

# CERTIFICATE OF PROFICIENCY IN SEED TESTING

## INTRODUCTORY INFORMATION

### BLOCK 1



### STANDARD COURSE

This introductory information for Block 1 of the Certificate of Proficiency in Seed Testing has been prepared by Seed Technology Institute Australia Pty Ltd, P O Box 410, Blackwood SA 5051, Australia.

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# Introductory Information

## Block 1

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# Introductory Information

## Block 1

### **FOREWORD**

Seed testing, as we know it today, began in the 19<sup>th</sup> Century in Germany when the first seed testing station was opened in 1869 by Friedrich Nobbe. At this time he was a lecturer at an agricultural college in Tharandt, Saxony, and was concerned about the poor quality of seed on sale locally. He and his colleagues developed the purity and germination tests as ways of assessing seed quality, and thus providing a method for making comparisons among seed lots.

Knowing how to accurately determine seed quality requires a seed analyst to possess a number of different skills. These skills are best obtained through a combination of background information and “hands on” training. The six modules which comprise Block 1 of this Certificate of Proficiency in Seed Testing Course are designed to provide both these requirements for the trainee seed analyst.

Seed Technology Institute Australia Pty Ltd

February, 2005

## INTRODUCTION TO SEED TECHNOLOGY INSTITUTE AUSTRALIA PTY LTD

Seed Technology Institute Australia Pty Ltd (STIA) is a registered Australian company established in 2001.

STIA's guiding vision is:

*to be a preferred Australian provider of seed services to industry, and Asia/Pacific leaders in the provision of training and consultancy to national and international seed technologists and seed industries.*

To become a preferred provider of seed services to industry, STIA aims to:

*deliver quality services to the Australian and Asia/Pacific seed industries and ancillary providers.*

The strategic intent of STIA is to:

- maintain and enhance a quality seed testing service for the Australian seed industry
- develop a seed testing/seed technology training service for Australia and other Asia/Pacific nations
- maintain and enhance an expertise base in seed technology

STIA operates the Queensland Seed Technology Laboratory (QSTL) located at the Gatton campus of the University of Queensland. QSTL is accredited by the International Seed Testing Association and authorised by the Australian Seeds Authority to issue ISTA international seed analysis certificates.



## INTRODUCTION TO STIA's PEOPLE

Dr John Hampton (COP course co-ordinator, module author and series editor)



John is a Director of STIA and Wrightson Professor of Seed Technology and Director of the Bioprotection and Ecology Division at Lincoln University, New Zealand. He began his career as a seed pathologist before widening his interests to seed production and seed quality assurance. He has 30 years of experience as a scientist, teacher, writer, and postgraduate supervisor in seed technology. He has been an international consultant and training provider in The Islamic Republic of Iran, The Peoples Republic of China, the former USSR, Thailand, Brazil, New Zealand and Australia. John is an Executive Committee Member of the International Seed Testing Association (ISTA), a member and former chairperson of the ISTA Vigour Test Committee, Deputy Chair, ISTA Rules Committee, and Member of the Editorial Board and Associate Editor for Seed Science and Technology. He is a Fellow of the Agronomy Society of New Zealand and holds Certified Practising Agriculturalist (CPAg) status through the New Zealand Institute of Agricultural Science.

Dr Kevin Boyce (module author)



Kevin is a Director and Company Secretary of STIA. He is the former Head of PIRSA Seed Services of the South Australian Government, is Chairman of the Technical Committee on Training and Education for the Australian Seeds Federation and member of the Technical Advisory Committee of the Australian Seeds Authority. He has an extensive knowledge of the Australian seed industry including legislation and policy, production, seed certification and seed quality assurance. He also has wide ranging international experience, being a former President of the International Seed Testing Association, Australia's representative and past chairperson of the OECD seed schemes, and a seed technology consultant in the Middle East and Asia. He is the Personal Member for the STIA laboratory accredited with ISTA..

Karen Hill (module author)



Karen is a Director of STIA and the Laboratory Manager of the Queensland Seed Technology Laboratory (AUDL02). She holds an Advanced Certificate of Proficiency in Seed Testing from New Zealand and has been involved with seed testing as a bench analyst, section supervisor and laboratory manager for 30 years. Karen was previously Seed Laboratory Manager of the ISTA accredited laboratories at Massey University (NZDL02) and Lincoln University (NZDL04). She is a Personal Member of ISTA and has served on both the Germination and Purity Technical Committees of ISTA. Karen has been involved with training in seed technology and seed analysis at certificate, graduate and postgraduate level, and has been involved in training programmes in The Peoples Republic of China, Thailand, The Philippines, New Zealand and Australia.

Dr Murray Hill (module author)



Murray is the STIA Chairman of Directors and former Director of the New Zealand Seed Technology Institute and Professor of Seed and Crop Science at Lincoln University, New Zealand. He has over 40 years experience as a teacher, researcher, consultant and author in seed technology, and under his leadership, the Massey University Seed Technology Centre and the New Zealand Seed Technology Institute collectively have a seed technology student alumni of nearly 1200 people from 64 countries. He has been an international consultant and training provider in The Peoples Republic of China, Malaysia, Thailand, Laos, Cambodia, Vietnam, Indonesia, the Philippines, New Zealand and Australia. Murray is a former member of the Seed Moisture and Storage Committees of ISTA, a Royal Society of New Zealand Science and Technology medallist, a Fellow of the Agronomy Society of New Zealand, and holds Certified Practising Agriculturalist (CPAg) status through the New Zealand Institute of Agricultural Science. He is currently an Honorary Professor in seed science and technology at the University of Queensland.

# **CERTIFICATE OF PROFICIENCY IN SEED TESTING:**

## **INTRODUCTION**

The STIA Certificate of Proficiency in Seed Testing is provided in two blocks:

Block 1: Standard Course

- six modules (seed quality; seed biology; seed sampling and dividing; purity testing; seed identification; germination testing)

Block 2: Advanced Course

- eight modules (the seed industry; the seed laboratory quality system; seed weight determination; seed moisture testing; seed dormancy; testing for seed viability; seed vigour testing; seed analysis certificates).

These modules have been written using the Mastery Learning format (see Section Five), and are designed so the trainee can work at their own pace, both in the seed testing laboratory and in their own home. It is expected that Block 1 would be completed within 15 months, and Block 2 would be completed within 18 months. However trainees may choose to complete the modules in less time than this. Note that before enrolling for the Advanced Course (Block 2), a trainee must have successfully completed the Standard Course (Block 1). Trainees will be assessed on both their knowledge (written examination for each module) and abilities (practical examination for relevant modules) plus participation in a proficiency test programme (for purity, germination, other seed determination and moisture).

Further detail on Block 1: Standard Course is provided in Section Four of this Introductory Information.

# **CERTIFICATE OF PROFICIENCY IN SEED TESTING: BLOCK 1: STANDARD COURSE: SPECIFICATIONS**

Course Co-ordinator: John Hampton

Other Contributors: Kevin Boyce, Karen Hill, Murray Hill

Course Schedule: Fifteen months

## **Synopsis**

An overview of seed quality, seed biology, and techniques associated with working sample preparation, purity analysis, seed identification and germination testing.

## **Modules**

- Module 1. Seed Quality
- Module 2. Seed Biology
- Module 3. Seed Sampling and Dividing
- Module 4. Purity Testing
- Module 5. Seed Identification
- Module 6. Germination Testing

## **Module Objectives**

**Module 1** – an overview of seed quality, and an introduction to the International Seed Testing Association, leading to the demonstration of mastery of an understanding of the various components that make up seed quality.

**Module 2** – an introduction to the plant kingdom, plant reproduction and seed development, and seed anatomy and morphology leading to the demonstration of mastery of an understanding of seed biology.

**Module 3** – an explanation of the importance of accurate seed lot sampling for seed testing, how to sample seed lots correctly, and how to reduce the submitted sample to the required working sample size without bias leading to the demonstration of mastery of laboratory sample division.

**Module 4** – an introduction to the equipment required for purity testing, and information on the internationally agreed purity test methods for different species, and how to conduct these tests leading to the demonstration of mastery for purity testing and the determination of other seeds by number.

**Module 5** – an explanation of the characteristics of seeds of different plant species, and an introduction to seed description keys leading to the demonstration of mastery for identification of selected crop and weed seeds.

**Module 6** – an explanation of the process of seed germination, an introduction to the equipment required for germination testing, and information on the internationally agreed germination test methods for different species and how to conduct these tests, leading to the demonstration of mastery for germination testing.

### **Assessment**

(i) **Knowledge**

Mastery Learning Written Assessment Sheets for Modules 1-6.

Marks available per Module = 50.

Minimum marks required per Module = 40.

(ii) **Abilities**

Mastery Learning Practical Assessment Sheets for Modules 3, 4, 5 and 6.

Module 3 (laboratory dividing)

Marks available = 50.

Minimum marks required = 40.

Module 4 (purity testing)

Marks available = 150.

Minimum marks required = 120.

(other seeds by number)

Marks available = 100.

Minimum marks required = 80.

Module 5 (crop seed identification)

Marks available = 50.

Minimum marks required = 40.

(weed seed identification)

Marks available = 50.

Minimum marks required = 40.

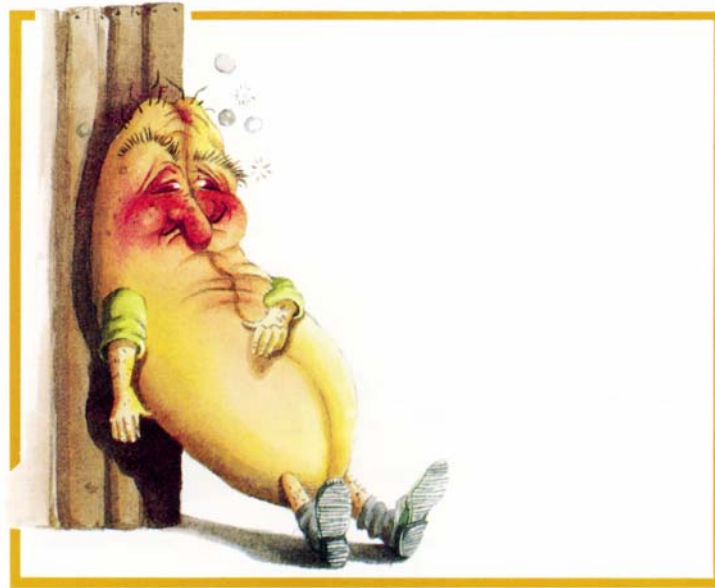
Module 6 (germination testing)

Marks available = 200.

Minimum marks available = 160.

Assessment of both knowledge and abilities will be conducted at a block course/workshop run for this block (see Section Seven).

In addition to these formal assessments, each trainee must participate in 3 proficiency test rounds (see Section Six) for each of the purity, determining other seeds by number and germination tests over the 15 month period and achieve an overall B rating or better for each test (see Section Six).



## MASTERY LEARNING

In all the modules prepared for this Certificate of Proficiency Course we have used a Mastery Learning format. So what is “Mastery Learning”?

Everything we can do	.....	we have learnt	Skills
Everything we know	.....	we have learnt	Knowledge
Every attitude we have	.....	we have learnt	Attitudes

Educationalists usually distinguish between skills, knowledge and attitudes; there are differences in the “things” being referred to. However they all have one thing in common – their presence or absence can be demonstrated.

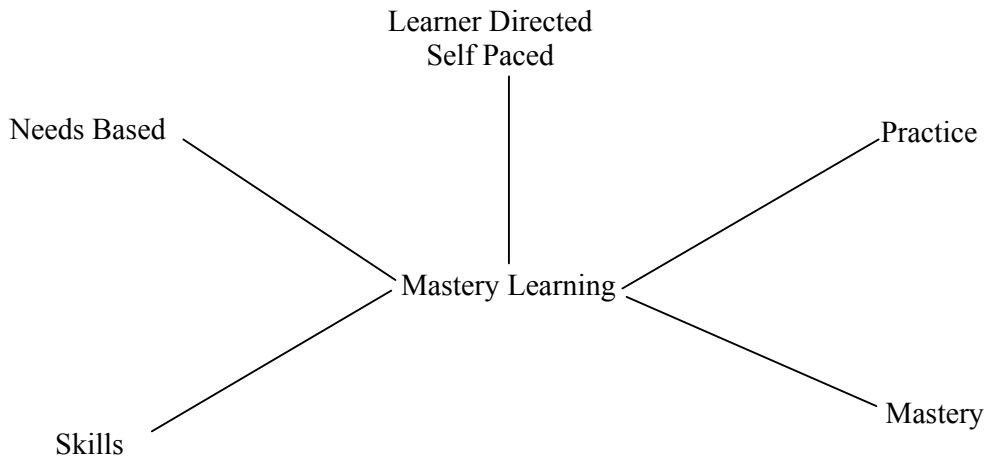
- You can demonstrate if you know the difference between a normal and an abnormal seedling
- You can demonstrate that you can make a decision
- You can demonstrate whether you are fond of dogs or not.

Therefore we can consider them to be skills. Mastery Learning is aimed at helping you to achieve things that:

- i) are useful i.e. NEEDED
- ii) can be DEMONSTRATED
- iii) to a pre-set standard i.e. MASTERED

- iv) are SELF-DIRECTED and SELF-PACED; and
- v) can be PRACTICED

Mastery Learning is based on a five key element learning system.



where:

- i) SKILL is a set of actions that result in the production of a result that is observable and measurable e.g. entering germination test results on a work card.
- ii) NEEDS BASED is a programme based on the skill gap between what you can do and what you have to do in a particular job or situation (NB – a need is a gap).
- iii) LEARNER DIRECTED AND SELF PACED is where the learner has involvement and control over what is to be learnt, where and when. This includes being able to proceed at your own pace, independently of other learners.
- iv) PRACTICE is the use of resources made available for the learner, under guidance. The guidance may be indirect (e.g. in written form) or direct (from your Laboratory Manager).
- v) MASTERY refers to being able to perform the skill to a standard.

You are required to work through six modules for the Standard Course and a further eight modules for the Advanced Course, the goal being to successfully demonstrate your Mastery of the topics for all the modules.

This work will be done in your own time and/or in time allocated to you by your Laboratory Manager. You work at your own pace. How quickly you complete the modules will depend on your skill level; those of you with a good grasp of the required skills will require little time to successfully complete the modules – others of you with less experience will have time to improve these skills to meet the required standards.

To demonstrate your mastery, you will need to meet or better the pass mark for exercises in the mastery demonstration worksheet(s) for the modules within the allocated time, and without reference to the module. These worksheets will be available at the workshops/block courses scheduled for this Certificate of Proficiency course. Don't become unduly concerned if you are not successful at the first attempt for any of the modules. Your course manager will offer advice, you will have time to concentrate on those areas where your skills are deficient, and you may attempt any worksheet as many times as it takes for you to succeed.

You must demonstrate your mastery for all the modules.

Instructions as to what you have to do are provided within each module.

## PROFICIENCY TESTING

A proficiency test for germination, purity or other seed determination is your chance to demonstrate your skills in conducting these tests of seed quality, i.e. your analytical competence. It is expected that while at the beginning you may have some difficulties, by the time you have worked your way through the relevant modules, you will be able to readily achieve the performance rating required (see Section Four). What happens is as follows:

1. You will be sent a submitted sample for a species with which you are familiar and be asked to conduct a germination and/or purity and other seed determination tests on it.
2. This submitted sample will have been especially prepared by the proficiency test organisers, and each course participant will receive a submitted sample drawn from the same seed lot (i.e. all its quality attributes will be the same for each submitted sample).
3. You will be asked to conduct the nominated test(s) using the correct internationally agreed method (International Seed Testing Association Rules – see the relevant Modules) for the species, and send your results on the form provided back to the proficiency test organiser.
4. Your results will then be compared with the result from an ISTA accredited seed testing laboratory nominated by the proficiency test organiser, as will all the results from the other trainees.
5. All these results (for purity and germination) will be analysed using a statistical evaluation which determines by how much your result differs from the ‘true value’ of the sample (how this is done is not important here: except to say it is the method ISTA uses for the compulsory proficiency testing required for all its accredited laboratories).
6. You will then be given a rating for your performance as follows:  
  
A = congratulations, no worries.  
  
B = minor problems, be more careful next time.

C = there are problems with your results, they must be corrected.

BMP = below minimum performance; you need help!

7. For other seed determination you will be rated on the percentage of seeds you retrieved and correctly identified, i.e.

A =  $\geq 90\%$  retrieval and identified

B =  $\geq 85\%$  retrieval and identified

C =  $\geq 80\%$  retrieval and identified

BMP =  $<80\%$  retrieval and identified.

8. You will be required to participate in 3 rounds for each of these 3 tests over the 15 months.

Your overall performance will depend on your performances in each round, i.e.

an A = 5 points

A = 14 – 15

a B = 4 points



Overall score

B = 11 – 13

a C = 3 points

C = 8 – 10

a BMP = 0 points

BMP = below 8

For example for the germination proficiency test

Round 1 = C = 3 points

Round 2 = A = 5 points

Round 3 = B = 4 points

$\therefore$  overall score = 12 points = B (and a B rating or better is what you are after).

9. The proficiency test organiser will always provide you with an explanation as to why your results were given a specific ranking. Examples could be:

- (i) germination – you are having trouble identifying abnormal seedlings in this species.

- (ii) Purity – your percentages added up to more than 100%. Either you are having trouble using the balance or calculating percentages.
- (iii) Other seed determination – you did not find the two *Dactylis glomerata* seeds added to the sample and misidentified *Trifolium dubium* as *T. repens*.

10. What happens with BMP ratings?

It would not be unusual at the start to have one or more BMP ratings (skills improve with experience after all). In such cases the proficiency test organiser will explain where the problem(s) occurred and will arrange for your laboratory manager to organise within laboratory comparative tests (nothing beats practice!). However if you continue to receive BMP ratings then there are major problems with your skills and you are not therefore ready to demonstrate your mastery in these areas. The proficiency test organiser will discuss ‘what to do next’ with you. Remember that you are required to achieve an overall rating of B for each of the germination, purity and other seed determination tests before successfully completing the course.

## **BLOCK COURSE/WORKSHOP**

At least once, and probably twice, in the 15 months over which Block 1 of this Certificate of Proficiency in Seed Testing will run, you will be required to attend a 4 – 6 day block course or workshop. The purpose of this requirement is to allow you to:

- (i) meet the course providers
- (ii) meet the other trainees
- (iii) receive further information and experience (including practical work where relevant) on the module topics
- (iv) demonstrate your mastery for individual modules (for both knowledge and abilities)
- (v) receive feedback on your performance and advice as to what is further required to achieve mastery if you were not successful on your first attempt.

Whether it is called a block course or workshop is not important; it depends on which country and who is running it. For example STIA may run a block course in Australia for Australian trainees, and may facilitate a workshop in Thailand for trainees from Thailand and neighbouring countries.

The times, location and costs for these block courses/workshops will be provided on request.



## INCREASING SUCCESS IN LEARNING

By embarking on this Certificate of Proficiency in Seed Testing programme you will have made the decision to take the responsibility for your own learning. Here are some tips to help you with this process.

### 1. Getting the Most From Your Laboratory

Do you understand how things work in your laboratory? Finding the answers to these key questions is one way of helping you to find out.

- (i) Who is in charge of your laboratory?
- (ii) What are the roles of:
  - the laboratory manager?
  - the senior (or supervising) seed analyst?
  - the seed analyst?
- (iii) Where can I go to get assistance with:
  - job difficulties?
  - personal problems?
  - goal setting?
  - the modules in this course?
- (iv) Where can I go to get information on:
  - the ISTA Rules for Seed Testing?
  - the laboratory Quality Assurance system?
  - my country's seed industry?

UNDERSTANDING MORE ABOUT HOW THINGS WORK IN YOUR LABORATORY WILL HELP YOU ACHIEVE YOUR SEED TESTING CAREER GOALS – DON'T BE AFRAID TO ASK.

**2. Getting the Most From You**

Check through this list and answer YES, SOMETIMES or NO for each:

- I am well organised .....
- I listen carefully to instructions .....
- I enjoy my seed analyst job .....
- I complete my work on time .....
- I make an effort to produce a good standard of work .....
- I enjoy working with others .....
- I enjoy talking with others .....
- I assist other staff members if they ask me .....
- I ask questions when I am not too sure about something .....
- I keep up with what is happening in the laboratory .....
- I have set myself some goals for this year .....

If most of your responses are YES, then you are generally well organised, enjoy your work, and on track to enjoy the course. You might want to write down any specific areas for your SOMETIMES and NO responses you wish to improve upon. Think about asking for assistance in this from your laboratory manager, a fellow seed analyst or a friend.

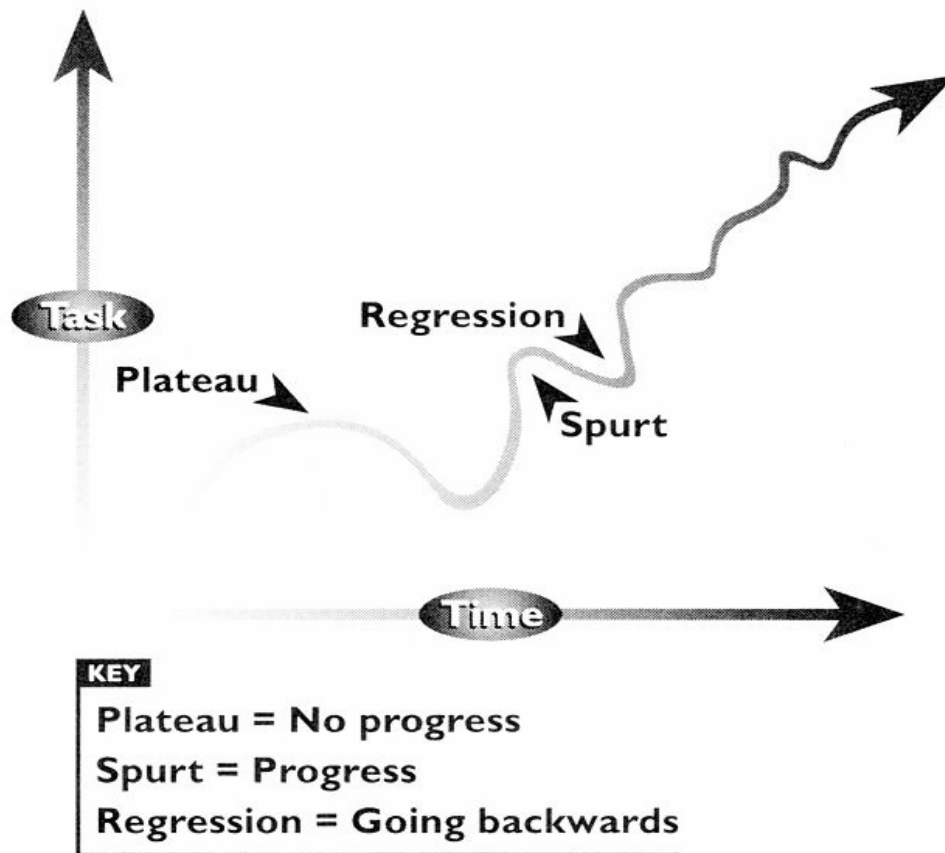
**3. Learning and Learning Styles**

Learning combines outside information (e.g. the module contents) and inside information (e.g. what you already know about seeds). It is often a slow and step-by-step process. If you begin this course knowing virtually nothing about seeds, you can only learn so much at a time; if you have already worked for some time as a seed analyst you already know more, and

will learn more quickly because it is easier to relate this new information to your existing knowledge.

Whatever your starting point, don't assume that your learning curve will be a smooth, steady climb, starting slowly and getting faster as time goes by.

## Here is a normal learning curve.



Learning often starts off with a degree of confusion, and lifts, stalls and even goes backwards sometimes. As time goes by more progress will be made. Learning takes time. Some will learn faster, others more slowly, but everyone will learn. If you get really interested in a certain topic or topics, you will find that learning goes much faster.

People have different learning styles (which have no connection to how intelligent you are!).

We all use our senses in learning, but often one of our senses dominates.

Some people are very VISUAL – they prefer learning by using their eyes, e.g. they learn best from seeing a test method demonstrated in the laboratory, or from watching a video, or by reading notes they have taken.

Other people are AUDITORY – they prefer listening to someone speak about a topic and then discussing this information. When they are reading, they often prefer to read out loud so that they can hear what they are reading.

Still other people are KINAESTHETIC – they prefer to learn by doing things, e.g. by working with a fellow seed analyst conducting a test in the laboratory. These people need to be active in order to learn well.

It is important to find the style you are most comfortable with and then use this knowledge to help your learning.

Put a circle around the following statements which are most like you.

<b>VISUAL</b>	<b>AUDITORY</b>	<b>KINAESTHETIC</b>
<ul style="list-style-type: none"><li>• I read and watch TV</li><li>• I watch people</li><li>• I go to movies</li><li>• I write or draw</li><li>• I like things tidy</li></ul>	<ul style="list-style-type: none"><li>• I talk and listen to people</li><li>• I tell jokes</li><li>• I listen to music</li><li>• I remember phone numbers by heart</li><li>• I dislike other people's 'noise'</li></ul>	<ul style="list-style-type: none"><li>• I move around</li><li>• I touch and play with things</li><li>• I play sport</li><li>• I dance</li><li>• I 'do' rather than watch</li></ul>

If you have most/more circles in just one group, this indicates your preference for the particular learning style.

If you have many circles in two groups but very few in the third you have two strong learning styles.

If there is a fairly even spread of circles over all three groups you have no strong preference (although this may change over time).

❖ If you are strongly VISUAL try to:

- underline notes/key points
- watch relevant videos
- use graphs/diagrams
- make new ideas look different on the page
- look at photographs and pictures
- create mind maps (see next section) using colour, shape and keywords
- practice turning visual notes into words

### **LEARN TO TURN AS MANY OF YOUR NOTES AS POSSIBLE INTO DIAGRAMS**

❖ If you are strongly AUDITORY try to:

- read information aloud
- record information onto tape and play it back
- create mind maps and talk them through to yourself
- discuss topics with your laboratory supervisor and/or fellow seed analysts
- work in a group as much as possible rather than by yourself

### **FIND SOMEONE WHO WILL DISCUSS THE LEARNING WITH YOU ON A REGULAR BASIS**

❖ If you are KINAESTHETIC try to:

- use a 'hands on' approach
- use a computer
- do lots of practical work
- discuss with your laboratory manager how what you are learning is connected to commercial seed testing
- repeat practical work and ask fellow seed analysts to critique your techniques

**TURN NOTES INTO PRACTICAL EXAMPLES WHICH YOU CAN DO IN THE LABORATORY SO THAT YOU ARE TESTING YOUR SKILLS IN THESE NEW AREAS.**

#### **4. Memory and Mind Maps**

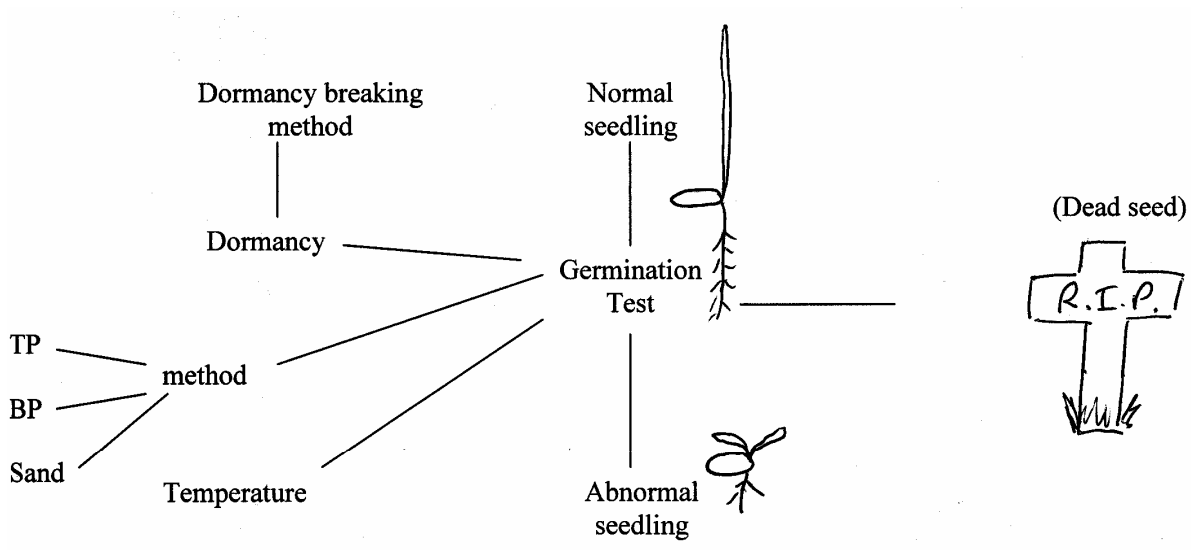
The information on learning and learning styles you have just read will now be stored in your short-term memory. However, your short-term memory is quickly overloaded as it can only retain a small number of items. If you now go and do something else for 20 minutes (e.g. read a magazine, listen to the news on the radio or TV), then by the time you get back to reading this page, the information in learning and learning styles has most probably been replaced in your short-term memory by an article you read in the magazine or a news item you heard. If you really want to store information, it has to be transferred from your short-term to your long-term memory.

In your long-term memory, information is stored in “clusters” i.e. pieces of information that relate to each other. What is already known is used to “attach” new pieces of information, and through these associations you can retrieve the stored information.

Memory is more efficient when:

- you can see something happen
- it is part of a “bigger picture”
- you can play about with thoughts
- you understand what happened
- you connect the thought to something you already know

A mind map is a way of putting on paper what you have in your head about a topic. It uses pictures, symbols and words to connect ideas that are related.



Example of a mind map of the words “Germination Test”.

You can use mind maps to help you sort out ideas, to revise actively, thinking about the whole picture and making connections, rather than just reading through notes without connecting the ideas. **Mind maps can be a good way of remembering information.**