

VPPL was designed to introduce logic concepts, investigative skills and case management approaches for plant disease diagnostics.

This was created to improve student engagement and learning outcomes in plant pathology.
Key features

- Uses real case studies in an authentic learning environment
- Teaches the principles of plant disease case management
- Uses a logical framework (scaffolding) to reinforce appropriate process
- Reinforces notion of critical decision-making points
- Uses high quality images and an engaging interface
- Demonstrates appropriate clinical laboratory skills and management outcomes.
MEET CLIENT AND VIEW PROBLEM

Your name is Peter Binek, it is your second year out of university and you are employed as a plant pathologist with the Department of Primary Industries & Fisheries (DPI&F) in Gatton.

Farmer Jo contacts you by telephone to let you know that she has a serious problem with her silverbeet crop. She tells you her crop is looking unwell and requests that you come to her farm as soon as you can.
PART D - VISUAL EXAMINATION AND RECORDING OBSERVATIONS

Record symptoms in detail (foliage and twigs; trunk, stem and branches; flowers and fruit; taproot, main roots, feeder roots). How does this compare to a healthy specimen?

Affected plants appear to be covered in a white powdery substance. This is present on both the upper and lower sides of the leaf. On younger leaves, this symptom is patchy, whereas on older plants, the entire plant surface appears to be covered by this material. The plants don’t appear to be affected in any other way, there is no obvious sign of insect activity or other forms of superficial damage.

VISUAL EXAMINATION

You take the plant specimens out of the collection bags and place them on the laboratory bench. You carefully examine the silverbeet leaves with the aid of a lamp to provide a strong light source.

You record your findings in PART D of the case form.
HIGH POWER MICROSCOPE EXAMINATION

You have now reached the limit of magnification of the low power (dissecting) microscope. To see more detail you need to increase magnification power. This requires you to use the high power (compound) microscope which is ideal for looking at the detailed structures of pathogens, particularly fungi.

You conduct a high power microscope examination. Check out the hig
Method 2 – Sticky tape method

Some plant pathogens produce evidence of their activity directly on the plant surface. These structures (hyphae and spores) can be removed intact quite easily using clear sticky tape.

A piece of tape is gently pressed onto the plant surface over the area of interest and then carefully removed.

View movie showing first part of sticky tape method.
Assessment by Peers

The VPPL CD-ROM and a questionnaire sent out to approx 50 plant pathology practitioners, academics and postgraduates in May 2006

Data was collected on 18 fixed questions, 5 open ended feedback and demographics.

26 Responses were received
<table>
<thead>
<tr>
<th>Learning opportunities and engagement</th>
<th>Your assessment</th>
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<tbody>
<tr>
<td></td>
<td>Strongly agree</td>
</tr>
<tr>
<td>1. The scope of the resource is clearly stated.</td>
<td>38</td>
</tr>
<tr>
<td>2. The resource appropriately supports learning for both distance and on-campus students.</td>
<td>46</td>
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<tr>
<td>3. There is an appropriate organisational scheme (e.g. by case study).</td>
<td>50</td>
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<tr>
<td>4. There is appropriate integration of resources and activities.</td>
<td>38</td>
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<tr>
<td>5. Users can easily obtain information or perform tasks by following the links provided by the system.</td>
<td>58</td>
</tr>
<tr>
<td>6. The resource attracts and maintains the user's attention.</td>
<td>62</td>
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<td>7. The activities pose an appropriate level of challenge.</td>
<td>38</td>
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<tr>
<td>8. The activities have the potential to invite collaboration.</td>
<td>27</td>
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<td>9. Avenues for support are provided.</td>
<td>38</td>
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<tr>
<td>10. The use of authentic case studies is relevant to learners.</td>
<td>77</td>
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<tr>
<td>11. The reinforcement of the diagnostic process via the flowchart and the consistent structuring is useful for developing professional expertise.</td>
<td>58</td>
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<tr>
<td>12. The resource is accurate and up to date.</td>
<td>40</td>
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<tr>
<td>Feedback mechanisms</td>
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<td>------------------------------------------------------------------------------------</td>
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<tr>
<td>13 There is sufficient formative feedback for students.</td>
<td>27</td>
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<td>14 The completed case forms provide adequate feedback to students upon completion of each case.</td>
<td>27</td>
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<table>
<thead>
<tr>
<th>Use of information communication technologies</th>
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<tr>
<td>15 The use of a CD-ROM with high resolution images and other multimedia features contributes to the clarity and usability of the resource.</td>
<td>81</td>
<td>19</td>
<td></td>
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<tr>
<td>16 It is appropriate to use multimedia for this learning resource.</td>
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<td>38</td>
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<th>Overall consistency and coherence</th>
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<tr>
<td>17 The learning activities are likely to develop the intended skills and understandings.</td>
<td>50</td>
<td>42</td>
<td>8</td>
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<tr>
<td>18 This package has a strong sense of cohesion.</td>
<td>46</td>
<td>54</td>
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Response summary

Overall approval of the resource was high among peers

Constructive feedback was received for further development of the resource

Requests were made for use of the resource for training at other universities and government organisations.
Chapter 2: Using on-line teaching to develop critical understanding of the diagnostic process
The Problem

VPPL was issued to students for self-directed learning supported by an on-line discussion forum

Student engagement with VPPL was highly variable (mostly poor)

Many did not understand how to use VPPL in their learning

Translation of concepts from VPPL into lab sessions and a collaborative assignment was not occurring as intended
Virtual Plant Pathology Lab # 1

This is a discussion board for the Virtual Plant Pathology Lab exercise.

There are three activities that you are required to be a part of - Here are the details of the first activity.

1. Firstly you should investigate the demonstration case in the Virtual Plant Pathology Lab (VPPL) CD-ROM (Silverbeet case) and then enter the first discussion session. Use this discussion session to make comments on this case and to question the process used. Do you understand how and why this case was solved? Do you agree with the process? Would you have done anything different and why? Are there any points of logic that do not seem logical to you?

The idea of this first exercise is to introduce you to the process and logic of plant disease diagnosis. Use this activity to question this process. Just like skinning a cat (yuk!) there is more than one way to go about this process and the path selected for this case may not be the only way it can be done.

For each new question please create a new discussion thread. I will attempt to answer questions as they arise - however you should also chip into the discussion and question my logic as well - nothing is sacred here!

In a few days we will start the next activity - this session will remain open for 2 weeks!

Virtual Plant Pathology Lab # 2

Hello team,

This is the second discussion forum for the VPPL. In this forum you will discuss the Melon case (case #2) on the CD-ROM.
Forum: Virtual Plant Pathology Lab #1
Date: Mon Aug 28 2006 20:44
Author: Lenane, Peta <s4129429@student.uq.edu.au>
Subject: Diagnosis

I was wondering why there are so many possible causes on the possible causes list when most of them don't sound anything like the symptoms. Also in step 5 - visual diagnosis it said that diagnosis at this stage is not possible, but by this stage I had narrowed it down from the descriptions to powdery mildew, then in later steps it had downy mildew as a possibility, however I eliminated downy mildew with the others as it occurs in cool, damp weather, whereas the crop in question had abnormaly hot and dry weather when the symptoms occurred.

Is the extensive list of possible causes and the investigating using a high powered microscope to ensure that there is a minimum chance of inaccuracy, or could it be diagnosed earlier on?
The Solution

A series of on-line collaboration sessions using Wimba Classroom was offered.

Each session was used to interrogate and review an individual case from the VPPL.

Engagement allowed students to appreciate the underlying philosophy behind the approach to case management.

Support from the academic was critical to develop and maintain student momentum.
The Wimba Sessions

Voluntary involvement (with a carrot)
Conducted at night (flexible delivery)
Involved on-campus and distance cohorts
Structure of Live Classroom sessions

Lesson plans were prepared for each 1 hour session
Application sharing or simultaneous local use of VPPL by lecturer and learners integral in learning experience
Sessions allowed for regular polling on issues
Students able to contribute by voice and/or text messaging
Team teaching using support of a tutor allowed larger group handling
Purpose of these On-Line Discussions

- To thoroughly investigate some of the cases in the VPPL CD-ROM
- To develop an understanding of the process of plant disease diagnostics processes and resources
- To learn about professional approaches to plant disease case management
Shortening the list: Symptom Matching

- We will work through the symptoms for each possibility
- Vote **Yes** for a good or even a close match
- Vote **No** for a bad match
Dissecting Microscope

- The low power microscope views did not help with the diagnosis

- Why not?
Outcomes

Deep interrogation of each PBL styled case allowed students to better understand the underlying principles and processes involved in clinical plant disease case management.

Critical discussion of each case identified potential weaknesses or variations in process used.

Involvement in group learning developed a sense of community among students which particularly benefited distance learners.
Chapter 3: Collaborative learning as a mechanism to reinforce understanding of diagnostic procedures and client relationships
Students are thrown into the (virtual) deep end to practice their knowledge

A mystery case was presented to students for them to solve (role play)

Activity conducted using an on-line discussion forum

Lecturer/Tutor as the client, providing information (on request only)

Students as investigators – requesting information and directing the case as they share knowledge and process of enquiry
Can you please help me?

Hi, name is Aloesi.

I am a research assistant working in Dr Vic’s lab and I need some assistance if you can help me. Earlier this week a farmer came to the lab with a problem he is having with his crop of sweet potatoes. He is half way through his harvest, and he has found that some of the rows are producing some malformed potatoes which he can’t sell. He has never seen this problem before and needs to know what is causing this damage and what he can do about preventing this problem from getting worse.

My problem is that although I have studied a little about plant pathology, I have never had to manage a diagnostic case like this before. And to make matters worse, Dr Vic has gone away to a meeting in Cairns (although I suspect it may be a fishing trip) and he has left me with this case to solve.

I have full access to Dr Vic’s laboratory and have the address of the farmer, so I can visit his property to fully investigate the case. Right now, all I have to go on is a phone number and a single sweet potato that doesn’t look so good. I have attached a photo for you to see.

To carry out this investigation I need you to instruct me. Please let me know what I should do, and in what order, and together we can solve this case. I would like to get some answers back to the farmer before Dr Vic comes back to work, and more importantly, come up with some recommendations to help the farmer.

I will be your eyes, ears and hands and will do anything I can to provide you with the information and observations about this problem in the field, and then carry out any laboratory work required. I have access to a digital camera, and can also take photos of what I can see down a microscope. The lab here is fully equipped for this type of work. I am sure that together, we can investigate this problem and come up with a diagnosis and a management strategy.

I will be here on-line to wait for your next instructions.

Regards,

Aloesi
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<thead>
<tr>
<th>Thread: The Case Begins Here</th>
<th>Total posts: 77 Unread posts: 69</th>
</tr>
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<tbody>
<tr>
<td>The Case Begins Here</td>
<td>Victor Galea 9/15/07 9:47 PM</td>
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<tr>
<td>RE: The Case Begins Here</td>
<td>Glenn-Martin Bergin 9/15/07 1:38 PM</td>
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<tr>
<td>RE:RE: The Case Begins Here</td>
<td>Naomi Galbraith 9/15/07 5:55 PM</td>
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<td>RE:RE:RE: The Case Begins Here!</td>
<td>Glenn-Martin Bergin 9/16/07 5:31 AM</td>
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<td>RE:RE:RE:RE: The Case Begins Here!</td>
<td>Rebecca Roberts 9/17/07 9:10 AM</td>
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<td>RE: The Case Begins Here</td>
<td>Aloesi Dakuidreketi 9/20/07 4:20 PM</td>
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<td>RE: The Case Begins Here</td>
<td>Swoo Soh 9/17/07 12:28 PM</td>
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<td>Victor Galea 9/17/07 3:38 PM</td>
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<td>Bee Chua 9/17/07 4:23 PM</td>
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<td>Sarah Limps 9/17/07 11:17 AM</td>
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Outcomes

Student engagement in the process was improved as a result of Wimba sessions – feedback has been extremely positive

Non-participating students had access to recorded sessions

Student questioning indicated a good depth of reasoning and analysis

Modelling of process was demonstrated in submitted reports

Development of a learning community resulted
What the students had to say

Glenn-Martin Bergin

The use of the Live Classroom to hold forums which allowed online verbal discussion with the aid of PowerPoint presentations, eBoard and a CD-ROM to assist with solving the case studies, was an impressive collection of resources and knowledge that provided me with efficient and effective learning outcomes. I personally found this style of teaching delivery very professional, cutting edge and rewarding, whilst at the same time it allowed me to continually ask more questions of myself and my researching techniques and abilities.
Sheridan Moore

*We have been able to contribute ideas in an internet group setting with instant feedback. This enables students to have their questions answered and have immediate gratification... This has been the most interesting style of learning I have ever participated in at university and I hope more programs take up its style.*

Stuart Longworth

*I found the online voice communication very useful and it gave me a great understanding of what everyone was thinking. I also found that the interaction through the typed messages in Live Classroom was useful in putting forward an idea or just if speaking aloud was not comfortable.*
Chapter 4: Industry based problems – letting students loose in the lab working for real clients
Objectives

- Develop skills in diagnosis of plant diseases
- Develop logical thinking ability
- Reinforce knowledge of plant pathology
- Improve communication skills
- Develop extension skills
Senior Student Professional Diagnostic Project

Major assignment

Students conduct full diagnostic investigation of a plant disease for a client

Requires interaction with client to establish case background

Results and recommendations to be communicated back to client
Principles of plant disease diagnosis taught in class setting

Students resolve problems individually

Resource materials identified and used

Diagnostic outcomes confirmed by lecturer / tutor

Logic process flowchart used to guide process (framework)
Sourcing Problems

Industry clients are sought to volunteer problems from their commercial production systems
Students select problems to work on individually
Students make direct contact with client to begin process of case development
Procedure

Students keep material alive in glasshouse or in cold storage

Work is carried out progressively over a period of several weeks in an “open lab”

Support on demand is given to each student working on their individual case
Multimedia Case Record

Case record managed as a computer file using Challenge FRAP (Stewart, MacIntyre & Galea 2005)
Multimedia template designed specifically for this purpose
Flexible format allows case record to be adapted to suit each case
Basic structure and content provides guidance prompts
Plant stems mostly intact. Generally, one stem per pot showing basal necrosis and dead upper shoot.

I have decided to examine the stem more closely as this appears to be the cause of the problem.
Progressive Feedback

Template has discussion / feedback box in each frame view

Template is submitted in draft form to allow lecturer guidance

Students re-submit completed file two weeks later
John, I suspect that there may be nematodes in this stem area. What would have been the best way to observe these?

gavgalea (25/09/04):
Multimedia format encourages development of new skills and competencies
Student Outcomes

Interaction with client adds relevance to activity
The requirement to provide feedback and a solution integrates theory with practice
Research skills encouraged
Multimedia approach more relevant to today’s students
Students are highly motivated
Teaching and Learning in Plant Pathology for a new century - what has changed?

- Students learn differently from the way we did, and we need to keep pace with their needs if we are to remain relevant to them
- New communication technologies allow us to communicate more effectively and flexibly with our students bridging many gaps which were previously impassable
- Universities now acknowledge and support the development of good teaching and learning practices
- Research and further study in education is also a valid pursuit for academics


What hasn’t changed?

- Computers haven’t taken our jobs, they have just become an integral part of our lives
- There is no substitute for good educational design and teaching practice with a human touch
- Teaching plant pathology remains as rewarding and exciting as it ever was
- The lineage of dedicated and passionate plant pathology academics continues across our universities
- The generation gap between students and academics continues to exist (refer to previous slide!)
Acknowledgements

- Dr Terry Stewart – Massey University
- Dr Caroline Steel – University of Queensland
- Teaching and Educational Development Institute – University of Queensland
- Professor Terry Price – La Trobe University
Thankyou for your attention