Other resources   Centre for Social and Educational Research

2019

A Guide for VET Teachers with a Focus on Aquaculture: Using Student Rapid Response Systems (SRRS) for Formative Assessment and for Recognition of Prior Learning (RPL)

Anne Murphy
Technological University Dublin

Aiden Kenny
Teachers' Union of Ireland (TUI)

Martyn Haines
Pisces Learning Innovations (PLI) Ltd, Scotland

See next page for additional authors

Recommended Citation
Murphy, A., Kenny, A., Haines, M., Dudgeon, C. and Willmann, D. (2019) A Guide for VET Teachers with a focus on aquaculture: Using student rapid response systems (SRRS) for formative assessment and for recognition of prior learning (RPL), *Optimal Erasmus+ Research Project,* Teachers' Union of Ireland.

Authors

Anne Murphy, Aiden Kenny, Martyn Haines, Christine Dudgeon, and Dag Willmann

A Guide for VET Teachers
with a focus on aquaculture

Using student rapid response systems (SRRS) for formative assessment and for recognition of prior learning (RPL)

Optimal Erasmus+ Project

AUTHORS: Anne Murphy, Aidan Kenny, Martyn Haines, Christine Dudgeon and Dag Willmann

OPTIMAL

Erasmus+

TEACHERS' UNION OF IRELAND · AONTAS MÚINTEOIRÍ ÉIREANN

Acknowledgements

Authors

Dr Anne Murphy, *Technological University Dublin (TU Dublin), Ireland*

Dr Aidan Kenny, *Teachers' Union of Ireland (TUI), Ireland*

Martyn Haines, *Pisces Learning Innovations (PLI) Ltd, Scotland*

Christine Dudgeon, *Pisces Learning Innovations (PLI) Ltd, Scotland*

Dag Willmann, *Guri Kunna VET School, Hitra and Froya, Norway*

Reviewer

Kathryn Stack, *Federation of European Aquaculture Producers (FEAP), Brussels*

Disclaimer

The provenance of the contents of this Optimal Guide variously includes new material and images generated by the authors as well as materials shared among partners and colleagues. Some material was drawn from good practice exemplars and commercial information in the public domain which are duly acknowledged.

Every effort is made to ensure currency of content though it is likely that some aspects of technology referred to in the Guide will have changed since the time of writing in mid-2019.

Views and opinions expressed are those of the Project only. The EU Commission cannot be held responsible for any use that may be made of the Guide by other parties.

Published by

Teachers' Union of Ireland (TUI), 73 Orwell Road, Rathgar, Dublin 6, Ireland, September 2019.

How to reference the Optimal Guide

Murphy, A., Kenny, A., Haines, M., Dudgeon, C. and Willmann, D. (2019) A *Guide for VET Teachers with a focus on aquaculture: Using student rapid response systems (SRRS) for formative assessment and for recognition of prior learning (RPL)*, Optimal Erasmus+ Research Project, Teachers' Union of Ireland.

Design by

Data Print, Athy, Co. Kildare, Ireland.

Introduction

This Optimal Guide is organised into 6 Parts as illustrated below.
The reader is free to follow the sequence of parts or simply go to the parts of relevance.

PART 1

About the Optimal Project and the use of SRRS for RPL in
VET aquaculture/fish farming qualifications

Authors: Willmann D., Murphy A., Kenny A.

PART 2

Student rapid response systems (SRRS) and polling tools explained

Authors: Murphy A., Kenny A.

PART 3

About RPL (recognition of prior learning)

Authors: Murphy A., Kenny A.

PART 4

ONE2Act and Socrative pooling tools explained

Authors: Murphy A., Kenny A.

PART 5

Combining polling tools and RPL for formative assessment in the classroom

Authors: Murphy A., Kenny A.

PART 6

Creating multiple choice questions for Objective Tests in aquaculture:
What they are; when to use them; how to create them.

Authors: Dudgeon C., Haines M.

PART 1
PART 2
PART 3
PART 4
PART 5
PART 6

PART 1

Introduction

About the OPTIMAL Project and the piloting of project tools in a VET school

In Part 1 of this Optimal Guide the reader is provided with the following:

1.1   *A description of the Optimal Project*
1.2   *The context of VET qualifications in aquaculture/fish farming*
1.3   *Optimal project activities*
1.4   *An outline of the recognition of prior learning (RPL) process used in the Project*
1.5   *Student Rapid Response Systems (SRRS)*
1.6   *The Optimal pilot of RPL and SRRS in Gura Kuri VET school in Norway*
1.7   *Guidelines for innovative use of response tools and RPL arising from the Optimal Pilot*

1.1   A description of the Optimal Project

Optimal was a European Commission funded Erasmus+ Key Action 2 Strategic Partnership Project KA2-SP, titled – '*Optimised Training: Innovative Methods and Tools for Acceptance of Prior Learning in Qualifications and Workplace Training*'. It started in 2016 and ended in October 2019.

The Optimal project involved a consortium of partners as follows:

Norway *- Blue Competence Centre and Guri Kunna VET School, Hitra and Froya*
Belgium *- Federation of European Aquaculture Producers (FEAP)*
Scotland *- Pisces Learning Innovations (PLI) Ltd*
Ireland *- Teachers' Union of Ireland (TUI).*

The partnership investigated the delivery of VET to work-based learners through the application of Student Rapid Response Systems (SRRS), Recognition of Prior Learning (RPL) and teaching methodologies and tools, considering how teachers and/or instructors could optimise their approach to training adult work-based learners about relevant industry knowledge and skills in the classroom and during self-directed learning. The project built on the partners' expertise and experience of different VET teaching and training methodologies and methods, exploring approaches to both formal and non-formal learning and the range of assessment and qualifications used in each partner's system. This included reviewing different curriculum structures and learning outcomes. The project also engaged with industry to explore current needs and demands for training and qualifications. The partners looked at the practical application of using different types of questions and feedback in the classroom. The partners validated project material and outcomes through peer review engagement during transnational meetings. The project outcomes are based on the collaborative participation of all the project partners. The project piloted and tested several combined teaching and learning methodologies and methods in a VET school with adult learners studying fish farming. The project was aware of the aquaculture and fish farming sectors need to both upskill workers and to provide accredited training for new workers.

1.2   The context: aquaculture and fish farming need for VET courses

The fish farming industry in Europe employs 85,000 staff and a further 120,000 work in support services. The EU seafood market sources 10% of its fish from EU fish farming, 25% from fisheries and 65% from imports. Norway, the largest producer, provides 36 million salmon meals daily.

Fish represent 50% of all consumed protein, and is expected to rise to 65% by 2030, reflecting a growth rate globally of 6.6% per annum. Conversely, despite ambitious national growth targets, the industry is stagnant. The lack of personnel with the correct skills and qualifications is becoming widely recognised as one of the main obstacles to sustainable growth in production. The industry is becoming increasingly sophisticated leading to specialisation within the workforce. However, the lack of accessible specialist training in operating the more advanced equipment and technologies has led to inefficiency and to fish losses.

At the farm level, throughout Europe, workforce development challenges are exacerbated by the remote rural location of many facilities. Consequently, the reliance on local recruits is growing, many of whom have knowledge and skills gaps and remain unqualified following a significant period of initial employment. Norway typifies this, where only 50% of their salmon husbandry staff has completed any relevant education leading to qualifications in 2014. In some countries, such as Scotland and Norway, where migrant labour is prevalent, language and cultural barriers to learning are intensifying, necessitating a more individualised approach to learning. Responding to this need, the Optimal project considered approaches to accrediting prior leaning and methodologies to support adults learners access training and qualifications whilst in the workplace. The project explored the VET training needs of the aquaculture sector and developed, piloted, and refined a training method to meet the requirements of industry and the skills needs of adult learners.

1.3   Optimal project activities

The Optimal project partners identified four main project strands including exploring RPL and technology in VET, piloting methodologies and methods, assessing the experience of participants and developing new tools and methods. These are detailed below.

i.   Evaluating alternative RPL processes and technology being applied within innovative VET delivery systems, and identifying best practice for sharing.

ii.   Piloting new, cost-effective and user-friendly RPL methods and ICT tools that can determine and document evidence of learners' existing knowledge and skills, for acceptance as formal competences within respected fish farming qualifications.

iii. Evaluating learners' experiences of the RPL process and the subsequent delivery of their individualised learning plan, to inform the development of improved RPL systems.

iv.   Developing new specifications for improved RPL methodologies and ICT tools, informed by learner and employer feedback during the piloting and evaluation phases.

The Teachers' Union of Ireland (TUI) had responsibility for the development of this Guide book, with input from all project partners. The Guide book supplies information and advice on RPL and SRRS methods and practice for teachers and trainers in the VET and HVET (higher vocational education and training) sectors.

1.4   An outline of the RPL process used in the Project

This Optimal Guide for VET Teachers focuses on two uses of Recognition of Prior Learning (RPL).

Firstly, pedagogical RPL - the use of assessment and recognition of prior learning (RPL) approaches and

student rapid response systems (SRRS) as pedagogical tools to assist the learning process in vocational education and training (VET), particularly in the aquaculture sector. The specific aim of 'pedagogical RPL' is to assist VET teachers to gain an understanding of the work-related knowledge, skills, and abilities of students before, during, and at the end of a programme of instruction, and indeed for accreditation purposes.

Secondly, RPL for accreditation - focused on the more generally understood purpose of RPL in enabling adults to have their previous knowledge, skills and competences formally assessed and 'accredited/ recognised' within formal accreditation systems in relation to qualification standards.

At the core of both pedagogical RPL and RPL for accreditation are assessment processes that are appropriate and fit-for-purpose. Therefore, the Optimal Project gave priority to the writing of appropriate and effective assessment test questions to determine the knowledge and understanding of RPL applicants/adult learners.

Aquaculture Recognition of Prior Learning (RPL) Pilot

The Optimal Project piloted a recognition of prior learning approach in a Norwegian VET school during three stages of a training course in aquaculture, as follows:

1. At the start of training course::
   » to carry out an initial evaluation of knowledge before students started their VET course as a pre-test of knowledge levels.

2. At each on-site training event:
   » to evaluate students' knowledge during start-up of each on-site training activity.

3. To determine the optimised effect of training before the final examination
   » What to teach?
   » How to teach it?
   » When to apply peer learning?

These steps were supported by the use of technologies to assess student knowledge, support preparation of the learning process and provide feedback to learners as they progressed. This included combining an RPL process with student rapid response systems (SRRS) to assist the teaching and learning process.
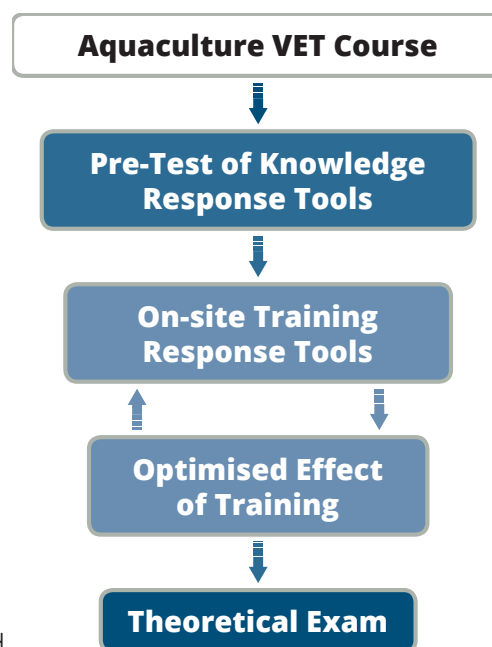
1.5 Student Rapid Response System (SRRS)

The use of SRRS has expanded with the widespread availability and use of mobile devices and smart phones by learners. Teachers who use SRRS methods can gain access to a range of polling software options without having to invest in hardware, as most learners/students have their own mobile device (laptop, tablet, smartphone).   While the accessibility to SRRS increases, the requirement for good pedagogical practice and instructional design remains. In the Optimal project SRRS was considered as:

- A tool to encourage student engagement in class activities.
- A way to provide both group and individual feedback.
- A method to assist instructional design.
- An instrument to enhance the teaching and learning process.

While this Optimal guide provides examples of some specific SRRS software, the range and variety of polling

software is acknowledged. However, in general the SRRS methods and advice provided in this Guide can be adapted for use with many SRRS software packages. The project did not focus on SRRS software but rather on the theory and practice required for the use of such software in a VET learning environment. Of particular importance were the instructional design element in question construction, and the feedback methods relating to assessment, and to recognition of prior learning.

Below is an information poster giving an overview of the use of RPL and SRRS in the pilot.
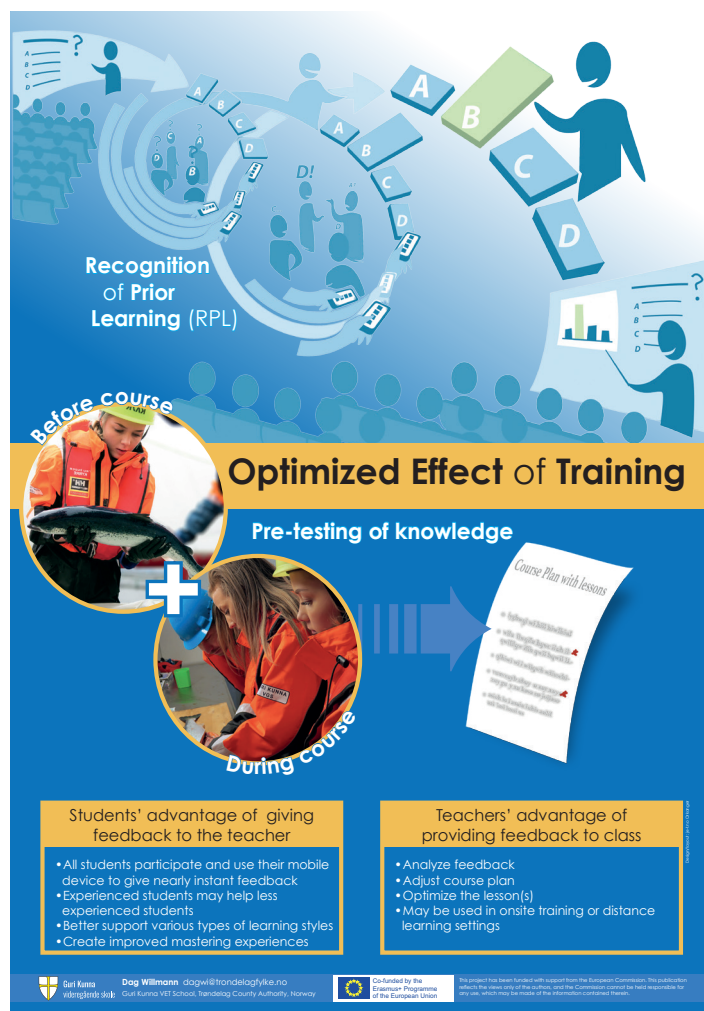
1.6 The Optimal pilot focused on VET teachers in the aquaculture sector and their teaching methods and practice

The project sought to explore the use of SRRS methods and the RPL process within a classroom setting. During the pilot stage of the project teachers in Gura Kuri VET school explored the application of SRRS and RPL. The outcomes from the pilot informed the project's approach. Some of the project tips and recommendations are outlined next, including introductory materials that may be of assistance to teachers and trainers.

Guideline for innovative use of response tools and RPL in vocational education and training

This guideline contains recommendations and tips for how modern response tools can be applied in teaching vocational training courses and in the preparations of teaching activities. The goal is to provide teachers with methods and materials for use in the classroom to have the greatest possible impact for students and to maximize the effect of the teaching and learning process.

How to write good questions for response tools

The quality of the questions are very important when using response tools. If students experience questions as thoughtful, relevant and stimulating, research indicates that the students will be positive regarding the use of a response tool in vocational education and training. Conversely, unprepared or less thoughtful questions are experienced as irrelevant and do not contribute to student learning. Students will often consider the use of response tools as a waste of time in this latter instance.

General guidelines

The challenge when writing high quality multiple-choice questions is not related specifically to the use of a response tool. In this section, general advice is provided on creating good multiple choices questions. Below some key guidelines are presented:

a. Have a clear understanding of what type of questions you want to ask- factual questions, conceptual questions, and/or questions prepared for discussions in groups (peer learning) or in class.

b. If you "borrow" questions from other sources (textbooks or Internet etc.), be sure to transform it into "your" language, making it relevant to the subject, the level and the leaners. In general, students display more interest in the learning process when they consider the teacher has invested in the development of the questions and leaning material.

c. Avoid ambiguity in formulations questions. A question may be challenging and difficult, but it should be clear.

d. Prepare detailed explanations for use after the questions. The teacher should discuss answers, highlight the correct option and explain the reasons for correct and incorrect responses.

e. Whatever the learning activities that follows the use of response tools (teacher's explanation, peer learning, discussions etc.), it is important that the teacher concludes with a full explanation. It is the teacher's explanation that is the factor that contributes most to the students' experience of learning. The teacher is, according to the students, the expert.

How can I know whether a task or problem is at the appropriate level?

Questions should be neither too easy, nor too difficult. Questions considered to be too trivial may not motivate students to take part in voting and the process might not lead to learning. The same happens if the tasks or problems are perceived as too challenging or too difficult.

A very general rule for evaluating whether a task or problem is at the right level of difficulty, can be based on the following:

- If more than 70% of the class answer correctly the question is too easy since it will be difficult to initiate discussions in the class or in groups.
- If fewer than 30% answer correctly the question is too difficult and it will be challenging to set up a discussion in the class or in groups.

The 30%-70% result is recommended to be operated as a rule of thumb when assessing the difficulty of a question. Having the percentage of correct answers within this range can enhance group discussions that supports learning. Just how well a question works will depend on the experience and knowledge level of the students: a question that works well in one class (e.g. a strong class) might not work well in another class, since the classes may be at different levels.

Can I introduce a problem or ask a question without showing the students the options?

Response tools may be used to stimulate interaction and discussion in the classroom. Multiple-choice questions of course have some limitations. For example, a question, when asked in multiple-choice form, could make a discussion less open and narrow the range of items considered. This may lead to a lower level of learning. One way to avoid the limitations of multiple-choice questions is to present the task or problem without showing the optional answers first. Almost all multiple-choice questions can be presented to the class without showing any alternatives. Here is an example:

> **Your boss raises money for what he believes is a charitable purpose, in good faith.**
> **You suspect, however, that your boss has been deceived, and that it is all about fraud.**
> **What do you do?**

After presenting the question, the students must get a chance to think and discuss in small groups.

The possible answers may be presented just before the voting takes place:

A. *I ask my colleagues not to give money to this purpose*
B. *I tell the boss about my suspicions*
C. *I investigate*
D. *I report my suspicions to my chief supervisor*
E. *I do nothing*
F. *None of the above.*

Not displaying answer options when the problem is presented may be used for knowledge-oriented questions too. The method may be particularly interesting and suitable for open and impartial discussion.

Suggestions for further reading on design of multiple-choice tests:

To make good multiple-choice tests requires experience. Part 5 and Part 6 of this guide provide useful recommendation and insights for developing multiple choice questions. Additionally, teachers may find useful theory from **T. Haladyna (2004)** *Developing and validating multiple-choice test items.*

Methodology for giving feedback to the class after gathering data with a response system

The timely provision of feedback to a group of learners after the use of multiple choice questions can greatly assist the leaning process, assisting learners to understand the correct and incorrect responses. In particular, providing feedback to groups and then discussing the answers seems to enhance understanding and learning.

How to review the questions after voting is finished

How teachers choose to review a question when a vote is completed, typically depends on the type of responses received, including:

- the percentage of correct and incorrect responses,
- how these are distributed.

CASE 1:   The majority of the class answer correctly

When a large percentage have answered correctly (about 90% correct answers) giving a brief verification in feedback can assist to reinforce the leaning process. The feedback could be:
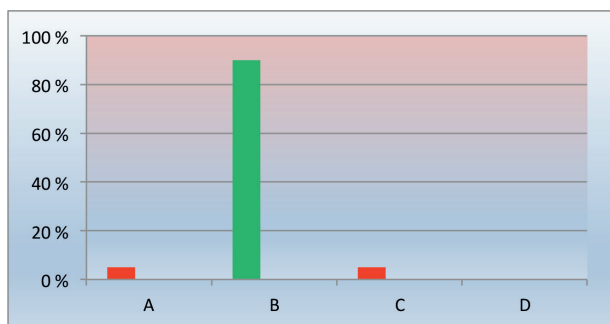

"Since most of you have answered correctly, green option B was right, and this is right because of ...., while the other options are wrong because of ....".

CASE 2:   The majority of the class fails to answer correctly

In cases where the vast majority of students answer incorrectly, it requires the intervention of the teacher in the form of a thorough review with in-depth explanations. Before such a review is given the students could be encouraged to discuss the following:

- why many answered incorrectly
- whether they experienced the task or problem as particularly difficult or formulated unclearly
- whether the students felt that the presentation of the question in advance was sufficient
- if it was an important concept or idea many had misunderstood
- whether there were other things that made so many answer incorrectly.
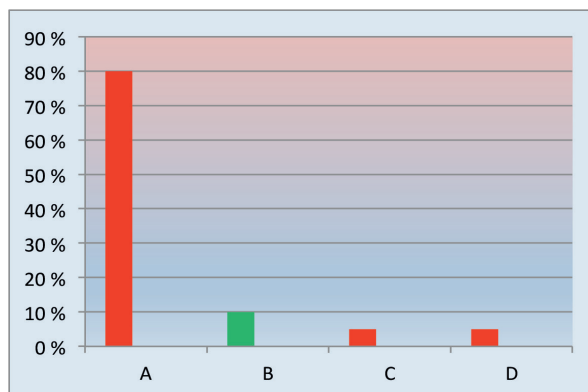
CASE 3:   "30-70%" of the students answer correctly
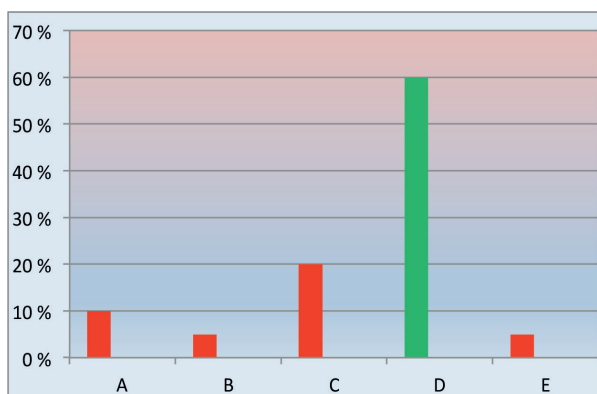
If the number of correct answers is between 30-70%, it is an ideal starting point for establishing a group discussion between the students and then afterwards run a new second vote without the teacher revealing the correct answer (which will be displayed at the very end). Such a distribution of responses indicates that a significant share of the students have understood the problem. The goal of the discussion is for the students to share their understanding of the problem and the solution.

Such a session may be sequenced as follows:

1. Teacher presents a question
2. Students will receive an individual pause of approximately one minute without any discussion
3. Students vote
4. The distribution of answers come up with a percentage of correct answers in the range of 30-70%
5. Without the teacher revealing what the correct answer is, request that the students discuss the problem with their neighbours or in groups where each one tries to argue for his/her views.

6. Take a new vote

7. The teacher makes a summary and does any necessary review.

The "peer instruction" method

"Peer instruction" is a methodology for response systems originally developed by physics professor Eric Mazur at Harvard University. As the name indicates, this is a method that envisages that pupils/students will have the opportunity to instruct one another ("fellow student/peer" in this context). When using this method, reconciliation occurs over two rounds- the first vote after a short thinking break, and then a new vote after a group discussion.

To follow up a response tool question with "peer instruction", the method goes as follows:

1. The teacher presents the question.

2. Pupils/students receive an individual thinking pause of up to 60 seconds.

3. The teacher runs a vote and the students vote. *Be sure to turn off the automatic display of the result graphs before starting the vote because the displaying of graphs will influence the discussion afterwards.*

4. The teacher then lets the pupils/students start a group discussion which can last 2-3 minutes.

5. The teacher runs a new vote and the students vote again. *Here it is natural that the result graphs come up automatically - you can turn this on before voting begins. You can also view performance graphs before and after discussion to demonstrate the efficacy of a discussion.*

6. Teacher sums up- exactly how the summary goes will depend on how students respond.

The purpose of the individual "thinking pause" at the very start is that each student will make an independent opinion on what the correct answer is, and why. This way they will be better prepared when the discussion starts, and students will be less likely to be "talked down" by dominant fellow students with divergent views on what the correct answer is.

Checklist before the first use of a response tool

Before using a response tool for the first time in class, there are certain things that should be checked and tested, as follows:

1. There must be software installed on your computer in the classroom where the system is used. If you do not have administrator access to that computer it can also be installed on a laptop which is brought to the classroom.

2. The computer that's running the response tool software must be connected to a video projector – this is for pupils/students to see the result graphs from a vote.

3. The wireless network where the system is used must have sufficient capacity. Response tools normally generate little data traffic, but the critical factor is whether the wireless access points can handle a sufficient number of simultaneous connections. It must be noted that the same pupil/student can have multiple devices online simultaneously.

4. Pupils/students need to be informed in advance of the first use of response tools – information about what the purpose and use of the system is, and how it will be done.

Examples of the use of response tools in teaching

Response tools are designed to be a flexible educational tool. Here are some examples for how response

tools can be used in teaching. Before proceeding, some methodological rules should be considered. This will make the use of response tools most time-efficient. It could also be a checklist for a teacher.

1. To do the actual voting most effectively, it is a great advantage for both teacher and students to log on to the system at the very start of every session. In this way the interface is ready for use and students need only to recall the vote page to vote. The teacher logs on to the interface and creates a session code.

2. Students log on and enter the session code. This should go quickly if the students have saved a log-on page as a shortcut on their mobile device.

Many people use the response tool as an element in mainstream education - for example to ensure that students have understood reasoning or to ask control questions along the way. This approach is illustrated below:

The teacher asks a question
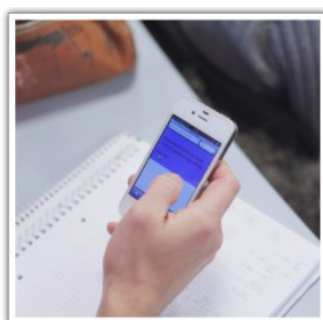
The students answer with their devices

The results are displayed and discussed

What happens after the question is asked and the voting is finished is up to the teacher. However, it is very important that the responses from the students are properly processed. The summary from the teacher is very important for the students' experience of learning.

Example from Aquaculture Vocational Education and Training

The teacher in the picture on the left, teaches aquaculture at Guri Kunna VET School in Norway. Kåre uses response tools in vocational courses delivered to the aquaculture industry as well as in upper secondary education for younger students. Both student groups have the goal of qualifying for a Nationally Recognised Qualification (NRQ) certificate in Aquaculture.

It is particularly relevant to use response tools in the courses provided to industry because these students get considerably less time with theoretical lectures than the young students. It is therefore important to optimize and streamline lectures. Using the following methodology can assist this:

Before the course starts, students from industry will receive a link to a **pre-test** that will be answered by the students in advance of the course. This is a quick evaluation where answers are given by using smart phones, tablets, or computers, depending on what the students prefer to use.

The answers from the students will help the teacher to decide which **parts of the curriculum** he has to highlight in the course and which parts that may be taught less thoroughly due to the experience that the students have obtained while working in a fish farming company. This he uses to finalise the details the course plan for the whole course. He then repeats this process in advance of each new module in the course plan in order to determine in more detail which parts of the curriculum in each module must be taught most thoroughly during each on-site training session.

In addition to the pre-tests, the teacher also uses response tools to promote engagement, interaction, and discussion between students during the lectures by conducting small quizzes during each session. Students reply by using a student response system. This helps him to check if the students have understood what he has taught during the lecture. This may be a prepared quiz, or it could be a question from a student who actually has a genuine problem. Kåre then repeats this question to the class, giving them three alternative solutions to vote on. In this way the student's question is smoothly included into the training session, without destroying the sequence of responses that the teacher tells the students.

At the end of the module, or towards the end of the course, the teacher repeats the advance pre-tests to document learning progression.

Example from mathematics

This is a picture of a lecturer who teaches mathematics for engineering students at the Norwegian University of Science and Technology (NTNU). The lecturer sometimes runs a so-called "flipped classroom" where "flipped" means doing the opposite of a traditional lecture. Here the students learn the theory on their own outside the lectures, and so he uses the time in class to review the subject matter that students found difficult when dealing with calculation exercises.

To make some random samples of how much the students have managed to learn on their own, the lecturer runs some multiple-choice questions from the subject matter by using response tools. The response tool makes it easy to locate any problem areas, and the lecture can be carried out in a far more convenient and time-efficient way: teaching can be focused on the areas where students are struggling. When the students are given time to discuss each task before the vote takes place, it helps to reduce the threshold for the students to ask questions.

Response tools and digital blackboards

The teacher's interface control of a response tool is normally designed to be very easy to operate from a digital board. All the buttons are large enough to be easily tapped on, and all functions require just a few taps. However, a digital board is absolutely not a requirement to use response tools, but goes hand-in-hand with the philosophy underlying the digital boards: this is a tool to help the teacher in telling a story and to give the best possible "flow" in teaching.

If there is access to a digital whiteboard in the SRRS tools this means that all communication from teacher to the class can take place in front of the board: you do not need to move from the whiteboard and over to the computer each time you run a vote.

Summary of key points for the teacher to consider:

- Develop relevant and clear questions based on the subject/curriculum/learning outcomes
- Use questions to obtain an understanding of the adult leaner's knowledge of the subject
- Customise questions to assess the class's level of knowledge
- Use in-class questions and SRRS to create group discussion
- Prepare feedback answers to enhance the learning process
- Develop different type of questions with levels of complexity
- Use text, pictures and video in the SRRS questions
- Not disclosing the multiple-choice can assist group discussion
- Prepare a range of questions for students with different levels of knowledge of the subject
- Practice questions and the SRRS approach with some colleagues for constructive feedback
- Check all hardware and software is working properly in advance of a class
- Advise students/adult leaners in advance of the class that they should bring their own device for use.

PART 2

Student Rapid Response Systems (SRSS)/Polling Tools explained

In this part the reader will be introduced to:

2.1 *Pedagogics of polling and voting before technology*

2.2 *Posing good questions to test understanding and learning*

2.3 *So, what is the pedagogical problem being addressed by polling tools?*

2.4 *Possible solutions?*

2.5 *What are the most widely used Student Rapid Response Systems (SRRS)?*

2.6 *Using personal devices (phones, tablets, laptops)*

2.7 *Logging in and tracking each student's learning*

2.8 *Improving attendance and engagement in learning*

2.9 *Preparation by the teacher in advance*

2.10 *Planning a class session using SRRS*

2.11 *Difficulty of questions and agreeing question design and purpose*

2.12 *Quick tips for designing good questions*

2.13 *Preparing students for SRRS*

2.14 *Where are SRRS best used?*

2.1 Pedagogics of polling and voting before technology

Teachers at kindergarten, primary and secondary school levels have traditionally used student voting/polling systems as a normal pedagogical tool both to involve students actively in their individual and group learning, and as formative assessment to check how well they are understanding subject-matter content.

Peer-to-peer learning around a table is a long-standing teaching and learning method.

Simple voting/polling tools like: a show of hands; holding up coloured cards; selecting from A, B, C, D optional answers; multiple choice questions; are cheap but effective formative assessment tools in any learning context.

It is not uncommon for such tools to be used in adult education settings, and indeed in VET and higher education, where discussion and debate are central to pedagogical approaches.

What is perhaps very different now is the extensive use of **technologies** in all areas of education and training. Regardless of whether we use older or new technologies, there are well-known principles of instructional design and class-room teaching. One such principle relates to the different pedagogical design required to suit either **passive** or **active** learning.

Depending on the context and the content of learning, it is sometimes appropriate to use 'passive' teaching approaches where the teacher/instructor/lecturer introduces new content and explains it in detail while students listen and watch.

To reinforce learning, or to explore wider aspects of learning, it is common to use more 'active' learning methods such as discussion, voting, debates, peer-learning etc.

Linguistically the term 'andragogy' is often used to describe active adult learning and teaching methods.

from **Pedagogy** to **Andragogy**
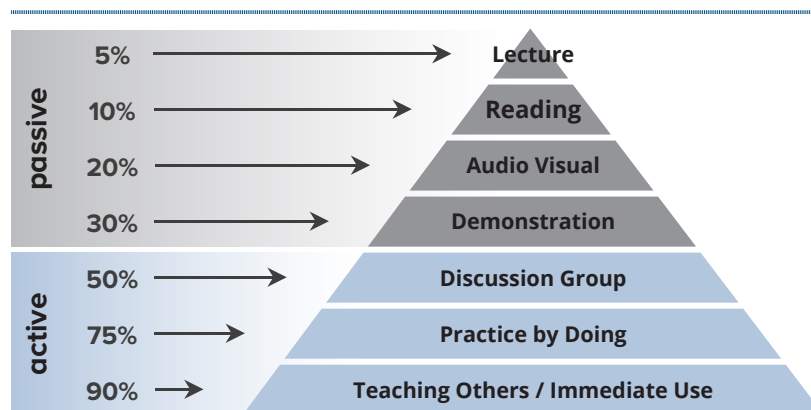
It is often argued that the pedagogical tools for teaching young children and for teaching adults are similar in that they emphasise **active** and **collaborative** learning more than they encourage passive learning, leading to a conceptually confused distinction between the term's 'pedagogy' and 'andragogy'.

Regardless of the terms we use to describe class teaching models, all teachers/trainers design pedagogical tools to fit the type of learning outcomes they aim to achieve, using some schema or hierarchy of learning levels, such as the much-promoted Bloom's Taxonomy of learning levels, as illustrated below for the **cognitive domain** of learning for **knowledge and understanding**.

Why use Learning Outcomes when planning questions for class polling activities?

It is now usual around the world to use a learning outcomes model of designing teaching sessions and assessment. Many countries, including the European Union, have developed qualification frameworks which incorporate learning outcomes within the system. These qualification frameworks provide for transparency of learning level, recognition of achievement, routes for progression, and act as qualification translation mechanisms.

Within the learning outcomes approach, it is also usual to separate out knowledge from applied skills / competences and from attitudes and behaviours when describing learning outcomes and when writing test questions.

A popular way of doing this is to use **Bloom's Taxonomy** of learning domains.

Bloom's three domains are illustrated below, showing increasing levels of difficulty.
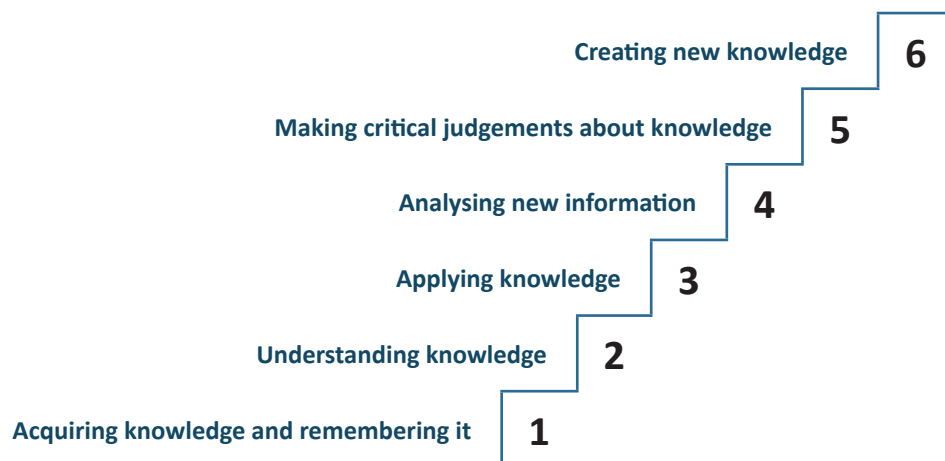
The three domains are:

1. **The COGNITIVE Domain:** concerned mostly with mental activity such as acquiring knowledge, understanding new knowledge, solving problems, analysing situations, drawing conclusions.

2. **The PSYCHOMOTOR domain:** concerned with learning new practical skills, demonstrating skills and performing skills to sets of competence standards.

3. **The AFFECTIVE domain:** concerned with learning particular types of occupational and professional behaviours, acquiring particular attitudes and values related to occupations and professions, and being aware of ethical and legal aspects of work practice.

Each domain has levels of difficulty which are reflected in levels of curricula.

Below, each domain is further explained.

The COGNITIVE Domain

The cognitive domain has six broad levels of difficulty as illustrated in the diagram below.

Creating new knowledge — 6

Making critical judgements about knowledge — 5

Analysing new information — 4

Applying knowledge — 3

Understanding knowledge — 2

Acquiring knowledge and remembering it — 1

So, we can make useful lists of words to describe learning outcomes for levels of the cognitive domain. Some examples are as follows:

1) Acquiring knowledge and remembering it:

The learner at this level will be expected to recall knowledge, list items learned, understand instructions, and explain them back to the instructor.

> *Describe, define, identify, list, name, recognise, reproduce, state*

2) Understanding knowledge/comprehension:

The learner will be expected to explain new knowledge, summarise new knowledge, paraphrase knowledge.

> *Articulate, distinguish, estimate, explain, generalize, infer, interpret, paraphrase, rewrite, summarise, translate, give examples of, express, illustrate, present, select*

3) Applying new knowledge:

At this level the learner will be expected to organize information, generalise from sets of data, produce knowledge in different formats.

> *Apply, change, construct, demonstrate, modify, operate, predict, prepare, produce, show, solve, use, calculate, explain, illustrate, classify*

4) Analysing new information:

At this level the learner should be able to classify sets of knowledge and data, rank data using criteria, infer conclusions from data, draw conclusions from sets of data.

> *Analyse, categorise, compare, contrast, differentiate, identify, illustrate, infer, outline, relate, select, separate, diagnose, experiment*

5) Make critical judgements from data:

At this level the learner should be able to apply analytical frameworks to evaluate data, make judgements regarding the value of data, make recommendations based on data.

> *Appreciate, assess, compare, conclude, contrast, criticise, critique, describe, evaluate, explain, interpret, justify, summarise, support, determine, grade, rate*

6) Create new knowledge:

At this level the learner should be also to create new knowledge and to defend its value, be able to invent, to compose and to design.
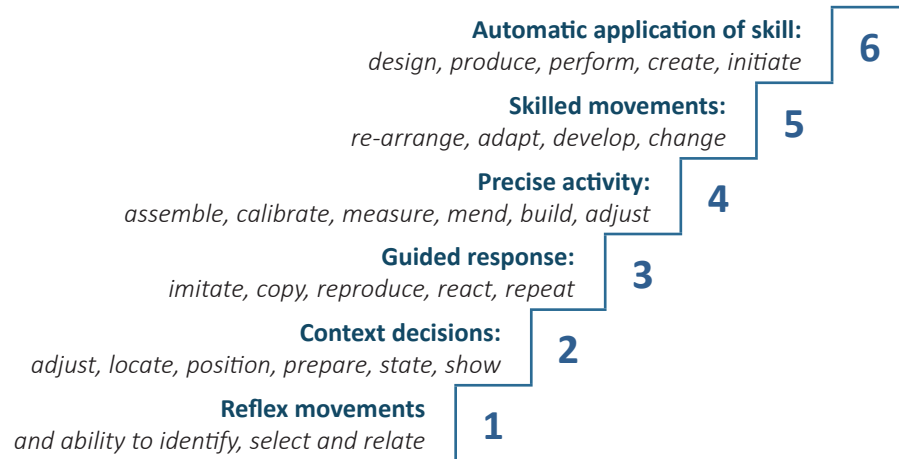
> *Plan, interpret, critically appraise, reorganise, generate, modify, solve, propose, formulate, suggest, recommend*

The PSYCHOMOTOR Domain

The psychomotor domain concerns actual activity which involved the use of both brain and limbs.

It involves physical activity of different kinds.

There are levels of difficulty in the psychomotor domain from simple to complex which indicate what a learner should be able to 'do', as follows:

Automatic application of skill: **6**
design, produce, perform, create, initiate

Skilled movements: **5**
re-arrange, adapt, develop, change

Precise activity: **4**
assemble, calibrate, measure, mend, build, adjust

Guided response: **3**
imitate, copy, reproduce, react, repeat

Context decisions: **2**
adjust, locate, position, prepare, state, show

Reflex movements **1**
and ability to identify, select and relate

Show, demonstrate, perform, measure, cut, design, operate, display, cook, present, etc., depending on the field of learning

The AFFECTIVE Domain

The affective domain is concerned with **behaviours**, **attitudes**, **opinions**, **beliefs** and **values**.

It is an important dimension of all human learning. It is also important in curriculum design and the selection of learning outcomes for different levels of learning. It is usual to identify four levels of learning in the affective domain, as follows:

1. **Receiving**: noticing stimuli around us, being aware of the external world and how people are behaving in it, listening, noticing, paying attention, tolerating difference.

2. **Responding to stimuli**: agreeing, disagreeing, answering, assisting, caring, communicating, conforming, contributing, co-operating, following, obeying, participating, volunteering, engaging in.

3. **Valuing**: knowing one's own values, attaching value to external events or other people, understanding the values of others, debating, adapting, guiding, balancing, theorizing, tolerating

4. **Internalising**: integrating learning into one's own value system and making judgements about it, acting ethically, exemplifying, influencing others, justifying one's opinions and actions, supporting, encouraging.

Receiving: accept, acknowledge, be aware, listen, notice, pay attention, tolerate
Responding to stimuli: agree, answer, assist, care, communicate, consent, conform, consent, contribute, cooperate, follow, obey, participate, read, respond, visit, volunteer
Valuing: adopt, assume, behave, choose, commit, desire, exhibit, express, initiate, prefer, seek, show concern, show desire, use resources
Internalising: adapt, adjust, arrange, balance, classify, conceptualise, formulate, group, organise, rank, theorise, act, advocate, defend, exemplify, justify, maintain, serve, support.

5.4 How to Match Learning Outcomes with Teaching, Learning and Assessment

Once the learning outcomes for a programme or module have been agreed, the next step it to decide how best to cover those learning outcomes in syllabus content.

When syllabus content has been aligned with the learning outcomes, the next step is to decide **how best to teach** the content.

At this time it is wise to plan what **learning activities** the learners will do as the content is being taught. The activities should be closely related to the expected learning outcomes and should anticipate how learning will be assessed for each learning outcome.

The final step is to **design assessments** that can objectively measure how well each learner has achieved the intended learning outcome standards for the module or course.

The diagram below is a reminder to match teaching, learning and assessment to the type of learning expected.

Learning outcomes		Teaching and Learning Activities	Assessment Methods
COGNITIVE Domain	Show knowledge, understanding, application, analysis, synthesis, evaluation	Lectures Tutorials Class work	**Quiz** **FAQs** Examinations Essays Theses
AFFECTIVE Domain	Integration of desired beliefs, attitudes and behaviours	Seminars Discussion Group work	Essays Debates
PSYCHOMOTOR Domain	Performance of applied skills	Project work Laboratory Workshops Practicals Work-placement Demonstrations	Practical exams Fieldwork Projects Presentations

Regardless of the taxonomy used, teachers design polling/voting tools and associated 'questions' informed by good teaching and learning methodologies, aware of the standards and levels of learning outcomes they aim to achieve in the classroom related particularly to the cognitive domain and to subjects where there are obvious correct and incorrect answers.

In both child education and adult education, teachers are aware that some teaching methods lead to better long-term and more accurate learning than others. Therefore, they try to mix their teaching methods to achieve the best outcomes for learners: lecture sometimes; practice sometimes; peer-instructions sometimes, depending on the context.

2.2   Writing good questions to test knowledge, understanding and learning

Designing good test questions is an important skill for teachers and trainers in any context.
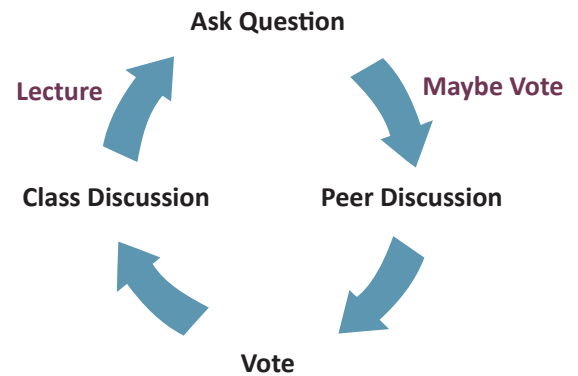
Designing good questions to use for voting/polling and discussion is a high-level skill. It is well known that designing a set of very well-structured questions for particular class-sessions and subjects takes a lot of time and expertise.

Sometimes it is best if questions are designed and agreed by teaching teams so that the required learning outcomes are being considered. There is more about designing good questions in Parts 5 and 6 of this Guide.

In any case, here is a simple example:

Peer Instruction Model by Eric Mazur

- The teacher poses a question to a class with a number of possible answers.
- The students select their preferred answer, vote individually, with the result of the vote i s displayed for all to see.
- Then the students discuss the possible 'correct' answer in groups of two or three, and then vote as a group.
- Then there is a class discussion with the teacher who shows the 'correct' answer and explains in detail why it is correct. The added value of this type of teaching approach is that it gains more individual attention from students, encourages structured discussion among class peers, involves more interaction with the teacher and is likely to lead to deeper and longer learning. In addition, it can be very stimulating and entertaining for all.

So, we can call this '360 degree learning' which encourages attention, content retention and student engagement.

2.3   So, what is the pedagogical problem being addressed by polling/voting?

Classes in VET and in higher education (HE) are now more mixed than was the case in the past. Leaners can have a different level and range of knowledge and skills based on their previous experience or work. Adult learners are likely to be present in most classes including VET (sometime also known as further education and training FET). So, it is necessary to design teaching and assessment approaches that suit them too.

In addition, it is generally accepted that large lecture-type classes are very ineffective when it comes to engaging the attention of students, allowing them to participate actively, or to become involved in discussion with each other or with the teacher/lecturer.
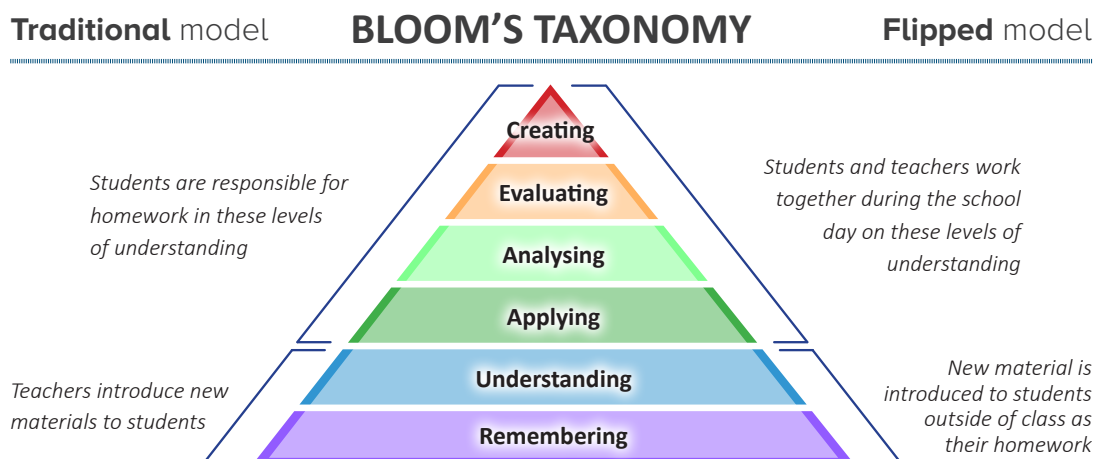
So, the three main problems are:

PROBLEM 1	**Poor attention** to the teacher in a 'top-down' passive teaching session with little or no interaction between teacher and students – the 'sage-on-the-stage' model
PROBLEM 2	**Poor attendance**
PROBLEM 3	No way of knowing how much the students in general are learning in the session, or indeed how any particular individual is learning

2.4   Possible solutions: The flipped classroom? From teaching to peer learning?

One solution is what is called 'the flipped classroom'. The basic concept is that the teaching and learning approach moves from a 'passive' model where the teacher seems to be 'responsible' for student learning, to a 'flipped' model where students take active responsibility for their own learning and **contribute to the learning of their peers**.

The self-explanatory Figure below illustrates in general the main differences between a traditionally passive model of teaching and a 'flipped' model, using Bloom's taxonomy as a framework. While the concept of active, participatory learning is not new in education, there are concerns that very large classes with mixed ability and mixed experience students are not served well by traditional lecturing methods.

Elements of the concept of the flipped classroom influence the design of technology-based student response/polling systems.

Traditional model   **BLOOM'S TAXONOMY**   **Flipped** model

Students are responsible for homework in these levels of understanding

Students and teachers work together during the school day on these levels of understanding

Creating
Evaluating
Analysing
Applying
Understanding
Remembering

Teachers introduce new materials to students

New material is introduced to students outside of class as their homework

2.5   What are Student (Rapid) Response Systems (SRRS)?

A student (rapid) response system, or a polling system, is a method of engaging students with relevant questions before or during a classroom session and seeking answers by means of electronic devices. As ICTs and smart phones become more nimble and more individualised, SRRS can become more nimble and individualised. The newer SRRS use cloud technologies, apps and personal devices for these reasonsThe original electronic devices were known as 'clickers', which were hand-held devices containing two to nine buttons. One clicker was provided to each student for the class session. The teacher posed a question and displayed several possible answers on the screen. Each student responded to the question by clicking one of the buttons associated with their chosen answer. The responses from the students were then displayed on a screen.

Pose Question   Participants Answer

The teacher used the class results to shape the classroom discussion on the specific topic.

While this method encourages student participation and peer learning in classroom activities, the 'clickers' device had limited functionality because of the small number of button options. They also required on-going maintenance and a lot of administrative and IT arrangements. However, they do not require broadband internet connectivity or ownership of a smart phone. This is important for learners in remote or resource-poor environments.

2.6   Using personal devices (smart phones, tablets, laptops)

The original clickers method was improved and made more flexible and accessible by the development of software and applications that enable students to use their own mobile device (phones, tablets, laptops) to respond to questions posed by the teacher. The advantages of allowing the students to use their own device are:

a. familiarity with the device and its functions
b. time efficiency- no need to distribute devices during class
c. cost effectiveness to the school/college
d. no on-going maintenance
e. Use of WiFi, apps and cloud technology.

2.7   Logging in and tracking each student's learning

The newer voting/polling software allows the teacher to create log-in requirements for each class session which identifies each student's response to each question, as well as having the function to display the whole class result. This enables feedback to both the class, and where required, to the individual student.

Some software packages have a facility to track student responses over time, providing the teacher with an opportunity to give targeted feedback on specific areas to individual students, as illustrated below.
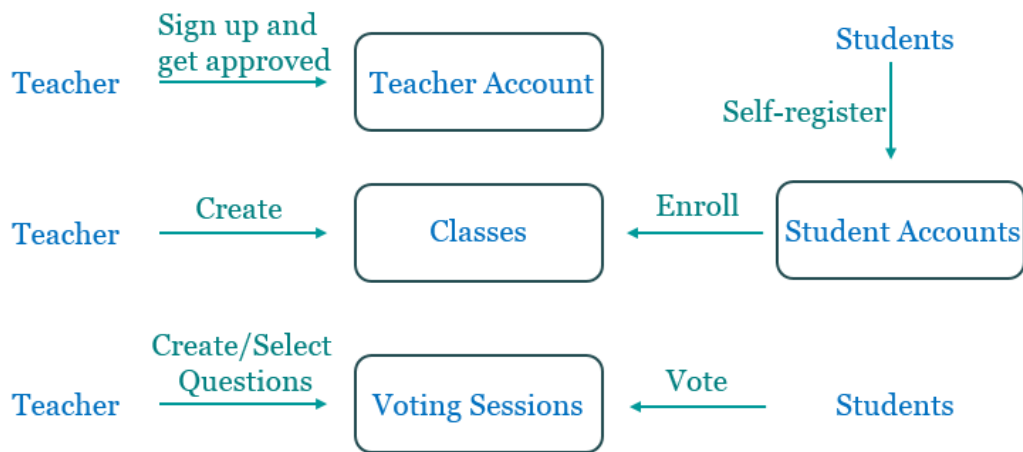
2.8   Improving attendance and engagement in learning

The own-device method can promote active student engagement in classroom work and in discussions. Students like to have the opportunity to use their own equipment in the classroom, lab, or workshop. Students are familiar with their own equipment and find it accessible and easy to use. Allowing students to use BYODs (bring your own device) in classrooms and encouraging to use the BYOD in an interactive session can create more interested in the subject and enhance participation. Combined BYOD and SRRS can be used to initiate individual student responses or as part of **group work and problem-solving projects**.


2.9   Preparation by the teacher in advance

There are now a multitude of devices and software packages available (shareware and fee paying), with considerable functionality and features. However, for the method to be effective it requires **detailed pedagogical planning** and **follow-up** by the teacher. The SRRS polling method is a tool that may be used by the teacher as part of his/her teaching practice in the classroom to support the learning process. Before using such a tool, the teacher needs to consider familiarisation with the tool (including available classroom ICT equipment) and to be aware of the time required to prepare lesson plans which incorporate the questions and answers to be used during each teaching session.

2.10 Planning a class session for SRRS polling

The preparation cycle for the SRRS polling method is detailed in the figure below.
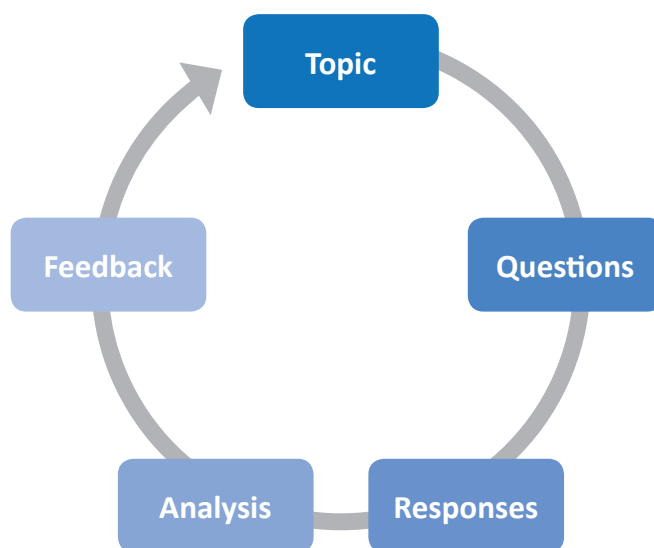
SRRS Cycle of Preparation

Step 1: The curriculum/module/standard is subdivided into the key subject/topic areas.

Step 2: The teacher then develops a lesson plan for each class session.

Step 3: The teacher then considers the topics to be covered in the class session

Step 4: The teacher constructs relevant questions for each topic. The question format (multiple choice, short answers, projects) and level of difficulty (facts, concepts, theory) can be incrementally increased in accordance with course progression.

Step 4: During the class session the teacher introduces the topic and uses SRRS polling as appropriate to pose questions to the class and to provide feedback on the aggregate class responses.

Step 5: The teacher encourages the class to discuss the result and where necessary provides explanation or clarification (peer-learning).

Step 6: The teacher then analyses the individual student results and provides separate feedback to each student. The method can be used by the teacher throughout the course.
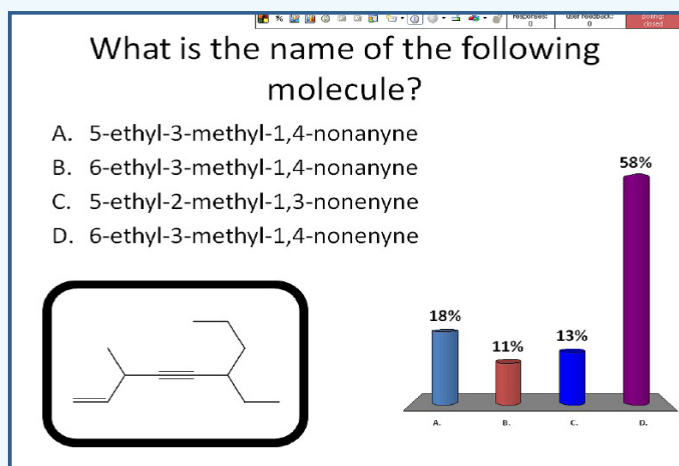
2.11 Difficulty of questions and agreeing question design and purpose

The type and level of difficulty of questions will depend entirely on the following:

a. The course itself
b. The learning outcomes
c. The type and structure of the course
d. The qualification standard involved
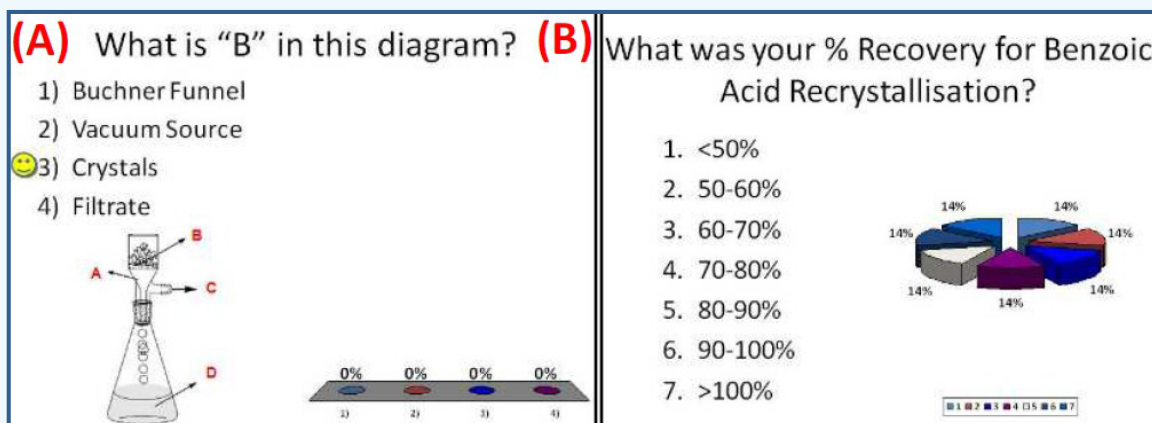e. The learning aim for the specific class session.

Testing knowledge and understanding

Some questions will focus on accurate technical knowledge and understanding, such as in the three examples below from chemistry in Technological University Dublin using simple clicker technology.

A visual representation of the work/system developed

What is the name of the following molecule?

A. 5-ethyl-3-methyl-1,4-nonanyne
B. 6-ethyl-3-methyl-1,4-nonanyne
C. 5-ethyl-2-methyl-1,3-nonenyne
D. 6-ethyl-3-methyl-1,4-nonenyne

Figure 1 — Screen capture of a typical lecture based Clickers question based on alkyne organic chemistry functional group.

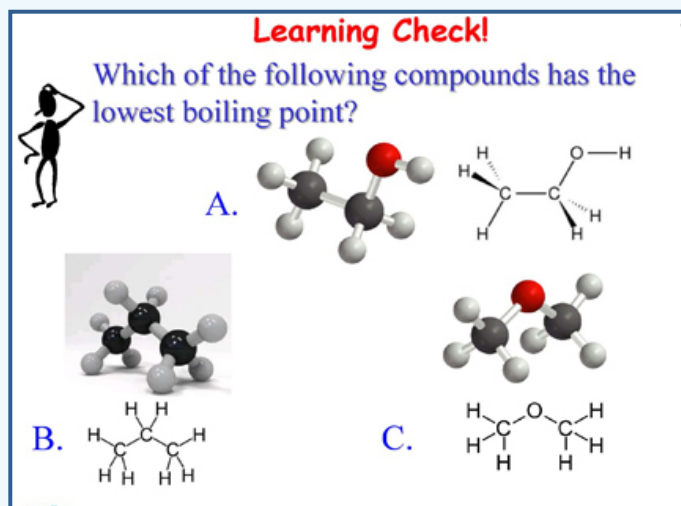MCQ equations were written with the best *pedagogical* practice in mind.

(A) What is "B" in this diagram?

1) Buchner Funnel
2) Vacuum Source
3) Crystals
4) Filtrate

(B) What was your % Recovery for Benzoic Acid Recrystallisation?

1. <50%
2. 50-60%
3. 60-70%
4. 70-80%
5. 80-90%
6. 90-100%
7. >100%

Figure 2 — Screen capture of a typical laboratory based Clickers question.

Part A represents a pre-lab MCQ, in which the student must individually answer questions based on their preparation for the lab. Items quizzed here include apparatus, experimental and safety knowledge. Part B depicts a post-lab survey in which the data generated in the lab session were collected and collated by each student clicking in their results.

Learning Check!

Which of the following compounds has the lowest boiling point?

A.

B.

C.

Figure 3 — Testing accuracy of knowledge.

2.12   Quick tips for designing good questions

SRRS polling should be considered as one of many methods to be used by the teacher in the classroom to encourage student participation in the learning process. The SRRS polling method is reliant on the pedagogical ability and subject knowledge of the teacher. As part of the teacher's class plan the SRRS polling method can be included to stimulate discussion at specific times and during specific topics.

The SRRS method relies on the teacher's development of relevant and insightful questions and answers. It can accommodate the use of visual and audio questions and answers. The number of questions and the timing of when to use the method is based on the professional pedagogical judgment of the teacher and on the teacher's understanding of the class and their stage and level of study.

The questions and answers used for the SRRS method need to challenge the student at the appropriate academic level of study.   The questions may be used in different ways, for example:

- several **short**, **broad subject-matter questions** put to the class in rapid succession to find out the class's general knowledge of a specific topic
- **exploratory** questions with a focus on prompting class discussion to gain a broader understanding about a topic
- **problem-solving questions** for small group discussion to stimulate deeper analysis of a topic
- **assessment** style questions which contribute towards a grade.

The questions and answers may be presented in the format of text, audio, video, or embedded in learning artefacts including multi-media objects. The important point is that the questions and answers need to be relevant, well-constructed, and of interest to the students.

Poorly formulated questions and answers can cause confusion amongst students and may lead to loss of interest in the method. As such, detailed preparation work is required in the development of questions and answers. It is good practice to test questions and answers by piloting them with a small group of students. Alternatively, a teacher may discuss the questions and answers with a colleague and share experience and knowledge.

Note: *There is further information about designing good questions in* ***Part 3*** *and* ***Part 6*** *of this Guide.*

2.13   Preparing students for SRRS

The reason for using the SRRS method needs to be fully explained to the students in advance of a classroom session. The expected outcomes and purposes should be clearly stated, including:

a.   Will SRRS polling be used for **grading** students in tests during the course, or at the end of the course?

b.   Will students know when it is not for grading, but simply **evaluating knowledge** in the class session?

c.   Will students know if they are **obliged** to participate in group work, or if it is voluntary?

d.   Will student have a **choice to engage in peer-to-peer** learning or not?

It is good practice to inform students that the aggregated class result will be displayed but the individual student response will not be shared with the whole class.
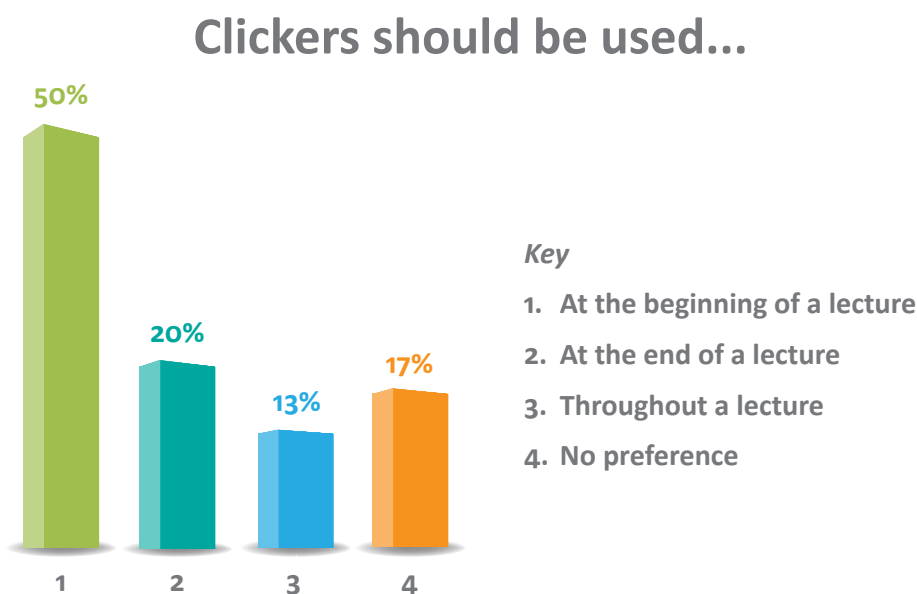
The teacher can provide individual feedback to specific students after the session if required.

2.14   Where are SRRS best used?

Each teacher will decide if SRRS questions are best used at the start, middle, or end of a particular teaching session – or not at all in a session.

As illustrate below, at least half of teachers believe that polling is best at the start of a class session.

Clickers should be used...

Key

1. **At the beginning of a lecture**
2. **At the end of a lecture**
3. **Throughout a lecture**
4. **No preference**

However, the SRRS method is not confined to education and training contexts. The method is now often used at **conferences** to test audience opinion on certain items, at **consultation meetings** to seek opinions on proposals, and in **workplaces** for training and planning purposes.

The SRRS method may be a useful tool to aid the teaching, learning and assessment process in the VET sector. Questions and answers can be developed that are directly associated with curriculum content and relevant to knowledge and skills of the workplace.

In summary, we can distinguish between the classic method of using SRRS and the **peer instruction** method.

In the **classic method** there are four linear steps as follows:

Step 1:   The teacher poses a quiz question to the class with a range of possible answers

Step 2:   Students are given a few minutes to discuss possible responses

Step 3:   Students vote individually

Step 4:   The teacher shows the voting results and explains the right answer.

In the **peer instruction** method, the steps are as follows:

Step 1:   The teacher poses a quiz question

Step 2:   Students have one minute to think about the possible correct answer individually

Step 3:   Students vote individually

Step 4:   Then students then discuss their responses with two or three peers.

Step 5:   Then the students vote individually again.

Step 6:   The teacher displays the collective results and explains the correct answer, and why the alternative answers are incorrect.

In the peer-instruction method the students have to actively discuss the possible correct answer to the quiz

question and defend their own decision to each other. They also have an opportunity to change their minds about the right answer in the second vote.

It is recommended that the use of SRRS quiz questions, followed by voting and discussion, does not take up more than 10% of the class time available: the process should really be 'rapid' so that student attention is focused on the immediate topic.

Some tips for teaching and learning with SRRS:

- Teaching and learning can be enhanced by using interactive methods and technologies
- Technologies and the use of BYOD can stimulate student interest in class activities
- Question design and delivery can support the learning and teaching process
- Interactive technologies can support question exploration and learning
- Teaching practice can be improved by use of group-based assessment methods
- The use of group discussion and peer learning can enhance the learning and teaching process
- The technology facilities should be tested in advance of the class.

PART 3

Assessment, recognition and accreditation of prior learning

Knowing what students know already, or don't know!

In this part the reader will be provided with information relating to:

3.1   What is assessment and recognition of prior learning for accreditation (RPL)?

Within a European context, the term recognition of prior learning (RPL) is also associated with the term 'validation of non-formal and informal learning'. Both processes provide a mechanism for a learner to have their **previous learning assessed and accredited against national or sectoral award standards**, or against parts of those standards. The process is promoted to enable learners to gain recognition of acquired and demonstrated knowledge, skills and competencies.

RPL can contribute to a learner's education and training progression routes within Lifelong Learning or career path options in the world of work. This understanding is detailed by the European Centre for the Development of Vocational Training (Cedefop) who state:

> *'Validating non formal and informal learning is increasingly seen as a way of improving lifelong and lifewide learning. More European countries are emphasising the importance of making visible and valuing learning that takes place outside formal education and training institutions, for example at work, in leisure time activities and at home'.*
> **Cedefop (p13, 2008)**

The Council of the European Union, Recommendation of the 20th December 2012, prioritised the validation of non-formal and informal learning to assist young adults gain employment, noting:

> *'The validation of learning outcomes, namely knowledge, skills and competences acquired through non-formal and informal learning, can play an important role in enhancing employability and mobility, as well as increasing motivation for lifelong learning, particularly in the case of the socio-economically disadvantaged or the low-qualified'.*
> **CEU (point 1, 2012)**

The Council recommended that member states should by 2018 have put in place mechanisms to allow an individual to have their knowledge, skills and competencies acquired through non-formal and informal learning validated and where applicable to **gain a full** or **partial qualification**.

Therefore, the recognition of prior learning is a process that can provide acknowledgement (in the form of validation or qualification) of an individual's knowledge, skills and competencies which were obtained either in non-formal activities (planned activities in education, training or work) or informal activities (unplanned or daily activities in work, leisure or family). In addition, the recognition of prior learning process provides a valuable opportunity to refugees and asylum seekers to gain recognition of formal qualifications previously held but where there is no documentation of evidence available due to the socio-political circumstances including war and/or displacement in the region where the person previously lived.

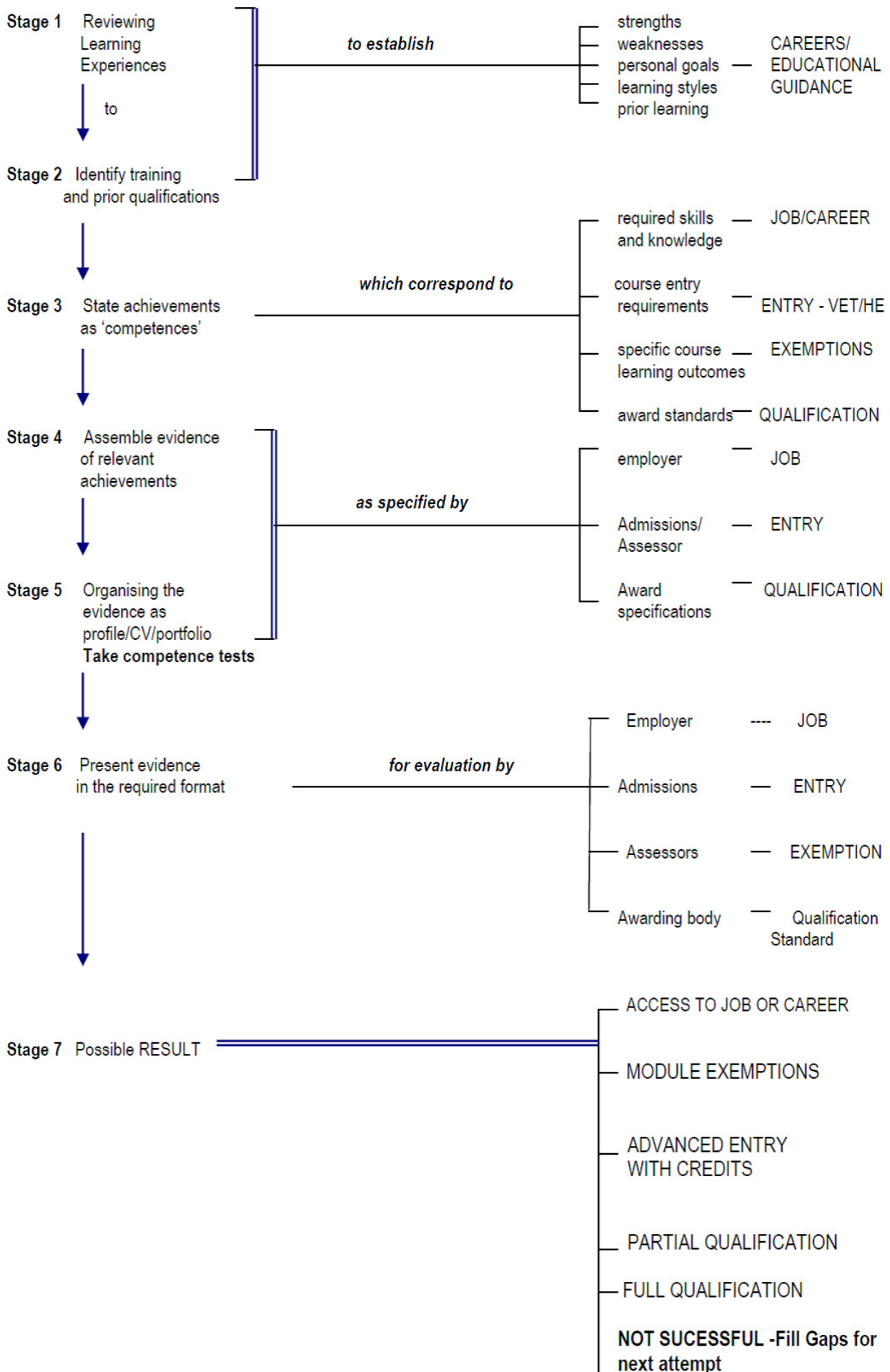## 3.2   What is the purpose of RPL?

Assessment and recognition of prior learning acknowledges that learning does occur in non-formal and informal environments, and that the acquired learning can be validated for a specific purpose, or recognised as achieving learning outcomes associated with an award level which can contribute towards a qualification.

As such, recognition of prior learning provides a mechanism to **retrospectively** consider an individual's level and depth of knowledge, skills and competencies for validation or qualification. The principle of recognition of prior learning is to provide the individual with a mechanism to **gain acknowledgement of their previous knowledge, skills, competencies** to:

- gain employment
- get promotion in work
- find an upskilling opportunity
- take on a new work opportunity
- match regulatory or professional requirements in work
- gain access to education and training
- gain credits for part of a course
- gain advanced entry to education programme
- gain certification for part of an award or qualification
- gain certification for a full award.

Below is a summary overview of the purposes of RPL adapted from Technological University Dublin (Murphy, 2009).

# A general summary of RPL with its range of different purposes and processes

Stage 1 Reviewing Learning Experiences

to

to establish — strengths / weaknesses / personal goals / learning styles / prior learning — CAREERS/ EDUCATIONAL GUIDANCE

Stage 2 Identify training and prior qualifications

Stage 3 State achievements as 'competences'

which correspond to
- required skills and knowledge — JOB/CAREER
- course entry requirements — ENTRY - VET/HE
- specific course learning outcomes — EXEMPTIONS
- award standards — QUALIFICATION

Stage 4 Assemble evidence of relevant achievements

as specified by
- employer — JOB
- Admissions/ Assessor — ENTRY
- Award specifications — QUALIFICATION

Stage 5 Organising the evidence as profile/CV/portfolio
Take competence tests

Stage 6 Present evidence in the required format

for evaluation by
- Employer ---- JOB
- Admissions — ENTRY
- Assessors — EXEMPTION
- Awarding body — Qualification Standard

Stage 7 Possible RESULT
- ACCESS TO JOB OR CAREER
- MODULE EXEMPTIONS
- ADVANCED ENTRY WITH CREDITS
- PARTIAL QUALIFICATION
- FULL QUALIFICATION
- **NOT SUCESSFUL -Fill Gaps for next attempt**

The potential beneficiaries of RPL include workers in the informal economy who would like formal recognition of their competences, workers who need up-dated qualifications, unemployed persons/adults who wish to reskill after retirement, migrant workers who need qualifications in new countries.

Profiles of potential beneficiaries of RPL
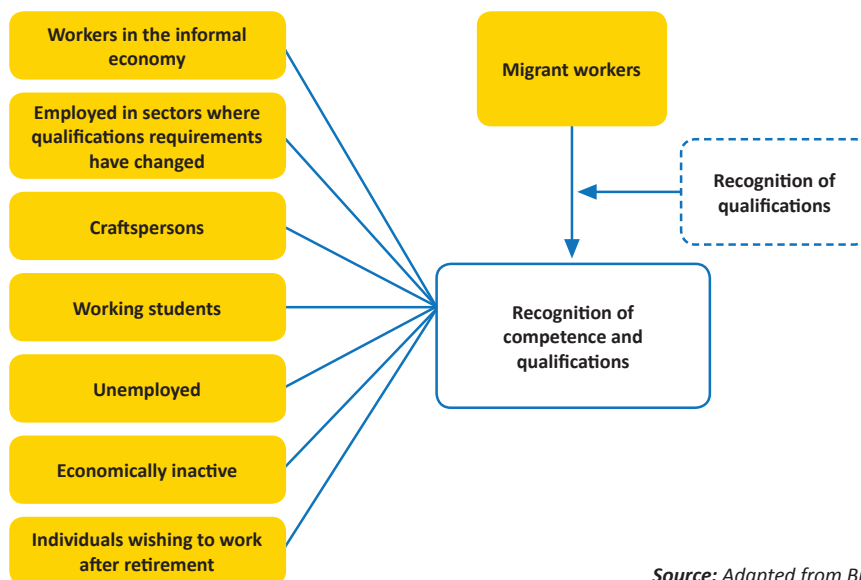
Source: Adapted from Branka (2016a)

Generic RPL process
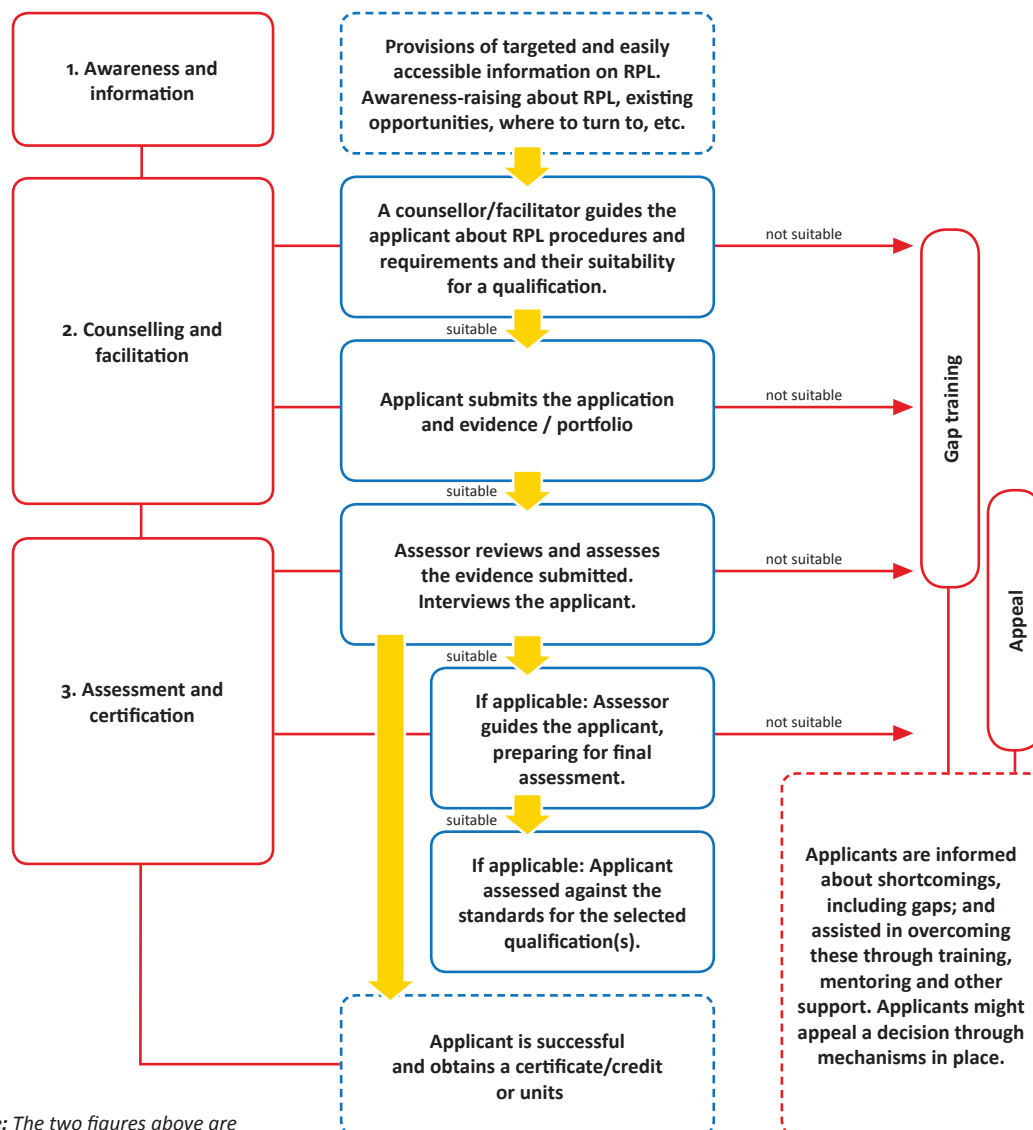
Source: The two figures above are adapted from the ILO guide for RPL

3.2 The RPL process

The recognition of prior learning process usually contains several stages such as: advisory, evidence, assessment, and accreditation. However, it can be specific to local legalisation, to the provider, and to the individual's needs. Within a European context, the Council of the European Union (2012) proposes four stages in the validation of non-formal and informal learning process, as follows:

a. **Identification** of an individual's learning outcomes acquired through non-formal and informal learning

b. **Documentation** of an individual's learning outcomes acquired through non-formal and informal learning

c. **Assessment** of an individual's learning acquired through non-formal and informal learning in relation to a qualification standard

d. **Certification** of the results of the assessment of an individual's learning outcomes acquired through non-formal and informal learning in the form of a qualification, or credits leading to a qualification, or in another form, as appropriate.

Each stage has specific requirements and generally follow each other sequentially. Additional stages may be offered in terms of '**guidance and advice**' before the start of the process: '**teaching**' before the assessment stage: and '**tracking**' after the certification stage.

The recognition of prior learning process may vary depending on the following:

a. the purpose and the provider

b. the motivations of the individual and that of the organisation

c. whether it occurs in an education institute or in the workplace

d. if it is offered by a public or private provider

e. the fees and resources available.

In general *education institutions* facilitate the recognition of prior learning process, advising and preparing the individual to gain recognition or an award based on established **learning outcomes, qualification standards and awards**. *Employers* may also facilitate a recognition of prior learning process based on their operational needs and standards, offering company-specific recognition. In some cases, *private agencies* offer a recognition of prior learning process as commissioned by employers or through competitive funding sourced from the state or municipality.
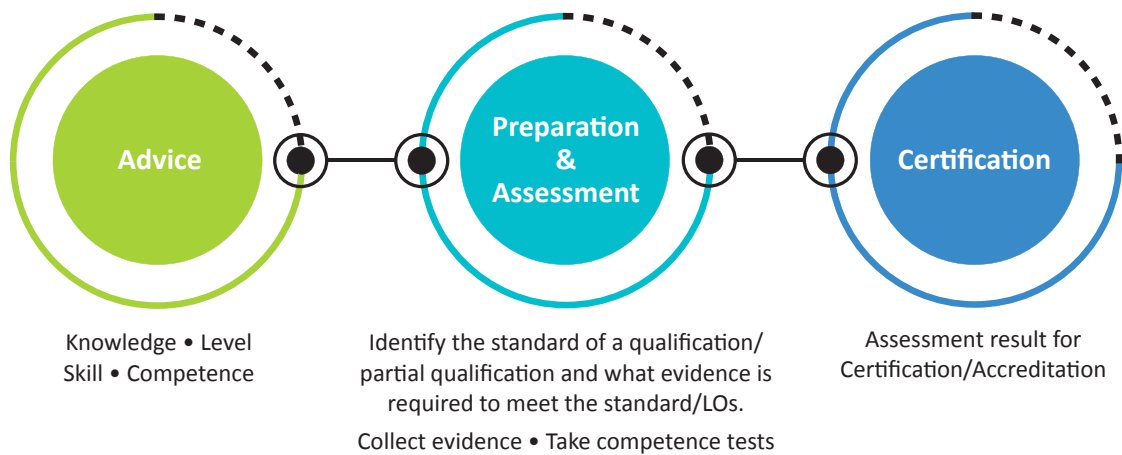
In general, the recognition of prior learning process is facilitated by teachers who are subject matter and assessment experts, counsellors, external assessors, or combination of these roles, and may include:

- The provision of relevant and accessible information to the individual
- Meeting and providing advice to the individual
- Assisting the individual to identify the level of their skills, knowledge and competencies
- Informing the individual on evidence-gathering criteria and what constitutes relevant evidence
- Assisting the individual in preparation of material for assessment
- Assessment of the individual, by examination, demonstration, or portfolio
- Accreditation of the individual's work
- Advice on the next steps either in education, training or work.

The process can cater for individual one-to-one sessions, face-to-face group sessions, or in some cases, online provision. The process requires full engagement from the individual, who must be reflective, precise with evidence, and willing to have their work assessed.

The RPL process can be grouped into three main phases which contain four stages, as follows:

PHASE 1	The applicant gains information on the RPL policy, procedure, process and criteria and is provided with guidance on the options available.
PHASE 2	This has two stages. Firstly, the applicant must reflect on their previous training and non-formal learning, and on their learning from experience, to identify their knowledge and skills with reference to a qualification standard or set of learning outcome. In stage 2 the applicant should also gather relevant evidence regarding their knowledge and skills which must be matched to the qualification standard or set of learning outcomes. In some cases, applicants should prepare for competence tests.
PHASE 3	The **final phase**. This is the assessment phase where the evidence produced is assessed by a subject-matter expert, and/or a competence test is performed. A certificate, or partial qualification may be awarded if the required standards/learning outcomes are achieved.

Advice — Knowledge • Level Skill • Competence

Preparation & Assessment — Identify the standard of a qualification/ partial qualification and what evidence is required to meet the standard/LOs. Collect evidence • Take competence tests

Certification — Assessment result for Certification/Accreditation

RPL/APL in 3 phases

3.4   The use of RPL/APL: quality assurance matters

Recognition of prior learning is used to evaluate an individual's knowledge, skills and competencies compared to established standards, learning outcomes and award level. Murphy (p9, 2008) states, 'RPL is essentially a judgment on past learning achieved through formal curricula, through private study or through work activities. The use of recognition of prior learning must be based on the relevant quality assurance procedures (national, sectoral or institute).

The use of recognition of prior learning must be carried out to the same level of professional competency and expertise as that of the formal teaching and learning process associated with the subject and qualification level.

Teachers or trainers who use recognition of prior learning must have the required qualifications in the subject area and trained in the use of RPL assessment methods.

3.5   'Prior learning' of adult learners in a mixed class context

Adults return to formal education and training for a purpose, usually to gain new knowledge and skills, and to achieve and qualification or an award. Adults bring life and work experience with them which makes them different to young school-leavers.

For teachers of mixed-age and mixed-experience classes, there is not sufficient time to find out precisely what each adult actually knows about the course content or about particular basic subject matter and learning outcomes that lead to a final qualification.

So, how can they realistically test each individual at the start of a course or the start of a module?

3.6 'Knowing what students know' before you start a teaching session

In an ideal world of teaching, there would be time and resources to find out what adult learners already know before you start your teaching sessions.

The 'ideal' RPL approach is based on a retrospective exploration of an individual's acquired knowledge and skills and, based on evidence gathered, finding where there are matches and gaps compared to **established learning outcomes contained in specific awards/qualification/national standard at a defined level**. The learner (or applicant) is at the centre of the RPL process, motivated to engage and participate in the different stages (identification, evidence, assessment and certificate) and achieve the requirements to reach their goal. As such, RPL could be considered as an individual leaner-centred process, which is guided and assessed by relevant experts (teachers, subject matter experts, guidance counsellor). Within this process the learner must map-out what they know (knowledge and skills), produce reliable evidence to support their knowledge and skills claim, and request to have their knowledge claim assessed against an established standard and level. The learner engages in a reflective cycle of self-assessment to identify the relevant knowledge and skills acquired which are appropriate to the standard and level.

For within this reflective cycle the learner may also become aware of gaps in their knowledge and skills that require attention (further education or training) to achieve a specific gaol (recognition of credit, entry to a programme, partial award, or full award). The RPL journey is usually undertaking by an individual learner. However, it is efficient, and indeed beneficial, to organise **group-based RPL** where several individuals are aiming to achieve the same qualification or partial qualification. RPL assessment, is always an individual process.

RPL/APL tools include portfolios of paper documents, challenge tests, testimonials from work, interviews, written tests.

The key principle is about matching prior learning to the learning outcomes and standards of the course/award/qualification concerned in every case.

Some tips for the use of the RPL process:

- Provide the student/learner with relevant information about the process
- Advise the student/learner of the requirements (time, resources, commitment, fee if applicable)
- Use an established method to find level of prior knowledge and advise on knowledge gaps
- Guide the learner to develop a plan to gather evidence of learning and prepare for assessment
- The use of technologies including SRRS can encourage the student to engage in the learning process
- SRRS can assist the teacher to assess knowledge and provide just-in-time feedback
- Group and peer learning can enhance student learning process and encourage interaction
- The RPL process can lead to part recognition or full recognition of an award or credit to access a course.
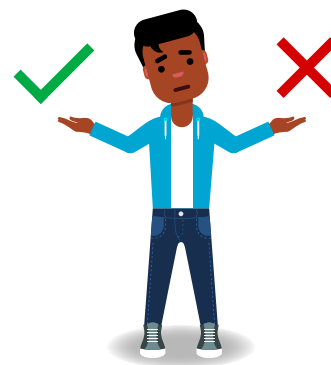
PART 4

ONE2Act and Socrative polling and assessment tools

In this part the reader is introduced to:

4.1   *Adult learners in VET classrooms: teaching challenges*
4.2   *Knowing quickly what adult learners know already*
4.3   *The prototype SRRS **One2Act** and the **EVAL** tool*
4.4   *Where and when to use One2Act SRRS tool*
4.5   *Pedagogical and technological advantages*
4.6   ***Socrative** and its uses.*

4.1   Adult learners in VET classrooms: teaching challenges

The vocational education and training (VET) sector offers many opportunities for young adults and more experienced adults to take part in education and training courses and to gain qualifications which are relevant to the world of work. VET can provide leaners with both practical skills training and theoretical education which are directly related to the skills demands of the workplace. Many VET providers actively **engage with employers** to identify skills needs and to develop appropriate courses to meet those needs or demands.

VET providers can offer courses to young adults seeking to gain skills to enter the world of work. They also provide **up-skilling** and **re-skilling** courses for those already in the workplace. In some cases, VET courses contain a mixture of **new student entrants** in their upper teenage years and **older adults** who already have experience of work. Teaching classes of mixed ability and mixed experience can be challenging for the teacher, particularly with regard to how to prepare and deliver the lesson plan to best meet the different knowledge levels and ranges of experience of the leaners.

4.2   Knowing what adult learners know already

For the teacher to develop a lesson plan effectively, it is important to gain a good understanding of the knowledge, skills and competency levels of the entire class. There are many ways of doing this such as:

a.   Practical pre-tests or interviews
b.   Written entrance examinations
c.   Occupational tests and skills demonstrations which can provide a profile of the learners' knowledge and skills about the course subjects.

However, such tests and examinations can act as a barrier to some leaners which stops them from applying to do the course in the first instance. One way of overcoming the pre-test requirement barrier is to set a minimum qualifications and/or equivalent experience threshold, and then assessing the learner's knowledge and skills once they have enrolled in the course. This approach encourages the learner to engage in education and training and allows the teacher to obtain an understanding of the learner's ability in the class. This type of process is explored below as a joint approach using One2Act and the RPL process.

4.3   The prototype, *One2Act* tools:

A small research group on Trondheim University Norway developed a prototype SRS method called **One2Act with four tools: SRS, Eval, PeLe and iLike**. Its purpose is to assist the teaching process and encourage lecturer-to-student engagement during classes. The project received funded from the European Union. The software developed contained features and functions that academic staff and students identified as useful. A working paper on the One2Act software notes the following:

> *'The ONE2ACT instruments are designed to leverage existing infrastructure to allow eliciting instant feedback from the students without a big logistical burden. The tools developed are geared towards specific scenarios and methods. The basket of ONE2ACT tools is geared towards simple responses from the students catering also to dynamic and spontaneous lectures via student response through ad-hoc questions.' (Stoica et al, p2, 2015)*

The One2Act software contains several tools including the following:

    a. A tool for votes, polls, and quizzes
    b. A tool for peer-to-peer learning
    c. An assessment tool for tests and examinations
    d. EVAL for evaluations and feedback.

The features of the tools are compared on the One2Act Website and summarised in the table following:

Comparison of question types in Socrative and Moodle

Features	SRS	iLike	PeLe	EVAL
One question at a time	✓	✓	✓	✓
Multiple questions at a time			✓	✓
Edit the text of the questions and choices			✓	✓
Question Types				
Multiple choice questions	✓	✓	✓	✓
Open text		✓	✓	✓
Likert scale				✓
Order words			✓	
Word pool			✓	
Tag words			✓	

The software can be used with a variety of media types including audio, visual and multimedia.

The One2Act software is available to download free of charge for non-commercial purposes only, from URL *https://www.one2act.no/* (Summer 2019).

4.4   Where and when to use One2Act

The One2Act SRRS tools are mainly used with groups of students. They can be used with small classes of 10 students, up to classes of more than 200 students. The tools can be used effectively for class sizes which are normal to VET courses, usually ranging from 10 to 30 students. The tools support the groupwork dynamic by encouraging participation, engagement and communication during the class session.

The SRS tool facilitates group feedback in the classroom and individual student feedback after a class session.

4.5   Pedagogical and technological advantages

The tools' functionality allows the teacher **flexibility** in how and when to use them.

The tools can be used with a multitude of **differed formats and software programmes**.

Through the development of precise curriculum-informed questions and answers a teacher can gain a snapshot understanding of the subject/topic knowledge of the students in the classroom. This **real time information** can assist the teacher to direct attention and explanation towards areas of subject/topic weakness, misunderstanding as indicated in the whole class result. This is a form of **instant feedback** to the class during the teaching session. In addition, the teacher has access to the individual student responses which can assist the teacher to provide targeted feedback to students after the class session.

The tools can be used as **feedback-loop** informing both the class and individual students of their performance as the course progresses. It is generally acknowledged, that the provision of regular feedback to students can be a motivational factor in improving outcomes.

The teacher can use the results gained from the SRRS tool to consider the performance of the class, to identify areas were further tuition is required, and where necessary, to amend lesson plans to accommodate student needs.

4.6　Socrative

Socrative is an app-based, easy-to-use tool for real-time, formative assessment and interactive teaching.

The student version, for users from kindergarten to university level, is free for users. However, the teacher version requires a payment and a secure login.

The teacher version provides access to extensive banks of pre-prepared, multiple-choice questions on a range of subjects. The teacher can also design quizzes, true/false questions, and short answer questions.
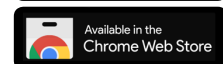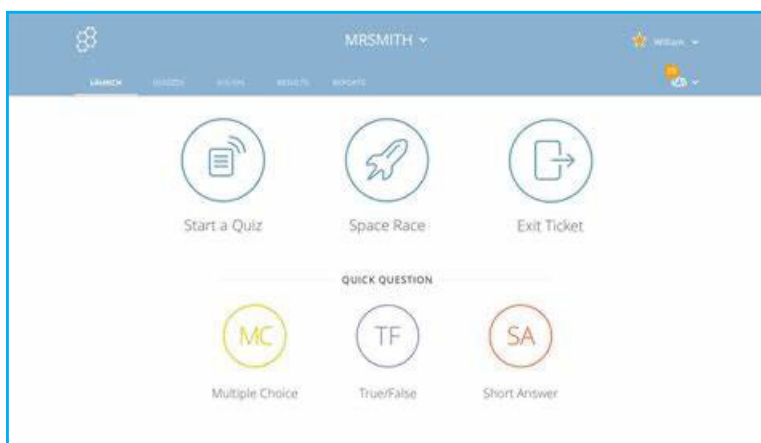
Some key tips for teaching and learning with SRRS:

- Preparation of good quality teaching material suitable to the learning level is essential
- The teaching process and method are central to successful learning and not the technologies
- Technologies should be used to support the teaching and learning approach
- Be aware that technologies can be a barrier to learning with some groups (note the digital divide)
- It is good practice to have a critical friend or colleague review questions and answers
- Use a range of formats in the question and answer design (picture, images, videos)
- Explain the process and SRRS to the class in advance of the session
- Provide feedback on responses to questions in a timely manner
- Encourage the students/learners to engage in self-directed learning of the subjects/topics
- Get feedback from the class on what they consider to be good and bad questions and answers

Part 6 of this Optimal Guide shows how to use Socrative to design questions for a specific subject matter, in this case *fish biology and fish farming*.

PART 5

Combining One2Act tools, Socrative and RPL in the classroom

In this part the reader is provided with information and advice relating to:

5.1 *Designing good quizzes and multiple-choice questions for assessing student prior learning*

5.2 *Types of teaching and learning activities suitable for SRRS polling*

5.3 *Banks of SRRS questions agreed by teaching teams*

5.4 *Always focus on the learning outcomes for the qualification*

5.5 *How to use the combined One2Act SRRS tool and RPL*

5.6 *What could be gained by using this approach?*

5.7 *Challenges in using a SRRS polling tools*

5.1 Designing good quiz multiple-choice questions for assessing student prior learning

Many instructors see multiple-choice questions as limited to testing students' recall of facts. However, multiple-choice questions can actually serve many other purposes in the class, including assessing students' higher-order thinking skills, since SRRS polling questions can be used not only to assess students, but also to engage them in active learning. Very effective questions are quite different to multiple-choice questions that might appear on examination papers.

Here are a few types of SRRS questions, based on guidance documents from Vanderbilt Centre for Teaching.

Type of Question	Purpose
Recall Questions	*These questions ask students to recall facts, concepts, or techniques relevant to the class session. They are often used to see if students actually did the assigned reading, remember important points from prior classes, or have memorised key facts. They rarely generate discussion, however, and don't require higher-order thinking skills.*
Conceptual Understanding Questions	*These questions go beyond recall. They assess students' understanding of important concepts. Answer choices to these questions are often based on common student misconceptions, and so these questions work well to help instructors identify and address their students' misconceptions.* *Questions asking students to classify examples, match characteristics with concepts, select the best explanation for a concept, or translate among different ways of representing an idea, are examples of conceptual understanding questions.*
Application Questions	*These questions require students to apply their knowledge and understanding to particular situations and contexts.* *Application questions often ask students to make a decision or choice in a given scenario, connect course content to 'real-world' situations, implement procedures or techniques, or predict the outcome of experiments, or even their peers' response to a subsequent question.*

Type of Question	Purpose
Critical Thinking Questions	*These questions operate at the higher levels of Bloom's Taxonomy – explained in Part 2 - requiring students to analyse relationships among multiple concepts or make evaluations based on particular criteria.* *Often these questions are 'one-best-answer questions,' questions that include multiple answer choices that have merit.* *Students are asked to select the one best answer from these choices. One-best-answer questions aren't appropriate for examinations, since the reasons students provide for or against answer choices are of more interest than their particular answer selections.* *However, these questions can be very effective in preparing students to engage in class discussions about their reasons.*
Student Perspective Questions	*These are questions that ask students to share their opinions and/or experiences. These questions do not have correct answers, but by surfacing the various perspectives of students in a class, they can help both instructors and students better understand those perspectives.* *They can often generate rich discussion, particularly questions about ethical, legal, or moral issues.* *They can also help students connect their personal experiences to more abstract course content.* *The anonymity that SRRS tools provide is often an essential ingredient in asking these kinds of questions.*
Confidence Level Questions	*Asking students, a content question, then following that by asking students to rate their confidence in their answers (high, medium, or low) can enhance the usefulness of information on student learning provided by the first question. Prompting students to assess their confidence can also aid in metacognition i.e. learning about one's own learning.* *Instructors can also ask 'predictive' confidence level questions by asking students how confident they are that they could correctly answer some question or accomplish some task in which they have not yet engaged.*
Monitoring Questions	*These are questions designed to provide instructors with information about how their students are approaching the learning process in their courses. For instance, one week before a written assignment is due, instructors might ask students whether or not they have completed rough drafts as a way to measure their progress.* *Asking students how long they took to complete an assignment they have just submitted can provide instructors with useful information about the difficulty of the assignment.* *SRRS questions can also be used to see if students remember good advice or course policies shared on a first-day-of-class course syllabus.* *The questions that appear on end-of-semester course evaluations also make useful monitoring questions at the midpoint of the semester.*
Classroom Experiments	*Classroom response systems can also be used to collect data from students for classroom experiments often used in the social sciences. Often data generated by students during class can be used to make points about social behaviour. By allowing these data to be collected and analysed during class, SRRS systems can bring a sense of immediacy and relevance to these kinds of experiments.*

5.2 Types of teaching and learning activities suitable for SRRS polling

Teaching with a SRRS can take a number of directions. Teachers will want to match activities to course content, time constraints, learning objectives, and their own teaching styles.

Added uses of SRRS include the following:

1	**Tracking Attendance**	*SRRS can be used to take attendance directly (e.g. asking students to respond to the question "Are you here today?") or indirectly by determining which students used their SRRS during class.*
2	**Formative Assessment**	*SRRS can be used to pose questions to students and collect their answers for the purpose of providing real-time information about student learning to both the instructor and the students. Students can use this feedback to monitor their own learning, and instructors can use it to change how they manage class 'on the fly' in response to student learning needs.* *Some brands of SRRS allow students to register their confidence level (high, medium, or low) along with their answer, providing more detailed feedback to the instructor.* *Some instructors assign participation grades to these kinds of formative assessments to encourage students to participate. Other instructors assign points for correct answers to encourage students to take these questions more seriously. Other instructors do a mix of both, assigning partial credit for wrong answers.*
3	**Summative Assessment**	*SRRS can be used for graded activities, such as multiple-choice quizzes or even tests. Some brands of SRRS allow for a 'student-paced' mode in which students answer questions on a printed test at their own pace.*
4	**Homework Collection**	*Some brands of SRRS allow students to record their answers to multiple-choice or free response homework questions outside of class and give their answers via the SRRS at the start of class.*
5	**Discussion Warm-up**	*Posing a question, giving students time to think about it and recording their answers via the SRRS, and then displaying the results, can be an effective way to warm a class up for a class-wide discussion. Compared with the approach of taking the first hand that is raised after a question is asked, this approach gives all students time to think about and commit to an answer, setting the stage for greater discussion participation.*
6	**Repeating a lesson or going forward**	*Since it can occasionally be challenging to determine what students understand and what they do not understand, SRSSs can be used to measure the extent of learning in real-time during class and modify one's lesson plan accordingly. If the data show that students understand a given topic, then the instructor can move on to the next one. If not, then more time can be spent on the topic, perhaps involving more lecture, class discussion, or another question.* *Certainly, there are other ways to determine if students are understanding course material as one progresses through a course, but SRRS can provide a convenient way of doing so.*

	Peer-to-peer instruction	*The teacher poses a question to his or her students. The students ponder the question silently and transmit their individual answers using the SRRS. The teacher checks the histogram of student responses. If significant numbers of students choose the wrong answer, the teacher instructs the students to discuss the question with their neighbour. After a few minutes of discussion, the students submit their answers again. This technique often (but not always!) results in more students choosing the correct answer as a result of the peer instruction phase of the activity. This is a fairly simple way to use SRRS to engage a large number of students in discussions about course material.*
	Repeated Questions	*In the peer-to-peer instruction approach described above, students respond to a given question twice – once after thinking about their answer individually, and again after discussing it with their neighbour.* *Some instructors ask the same question several times, with different activities in between rounds of voting designed to help students better answer the question. For instance, an instructor might have the students answer the question individually, then discuss it with their neighbour and respond, then participate in a class-wide discussion and respond, and then listen to a mini-lecture on the topic and respond.* *For particularly challenging questions, this can be an effective technique for helping students discover and explore course material.*
	Question-Driven Instruction	*This approach combines contingent teaching and peer-to-peer instruction.* *Lesson plans consist entirely of questions. Which questions are asked depends entirely on how students answer the questions. An instructor might come into class with a bank of questions, with multiple questions on each topic.* *As students perform well on questions, the instructor moves on to questions on new topics. As students perform poorly, the instructor asks further questions on the same topic.* *The instructor does not have a lesson plan in the traditional sense when using this approach. Instead, the course of the class is determined reactively to demonstrated student learning needs.*

5.3   Banks of SRRS questions agreed by teaching teams

Teaching teams are generally **subject-matter experts** who know the intended learning outcomes and standards for the qualifications on which they teach.

It is normal practice that assessment/examination questions are set by teaching teams.

So, it makes very good sense if the same **teams design a bank of SRRS polling questions** for each course and perhaps for each module/unit of a course. Some teaching teams may even agree multiple choice questions for each teaching session. This collective approach brings consistency and standardisation of learning. It also cuts down the work for the individual teacher who can go to the question bank to plan particular classes on particular topics.

5.4   Always focus on the learning outcomes for the qualification

The One2Act SRRS polling tool is mainly used with groups of students. It can be used with small classes of 10 students, up to classes of more than 200 students. The tool can be used for class sizes which are normal to VET courses usually ranging from 10 to 30 students. The tool supports the groupwork dynamic, encouraging participation, engagement and communication during the class session. The One2Act tool

facilitates group feedback in the classroom and individual student feedback after a class session. The tool's functionality allows the teacher flexibility in how and when to use it.

The SRRS tool can be used with a multitude of differed formats and software programmes.

Through the development of precise curriculum-informed questions and answers a teacher can gain a snapshot understanding of the subject/topic knowledge of the students in the classroom. This real-time information can assist the teacher to direct attention and explanation towards areas of subject/topic weakness, misunderstanding as indicated in the whole class result. This is a form of instance feedback to the class during the teaching session.

In addition, the teacher has access to the individual student responses. This can assist the teacher to provide targeted feedback to students after the class session. The tool can be used as a feedback-loop informing both the class and individual students of their performance as the course progresses. It is generally acknowledged that the provision of regular feedback to students can be a motivation factor in improving outcomes. The teacher can use the results gained from the SRRS tool to consider the performance of the class, identify areas were further tuition is required and where necessary amend lesson plans to accommodate student needs.

5.5   How to use the combined One2Act SRRS tool and RPL

Combining the reflective cycle of the RPL process with the feedback-loop potential of the One2Act method can create an interesting dynamic to assist teaching and lesson plan development in VET courses, particularly in cases where students have mixed abilities including varied knowledge, skills and experience.

To facilitate this process the teacher needs to map out the key learning outcomes (major topic areas) of the course and place them in order of sequence. Then, sets of short multiple-choice questions and answers need to be constructed based on the main learning outcomes of the course. The sets of questions and answers can be text-based. However, visual objects and audio/visual presentations are more interesting to students and may prompt responses.
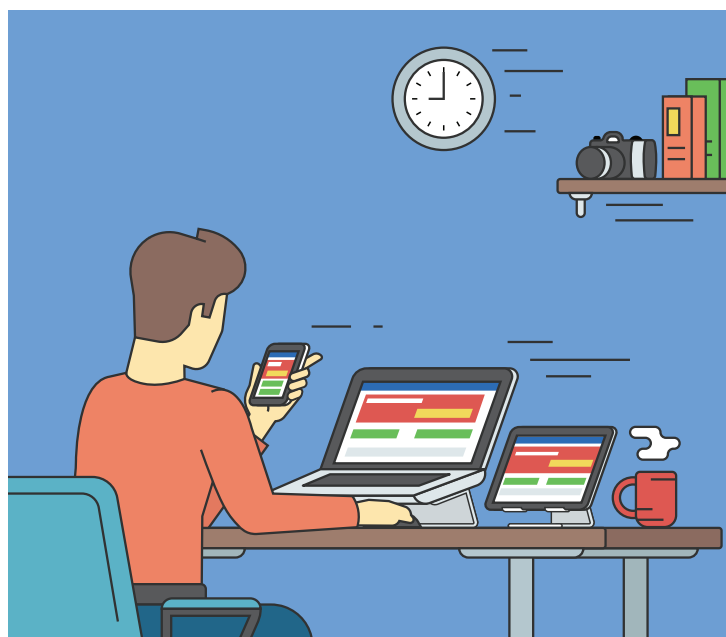
The sets of questions and answers are loaded separately and sequential in the One2Act tool. The teacher explains the process to the students. It is mostly used to identify knowledge areas and gaps, to provide feedback to students and to inform lesson plans for each session.

Before the quiz is presented, **the teacher introduces several topics** relating to the quiz and requests students in groups to **reflect on their prior learning and experiences** relating to the topic. After the group discussion, the teacher begins the quiz and answer session.

Each student uses their own phone to respond to the questions.

All the responses are aggregated and presented to the class, the results act as a focal point for discussion about the topic/learning outcome.

Students are requested to explain their experience of the topic and expand on other related areas (skill and knowledge) relevant to the topic/learning outcome. Teacher asks the students to discuss ways (other than qualifications) to prove a person has the skills and knowledge related to the topic/learning outcome.

The teacher advises the students that **individual feedback** on their own responses to the quiz will be **emailed** to them before the next session.

The exercise should take no longer than **30 minutes** of the lesson time.

By combining an RPL process with an SRRS technique the teacher can assess a group's previous knowledge of a subject and use the results to inform the development of teaching and learning materials for the class with a view to targeting the knowledge gaps. The process enables the teacher to construct feedback for the class to support the learning process. In addition, the teacher can provide feedback to individual learners on areas that may need further work.

The approach relies on good teaching practice and methods which use technology to enhance the student engagement experience and learning.

The combined reflective cycle and feedback-loop can be applied by the teacher during the subsequent classes. The results from the SRRS can assist the teacher to amend lesson plans to meet the needs of the class in terms of their knowledge and skills strengths and weaknesses.

The figure opposite depicts the integration of the RPL stages (identification and evidence) and SRRS (questions and responses) used to explore acquired knowledge in comparison to a qualification standard, and the provision of feedback to promote participation and learning.

Figure 1 - Combined RPL/APL approach and SRRS method

5.6   What could be gained by using this approach?

The combined approach consisting of reflection and feedback, quizzes and discussions can enhance student participation level in the class, bringing in real experiences gained from work.

The quiz type questions and answers can become progressively more detailed and problem-based, moving from factual style (multiple choice questions) to more conceptual and theoretical responses (short answers, essay, reports, project etc.). As the questions and answers become more in-depth the teacher can decide to cease requesting individual student responses and instead organise students into groups to discuss a solution to a problem posed and submit a group response.

The polling tools allow for student responses to be sent during class time or **outside of the class** at a timeframe set by the teacher (hours, days, weeks).

The teacher can review individual student responses, consider the areas needing further work and provide the student with immediate feedback, identifying areas of weakness and strengths, and suggesting areas to be studied in advance of the next classroom session. From the experience of using the polling tool, the teacher may develop sets of subject/topic specific questions and answers that can be provided to individual students to prompt revision or self-directed learning. This type of process enables the learner to reflect on their knowledge and skills on the subject/topic and engage in both study and self-assessment of their knowledge and skills acquisition whilst progressing through the course.

This approach encourages the teacher to develop a course plan, (based on the required learning outcomes or curriculum content) and individual class session plans which are supported by question and answer style quizzes which explore specific subjects/topics in a sequential manner, incrementally progressing in terms of difficulty and depth of knowledge and skills.

The approach also allows the teacher to measure a leaner's general understanding of the subject/topic at a specific time and point in the learning process. From a review of this information the teacher can consider the best type of feedback for the learner to support them in the learning process. The teacher can monitor the learner's responses over time, consider their progress, and provide feedback to the learner at different stages of the course.

The pedagogical approach is based on a continuous form of feedback, advising the learner of achievements and informing them of areas that require attention. An effective communication process is vital to support this type of feedback approach. The communication process requires active two-way engagement between the teacher-to-learner and learner-to-teacher. Each has their own responsibilities: teacher to consider and provide timely and relevant feedback, and the learner to review feedback and act on the suggestions made.

The process is also supported by the teacher providing feedback to the learners during class sessions. The teacher can provide relevant feedback to the class based on the information gained from the aggregated results from class responses to questions. This can support group learning and encourage group interaction and participation in the learning process.

5.7   Challenges in using SRRS polling tools

While a SRRS can facilitate a variety of student-active teaching activities, a teacher using any such tool should be aware of the following challenges.

- As with any use of computer technology in the classroom, **technical problems can arise**. A teacher using a traditional SRRS tool should allow time at the beginning of class to set-up and troubleshoot. Also, non- back-up activities should be planned in the event of a total failure.

- **Getting started with an SRRS tool takes some time**. Current systems are easier to learn and use than older systems, but there is still some start-up time required. Having an experienced user around is helpful. Adapting lesson plans to take advantage of a SRRS takes time, too. However, it is often not hard to start small by adding a question or two to each class, particularly if the instructor has a good idea where students are likely to have difficulties.

- **Using a SRRS in class takes up class time**. If students do not keep possession of transmitters between classes, some time will be spent at the beginning of class distributing the transmitters. Moreover, a few minutes will be needed for students to transmit their answers, and class time will be used discussing student responses. Some teachers have responded to this challenge by relying on **pre-class reading assignments** to convey portions of course material. Others use the time limit function of an SRRS (where students are given only so much time to respond to a given question) to help manage class time. Others feel that students need to master certain material before moving on, and use a SRRS to ensure that mastery is worth the extra time. Others feel that using a SSRS to get feedback on student understanding actually allows them to progress through material more quickly by determining what topics they can safely omit.

- The wrong answers that students choose in response to a multiple-choice question can reveal that the students have misconceptions, but **knowing that students have misconceptions does not necessarily reveal what those misconceptions are**. Teachers using SRRS questions sometimes find it surprising when large numbers of students choose certain wrong answers, and further classroom discussion is sometimes needed to explore why students chose the wrong answers.

- When a teacher uses an SRRS to check for student understanding during class, if it turns out the students do not understand a concept or application, then **the teacher may have to change his or her lesson plan 'on the fly.'** This can be challenging for teachers who are used to preparing their lessons thoroughly in advance or who do not think on their feet as well as some. Instructors often must decide when to move on to the next topic, what to do about students who answer incorrectly when it is time to move on, what to do if only a small proportion of students get a question correct, and what to do if students are still confused after the instructor gives his or her best explanation.

- Many instructors use SRRS to lead into class-wide discussions. Leading class-wide discussions can be challenging for instructors used to just lecturing.

Some key tips to consider:

- Time and resources are required to prepare good quality teaching material
- Teaching material should be reviewed by a trusted colleague
- Consider testing the teaching material with a learner for feedback
- The questions and answers for SRRS should be based on the learning outcomes for the course
- Teaching practice and method is essential to facilitate good group work and peer learning activities
- Don't allow the technologies to overtake the teaching methods
- The provision of good quality feedback is key to the learning process
- Provide feedback on time and in an accessible way
- Group feedback can enhance the learning and engagement process
- Remember confidentiality with individual student results.

PART 6

An introduction to creating multiple choice questions (Objective tests)

In this part the reader will gain insights into:

6.1   *Multiple choice questions, what they are*
6.2   *When to use multiple choice questions*
6.3   *How to create multiple choice questions*

6. 1   What they are

In this Part of the Optimal Guide we are looking specifically at creating a range of multiple-choice type questions that can be used online and/or as SRRS tools.

Multiple choice questions are also known as 'objective tests. 'Objective tests require a user to choose or provide a response to a question **whose correct answer is pre-determined**.' (Ref 1)

There is no room for a subjective response or opinions from the user. The options themselves must be either right or wrong, so that the question can be marked objectively.

Given this definition, objective tests can go well beyond the simple 'choose one correct answer from four or five listed'. For example:

- Multiple choice (select one)
- Multiple choice (multi-answer)
- Multiple choice (multi-answer with all or nothing marking)
- True or False (the simplest of multiple choice!)
- Fill in the blanks in the text from the drop-down boxes
- Type in the answer (short answer)
- Drag and drop words into the text
- Drag and drop answers onto an image
- Drag and drop markers/target
- Drag and drop to match images
- Drag and drop text/images to create a sequence
- Matching

There are many tools available for creating 'online questions. These may be within the Virtual Learning Environment (VLE) itself, software that provides questions that can be embedded into the VLE (e.g. H5P) or independently operating software such as the One2Act and Socrative Rapid Response Technologies, as illustrated in earlier parts of this Guide.

Video as well as still images can often be used within questions, in the appropriate question type.

The 'Good Practice' proposed in this part of the Guide has been drawn from national advisors in Scotland and from the authors' 15 years' experience of developing online assessments in bespoke software and the Moodle VLE. Much of the good practice outlined in 'How to create them' can also be applied to creating 'objective' tests that are to be used on paper.
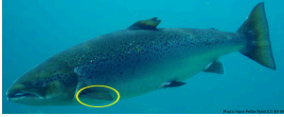
The two main sources of advice were the Scottish Qualifications Authority and COLEG (the Colleges Open Learning Exchange Group, now merged and subsumed into the Colleges Development Network).

Illustration of the range of objective tests

■ **Multiple choice (Select one answer)**

(Shown in Socrative)

Picture as answer (developed in Moodle)

Multiple choice (Multi answer, marks taken off for wrong answers)

Which of the following ingredients provide a source of protein in salmonid diets?

Select as many as you believe to be correct.

(Any number of answers, from 1 to 6, could be correct. Marks taken off for wrong answers)

Select one or more:

☐ Fish oil

☐ Fish meal

☐ Blood meal

☐ Astaxanthin

☐ Wheat meal

☐ Soya bean meal

(Developed in Moodle - any number of selections can be made, regardless of number of correct answers. Marks are deducted for wrong selections.)

Multiple choice (Multi answer, All or Nothing)

(K13) Which of the following salmonid feed ingredients pigment the fish flesh?

Select as many as you believe to be correct. (One or more may be correct.)

ALL correct answers must be selected.
NO MARK is given if there are any mistakes.

(A)   Fish oil

(B)   Minerals

(C)   Astaxanthin

(D)   Canthaxanthin

(E)   Soya bean meal

(Shown in Socrative - the only type of multi-answer multiple choice in Socrative. This software only allows as many selections as there are correct answers, but any answers can be selected.

*NOTE: **not** the conventional square check box.*

In Moodle, the Multi-answer All or Nothing question allows any number of answers to be selected, regardless of the number of correct answers.)

True or False

FINISH QUIZ

True or False?
It is your duty as an employee to wear/use the Personal Protective Equipment that has been provided for you for a task.

(T) True

(F) False

(Shown in Socrative)

Select missing words (drop down boxes)

Select the correct words from each drop down menu to complete this information about protein in the diet of farmed salmon.

Proteins are composed of [amino acids ⇕] which are used by the fish to buil [✓ muscle] .

Choose...
body fat
✓ muscle
bones

Proteins are also used in the formation of enzymes and [Choose... ⇕] .

The protein requirements of young fish are [Choose... ⇕] than for mature fish.

Sources of protein in commercial fish food include [Choose... ⇕] and [Choose... ⇕] .

(Developed in Moodle)

The following three True/False questions are about factors that influence the Food Conversion ratio.
Select the correct answer from each drop down box.

True or False?
Fish escapes will improve the FCR. [False ⇕]

True or False?
Food wastage will make the FCR poore [✓]

True
False

True or False?
Dissolved oxygen levels can affect the FCR value. [⇕]

(Developed in Moodle)

What is the scientific name for the Atlantic Salmon?

Type the name in the box below.

Correct spelling and format are essential to gain the mark.

Answer: Sala salmo ✕

The correct answer is: Salmo salar

(Developed in Moodle)

4 of 7
● SHORT ANSWER
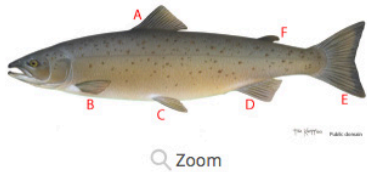
Which fin is the Caudal Fin?
Type the correct letter from the diagram into the box below.

🔍 Zoom

Enter Answer Here

(Shown in Socrative)

Multiply 64 by 12.

Type your answer in the box below.

Answer:

(Developed in Moodle)

Two or more questions in one (Embedded answers)
(CLOZE)

How do you calculate the Food Conversion Ratio of fish stock over a given period?

Select the correct FCR calculation.

- ⦿ Weight of food fed DIVIDED BY the change in the biomass of the stock
- ◯ Weight of food fed MULTIPLIED BY the change in the biomass of the stock
- ◯ The change in the biomass of the stock DIVIDED BY the weight of food fed
- ◯ Weight of food fed DIVIDED BY the change in the average weight of the stock

Which ONE of these FCR values is the POOREST?

- ◯ 2
- ◯ 1
- ⦿ 0.8

(Developed in Moodle)

How do you calculate the Food Conversion Ratio of fish stock over a given period?

Select the correct FCR calculation.

- ◯ Weight of food fed DIVIDED BY the change in the biomass of the stock
- ◯ Weight of food fed MULTIPLIED BY the change in the biomass of the stock
- ◯ The change in the biomass of the stock DIVIDED BY the weight of food fed
- ◯ Weight of food fed DIVIDED BY the change in the average weight of the stock

2000 salmon weighing 650 Kg in total were fed 100 Kg of food over one week. They then weighed 775 kg in total.

Calculate the FCR and type your answer in the box below.

(Developed in Moodle)

Drag and drop words into text

Drag and drop the correct text to complete each sentence about nautical terms.

Words can be used as often as you wish.

The distance from the water to the lowest point of the vessel where water could come on board is called the | freeboard | .

The maximum width of a boat is: | beam | .
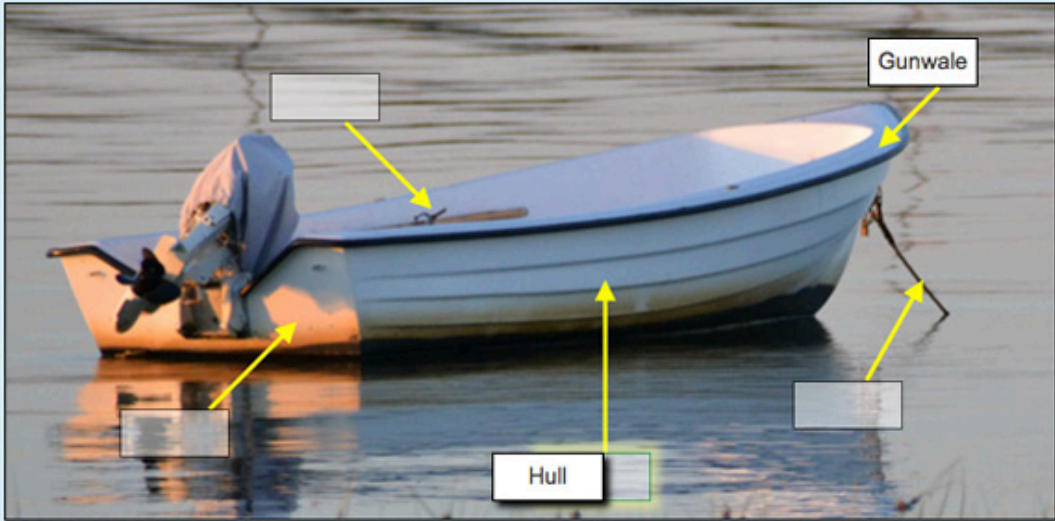
The term that describes the body of the vessel is the | | .

| beam | bulkhead | draft | deck | freeboard | gunwale | hull |

(Developed in Moodle)

Drag and drop onto image

Images and/or text labels are dragged and dropped into drop zones on a background image. The background image in Moodle is limited to 600 x 400 pixels.

Label the parts of this boat by dragging and dropping the correct term to each box.

| Stern | Bilge | Beam | | Cleat | Rowlock | Painter |

(Developed in Moodle – text labels only.
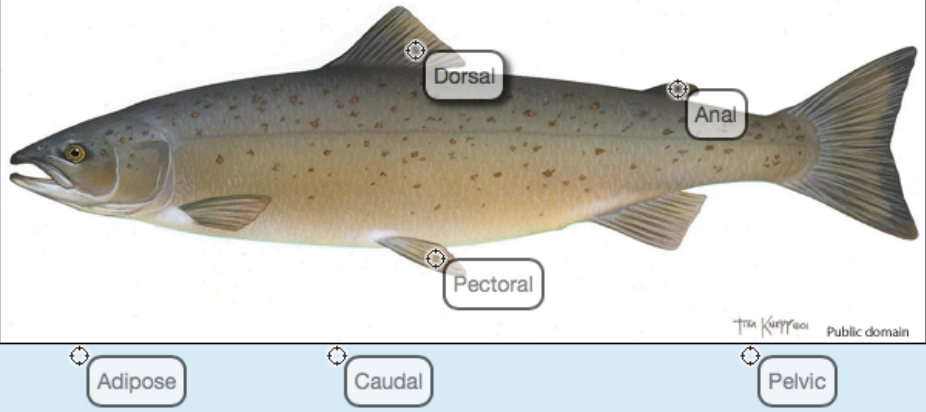
In this question type it is not possible to put the text BELOW the image.)

◾ Drag and drop markers/target

(The target circle must be placed in the correct area. The 'target circle' can be changed to a clearer/more distinctive image).

Background image is limited to 600 x 400 pixels.

(Developed in Moodle. In this question type it is not possible to put the text BELOW the image.)

◾ Drag and drop to match images

(Example from https://h5p.org)

Drag and drop text / images to create a sequence

Images and/or text labels are dragged and dropped into drop zones on a background image. The background image in Moodle is limited to 600 x 400 pixels.

This diagram shows some of the stages in the life cycle of the Atlantic Salmon.

Drag and drop each item to correctly place each image in the diagram and label this stage.

Parr

Egg

Smolt | Mature adult | Egg | Parr | Alevin

(Developed in Moodle – both images and text labels are dropped onto the background image of the arrow diagram including the mature fish. Text is set to be used more than once, if desired.)

Matching

Match the correct name to the stage in the Atlantic Salmon life cycle.

Alevin

✓ Choose...
Smolt
Alevin
Mature adult
Parr

(Developed in Moodle)

6.2   When to use online objective tests

Good objective tests take a lot of time to create, particularly in the writing of them. Finding/creating and preparing images can also take a considerable amount of time. Then there is also the time needed to get them into the software system.

A realistic estimate for creating the finished item is 3 questions per day.

However, this time can rapidly be recovered when:

- there are large numbers of candidates
- there is instant marking and feedback to candidates
- results can be automatically collated and stored in the VLE or exported if required
- the course is well established and the material can be used year on year

The use of online objective tests then reduces the amount of marking for staff members and improves the timeliness of results/feedback to candidates.

There are many opportunities within a learning programme for using online objective tests.

1.   Recognising Prior Learning

In this situation, the objective test/s are used before a course begins or at the start of the course to identify the candidates' prior knowledge and possible mis-conceptions. An Individual Training Needs Analysis may be developed as a result. The focus of classroom teaching may also be refined.

2.   Formative assessment

Formative assessment takes place during a course of study. It gives the candidate the opportunity to practice and develop skills and understanding. For example: they could practice the naming and location of fish anatomy or identifying different fish species.

Learning can be improved because:

- Candidates can get instant results and targeted feedback
- The feedback can include images, audio and video
- Skills can be practiced e.g. species ID
- Formative assessment can prepare the candidates for summative assessment, though care should be taken that they are not simply learning 'how to do the assessment'

Analysis of formative assessment results can help to improve teaching because these can indicate:

- where there are common wrong answers being selected and therefore potentially:
  - » students are having a problem
  - » teaching has not been effective
  - » where teaching and learning needs to be targeted
  - » the question itself is not well constructed
- where the Options themselves could be improved (for example, if a distractor is NEVER selected, then it is not doing its job and should be removed and, if possible, a better one found)

3.   Summative assessment

A summative assessment is used to make a judgement of each candidate's achievement in relation to the learning objectives of an award. This assessment is usually during or towards the end of a course but it could also be prior to it, thus Accrediting Prior Learning.

Other reasons for developing online objective tests

Allowing the reticent student to engage with the class

Rapid Response Technology, such as One2Act or Socrative can allow students to remain anonymous when class results are shared/viewed. Thus, quiet or timid students who find it difficult to engage in open discussions on topics are more able to take part in contributing to the class knowledge and the teacher's understanding of 'where the students are' in their learning.

Storing and sharing results

If set up correctly, the Grade Book in a VLE can provide results online to students, their mentors and their employers. The data is gathered automatically into the one Grade Book. Each of the different 'roles' can be given different levels of access to these results.

The Grade book system also has the potential to act as a form of e-Portfolio, though not one that the students could take with them when they leave the course.

When NOT to use objective testing

As we have seen, creating objective tests is front loaded with time. The benefits must outweigh the 'costs' of producing them.

Furthermore, objective testing is not always an appropriate assessment method.

- Objective tests do not allow candidates to express their own opinion or demonstrate their creativity.
- It is difficult to assess problem solving ability when the candidate has to select from a range of 'solutions. A 'blank page' is generally far more effective.
- Similarly, a candidate's understanding of a subject may not be truly tested by selecting from options; but it is not impossible in the right circumstances.
- Cleary, few practical skills can be demonstrated through online objective testing.
- The subject matter being tested must have clearly correct answers. Maths and science are full of opportunities for objective testing whereas many aspects of animal husbandry, for example, are based on opinion or highly variable circumstances so are definitely not!

(Ref 2)

Both professional judgement on 'when' to use objective testing and creativity in recognising opportunities are required. Combining objective testing with other assessment methods increases the validity and reliability of the overall assessment plan.

6.3   How to create multiple choice questions / objective tests

1.   Planning and process

Creating effective objective tests is a team effort. Subject expert and scrutiniser are the minimum number in the team. Someone with experience in creating online objective tests, regardless of the subject matter, is a very valuable addition to the team.

- Analyse the learning outcomes of the qualification and what needs to be assessed.
- Recognise the types of assessment that **must** be used and identify the opportunities for objective testing.
- Identify the type of objective test that best suits each identified opportunity.
- Prepare the questions in Word first (it is much easier to share, edit, spell check etc in Word than in the question software) and work with subject experts and others to refine and finalise each the question. DON'T use tables in your formatting, this makes transfer of text much slower. Decide on an agreed format in your Word doc that meets your needs before you start. A disciplined titling system pays dividends in the future for finding specific questions. An example of a format is given at the back of this guide.
- Create/source any artwork and images.
- If these questions are a summative assessment or APL, ensure that they meet any internal / external approval requirements.
- Upload questions to software and system (including results system, if required).
- Test!!
- Use
- Improve

2. Creating valid objective tests

A valid item allows candidates to show that they have the required knowledge / understanding / skills to meet learning outcome(s) of that qualification. (Ref 3)

It needs to be:

- **A.** Well-constructed and grammatically correct
- **B.** Technically sound

A)   Well constructed

The basic principles of objective testing are most easily seen by looking at a simple multiple-choice question (one correct answer from several choices – see page 6).

Construction is based on:

- the individual parts of the question (the **Stem** and the **Options**)
- the **layout** of these parts

The Stem *(Ref 2)*

This is the text of the question and should be a single, unambiguous statement or question. Don't be tempted to write 'clever' or 'tricky' text. Keep it simple and straightforward. You are usually assessing the candidate's knowledge and skills relating to a subject, not their reading skills.

- It should be concise and clear and only contain information that is directly relevant. There may, however, be an introduction to the question/creation of a scenario before the stem.

- The candidate should therefore be able to answer the question without looking at the Options i.e. the Options are answers to the question, not a way of working out what the question is.
- Avoid duplicating text in each option, include it in the Stem.
- Avoid giving clues in the Stem.
- If an image is part of the question (but not the question itself!) make sure it is labelled so that candidates are not wasting time trying to work out what it is.

The Stem of True/False questions *(Ref 1)*

True/False questions are a very simple form of multiple-choice question, in that there are only two choices: True or False. However, they are not necessarily simple to write as it can be difficult to create a stem that has two such absolute responses.

- The Stem of a True/False question should be written as a statement of fact, not a question (see example below)
- Avoid words that can signal the correct response. 'None', 'never', 'always', 'all', 'impossible' tend to imply false. 'Usually', 'generally', 'sometimes', 'often' tend to imply true.
- Avoid lifting statements from course materials/lecture notes etc so that recall alone is not used to give the correct answer.

Examples (incl. from Ref1)

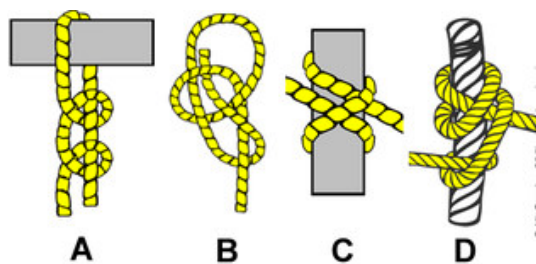*Single, unambiguous question or statement*

Which of the following nutrients are able to be used as an energy source by fish?

Select as many nutrients as you believe to be correct.

(Any number of answers, from 1 to 5, could be correct.)

a)   Carbohydrates

b)   Vitamins

c)   Minerals

d)   Proteins

e)   Fats

Scenario before the question

You need to tie your boat to a MOORING POST to unload items but quickly move on to the next job. The boat will be rocking up and down in the water.

Which ONE of these knots will you use?

Answer the question without having to read the options

Not like this!!

When mixed together:

A.   in equal quantities the colours blue and yellow make brown

B.   in equal quantities the colours blue and yellow make orange

C.   in equal quantities the colours blue and yellow make green

D.   in equal quantities the colours blue and yellow make red

E.   in equal quantities the colours blue and yellow make grey

(Also, duplication of text in the Options, making this more difficult and time consuming to read.)

Better like this:

When mixed together in equal quantities, the colours blue and yellow make:

A.   Orange

B.   Brown

C.   Green

D.   Grey

E.   Red

Don't give clues in the text:

A corkscrew shaped hand tool used to take soil samples is an:

A.   bradawl

B.   spade

C.   auger

D.   pinch

True/False question

True or False?

Dissolved oxygen levels can affect the FCR value.

The Options

These are:

- The **Key** – the correct answer
- The **Distractors** – the plausible incorrect answers

The Key

In a simple, one answer Multiple Choice question, there must be ONLY ONE Key, which is unquestionably correct.

The Distractors

Distractors must all be realistic and plausible, but definitely not correct! The best Distractors are the wrong answers that students have come up with themselves in previous tests or question and answer sessions. Therefore, an experienced teacher of the subject is likely to be the best source of good Distractors.

The idea of a 'wild card' or totally implausible Distractor is a myth. Such Distractors simply increase the likelihood of guessing correctly.

If you can only come up with two plausible Distractors, just use the two. A third one that would never be given as an answer to the question is of no value. But remember, if candidates have given a wrong answer before, even if it seems totally implausible to you, it is worthy of consideration as a Distractor.

Other important points about the Options (Ref 1)

- Options should be shorter than the stem, to avoid excessive reading.
- Options should each be of a similar length, if possible, but definitely in the same style and grammatical tense etc to reduce the possibility of guessing.
- The Options should relate grammatically to the Stem. If the Stem is a question, each Option answers the question. If the Stem is a statement, each Option completes the statement.
- Avoid giving a longer and more detailed correct answer!
- If the correct answer contains one or more key words that appear in the Stem, the Distractors should also include these key words. Otherwise, the correct answer is virtually a giveaway.
- Avoid 'All of the above' as a Distractor. If it is 'All of the above', use a Multi-answer Multiple Choice question type so that the candidate has to make this decision themselves. Otherwise, if the candidate recognises that another Distractor is incorrect, then 'All of the above' is also wrong. So, now they are down to a 50:50 chance of getting the question right.
- Don't use 'None of the above' as an Option. If it is the correct answer, then you still do not know if they have the required knowledge, only what they know it is not!
- Don't use 'always' or 'never' as, except in mathematics, these words may be hard to prove.
- Avoid 'perhaps', 'possibly', 'sometimes' or 'usually'. These mean that there isn't a definite answer. Objective testing can only test definite answers, not opinions. 'Usually' also tends to be used when the answer is true, so it is a giveaway.
- Make sure that the Options are mutually exclusive. If two Options have the same meaning but only one answer is to be selected, candidates will recognise that both must be Distractors.
- Mutually exclusive Options need to be considered carefully when providing 'ranges' of figures.
- Four or five Options are usually sufficient. It can be hard to think up more plausible ones. Set a high pass mark e.g. 70% or 80% to reduce passing by 'chance'.

- Only use negatives when absolutely necessary. If you do, make the word **BOLD** and/or block capitals to emphasise it. It is better to use a multi-answer multiple choice question to select as many correct answers as they consider correct than a multiple-choice question where they select ONE that is NOT correct.
- Do not use technical terms that are not directly related to the skills and knowledge being assessed.

Providing feedback within the question

The process of adding feedback to each Distractor highlights whether that Distractor is plausible or not. Explaining why this answer is wrong focuses the teacher on the detail of that Distractor and can lead to its improvement.

Any objective test is a learning opportunity for the candidate, but particularly when it is used in a formative assessment. Not including feedback in this situation is an opportunity lost, for both the candidate and teacher. Media can be used to highlight errors, links to further study / previous notes can be added. Candidates are learning at the time that they realised they mis-understood something. All in all, it can be fertile ground! (see Example, page 22)

Take care with Summative Assessments, though. Feedback must not compromise the security and validity of the assessment, during and after the event. The effort to make the assessment must be repaid by being able to use it many times. VLEs such as Moodle allow for different opportunities for feedback. Socrative does not allow feedback to be used in certain quiz set-ups.

The Layout

The layout of each question influences how easily it is read by the candidate. Since the question is assessing a subject and rarely their reading skills, layout plays an important part in creating an effective question.

Layout of the quiz

- One question per screen is far less distracting than a 'scrolling' test. There is also less chance that questions will be missed.
- Each question should fit the screen and not require scrolling down to see some of the Options. This requires an appreciation of the screens and machines that will be used but in general you should plan for the dimension of laptop widescreen as this is generally your greatest limitation of height to width.

Layout of the Stem

- Line length on the screen should be around 8 to 12 words. Much more than this and the eye finds it difficult to keep track. Unfortunately, widescreen laptops can allow for very much longer lines unless they are controlled e.g. by using tables. Not all software allows for this. All very good reasons for keeping the Stem succinct!
- Do not justify text (though you should rarely have enough text for this to be an issue!) The eye needs a ragged right-hand edge to help it find its way through text.
- If an image is used in the stem, keep it to the left of the text or above the text. When the eye first meets a page, it is drawn first to pictures. Then it will flow right and down to find the text (in the Western culture!). Images placed to the right of text or below it will require more effort from the reader to find the text. Sometimes, however, the nature of the question e.g. a target question requires the Stem above the image. Make sure the text is in **bold**, to help the eye find it more easily.

- An image within the Stem that is not intrinsic to the question itself has value to candidates at Further Education level and below. Used correctly, it can give a quick confirmation of context and can also simply make the page more interesting and engaging. This technique is of less or no value at Higher Education level and beyond.
- Do not use italics on screen – it is too 'jaggy' and undefined for easy reading.

Layout of the Options

- Keep the Options in a logical order
  - » Ascending/Descending numbers/dates etc
  - » Alphabetical order for single words of a similar length

- When the line length is not equal, lay out the Distractors with longest lines to shortest or vice versa so that they are as easy to read as possible. A jumble of different line lengths makes it more difficult for the eye to pick out the short ones. (See Example, page 24)
- For these reasons, Options should NOT be SHUFFLED

Examples

Grammatically related Stem and Distractors

Not so good:

What does this fin – circled in yellow - do?
Select one:
a) Propeller
b) Stabiliser
c) Steering, braking, moving up and down

Better:

What does this fin – circled in yellow - do?
Select one:
a) Propels the fish through the water
b) Stabilises the fish while it's swimming
c) Used in steering, braking, moving up and down

Avoid greater detail in the right answer/maintain key words in both stem and distractors

How does the Atlantic Salmon find the correct freshwater tributary in which it was hatched when returning as an adult from the sea?

Select one:

a) By sensing changes in water temperature
b) By visual recognition of river bed structures
c) By visual navigation using the moon and stars
d) By use of the lateral line to sense pressure changes
e) By olfactory recognition of the tributary's water chemistry

This is the correct option. The 'giveaway' is that it is the only one that includes the detail of the word 'tributary' (and also technical term 'olfactory')

Mutually exclusive Options

What is the OPTIMUM TEMPERATURE RANGE for marine cage farmed Atlantic Salmon feeding and growth?

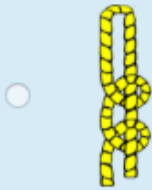(Assume fish stocks are healthy and dissolved oxygen levels are 100% saturation)

Select one:

○ Above 21 $^\circ$C

○ 19-21 $^\circ$C

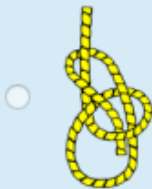○ 14-18 $^\circ$C

○ 9-13 $^\circ$C

○ 4-8 $^\circ$C

Feedback opportunities

Identify the BOWLINE knot.

Select one:

- This is a Sheet Bend. This knot joins two lines together. It is useful for joining lines of different diameter.
- The bowline knot is used to make a loop in the end of a line.
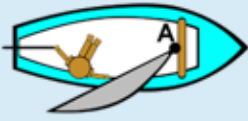
Feedback about a wrong selection

Boat A is a sailing vessel. You are in charge of powerboat B.

The boats are on a head-on collision course.

What action should each boat take?

Select one:

○ You should both give way, turning your boats to port.

○ You should both give way, turning your boats to starboard.

○ Maintain your course, sailing boats give way to power boats.

○ Boat A maintains course. You should give way, turning your boat to port.

○ Boat A maintains course. You should give way, turning your boat to starboard.

Layout of the Options: logical order

What is the feed rate for a stock of Atlantic Salmon averaging 500 grams with the water temperature at 12°C?

Refer to the feed table provided.

a)   0.71 %

b)   0.87 %

c)   0.97 %

d)   1.03 %

e)   1.33 %

(Numerical)

What is the name of the organ highlighted?

a)   Heart

b)   Kidney

c)   Liver

d)   Spleen

e)   Swim bladder

(Alphabetical)

Layout of the Options: readability

> **What is the primary function of fats in manufactured fish diets?**
>
> Select ONE
>
> a) To provide an energy source
>
> c) To provide a source of pigments
>
> b) To provide a stabiliser in food pellets
>
> d) To provide resources for muscle growth

Shortest to longest line length

B) Technically sound

There are three aspects to this:

- It must be completely clear in the question what is expected of the candidate, e.g the marking system and so on
- The marking by the software must be set up correctly to reflect the question
- Could the questions be improved?

Clear instructions

> **What is the OPTIMUM TEMPERATURE RANGE for marine cage farmed Atlantic Salmon feeding and growth?**
>
> (Assume fish stocks are healthy and dissolved oxygen levels are 100% saturation)
>
> Select one:
>
> ◯ Above 21 °C
> ◯ 19-21 °C
> ◯ 14-18 °C
> ◯ 9-13 °C
> ◯ 4-8 °C

Make sure the question is clear by making it bold text. Block capitals emphasise the focus of the question.

In this example, the question software confirms that the candidate has to 'Select one' answer. The convention is also to have radio buttons to select. (The software does this automatically.)

Where the software does not confirm that one answer is required, or if the quiz has several question types within it, confirm what is being looked for in the wording of the Stem.

For example: Which ONE of the following fish stocks would consume the highest percentage of their own biomass in food?

Emphasise the instruction ONE by using block capitals and/or bold.

Which physiological factors influence the feeding activity and growth rate of fish?

Select as many as you believe to be correct.

(Any number of answers, from 1 to 5, could be correct. Marks taken off for wrong answers.)

Select one or more:

☐ Size

☐ Health status

☐ Smoltification

☐ Flesh pigmentation

☐ Sexual maturation

Here the candidate has to 'Select as many as you believe to be correct' and, to confirm the nature of the question, it also adds that '1 to 5 answers may be correct'.

The convention for this type of multiple-choice question is to have square choice buttons. This is automatically formatted by the software.

Marking system

Socrative and H5P allow for Multi-answer Multiple Choice but these are effectively All or Nothing questions, with no recognition of partially correct responses.

Moodle has the Partially Correct scheme as standard (and 'All or Nothing' as a plug-in).

However, be careful with Partially Correct. Make sure that WRONG answers are not worth nothing, otherwise simply selecting everything will always give you the full mark, even if not everything is correct! Take marks off for wrong selections and include this information in the question itself so that the candidate knows the rules.

From the following list of minerals, select the TWO that are needed in fish diets in the HIGHEST quantities .

(Marks taken off for wrong answers.)

Select one or more:

☐ Iron

☐ Iodine

☐ Sodium

☐ Calcium

☐ Phosphorus

Ensure that the instructions in the question software match your instructions in the question.

For example, Moodle's standard software text for Multi-answer Multiple Choice is: 'Select one or more'. If you say Select 2 options in the question, Moodle's standard 'instruction' will cause confusion. A more generic text 'Make your selection' needs to be programmed into the software.

Could the questions be improved?

A VLE such as Moodle collects statistics from question results and allows you to analyse the quality of your questions.

Even without such a system, some checks can be made to improve the quality of your questions:

- Facility Index
- Analysis of response to each Option

The more candidates complete the question, the more reliable these analyses are. At least 100 results are required to get a reliable indication.

Facility Index

The **Facility Index** is the percentage of candidates who got that question correct. It shows how difficult the question is:

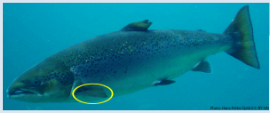| F I	INTERPRETATION
95 - 100%	Extremely easy
90 - 94%	Very easy
81 - 89%	Easy
65 - 80%	Fairly easy
35 - 64%	About right for the average student
21 - 34%	Moderately difficult
11 - 20%	Difficult
6 - 10%	Very difficult
5% or less	Extremely difficult or something wrong with the question

(Ref 5)

If you are randomly pulling out questions from a Bank of similar questions, then the Facility Index will help to confirm that the questions in each bank are fair and there are not hard questions and easy questions within the same Bank. Randomising from Banks is a useful way to reduce 'copying' and 'cheating' in assessments.

Analysis of response to each Option

From Socrative

In this example, both students chose the same, wrong answer.

Multiple choice question statistics from Moodle

From the following list of minerals, select the TWO that are needed in fish diets in the HIGHEST quantities .

(Marks taken off for wrong answers.)

Question statistics

Attempts	5
Facility index	58.00%

Analysis of responses

Part of question	Response	Partial credit	Count	Frequency
569	Iron	-20.00%	0	0.00%
570	Iodine	-20.00%	3	60.00%
571	Sodium	-20.00%	0	0.00%
572	Calcium	50.00%	5	100.00%
573	Phosphorus	50.00%	2	40.00%

Back to main statistics report page.

Multi-answer multiple choice statistics from Moodle

Here, only 2 people (40% of class) got the whole question correct. The Facility Index (58%) takes account of the fact that all made at least one correct selection.

The **frequency that a distractor is used** is an indication of validity. After a large number of attempts (e.g.100) if a Distractor is never selected then it should be replaced.

An examination of the frequency of wrong answers being selected can indicate target areas for teaching or improvements in teaching. In the second Moodle example above, although the numbers are still small, you may begin to wonder why candidates are selecting Iodine as a correct answer.

Discrimination Index and Efficiency

The Discrimination Index in Moodle shows how effective the question is at sorting able students from less able ones. Low and negative values indicate that the question is very poor or has an error in it. Such values result from the students who generally get questions correct getting this question wrong.

A Discrimination Index of 30 – 50 shows adequate discrimination. Above 50 is very good discrimination (Ref 5)

Low and negative values for the **Discriminative Efficiency** recorded in Moodle also indicate questions to check for 'technical soundness'. A zero Discriminative Efficiency occurs when everyone got the question right – i.e. there is no discrimination between poor and good students through this question. You are aiming for values greater than 50%. (Ref 5)

Notes on uploading to the question software

1.   Preparing pictures

Make sure that you are working within the Copyright laws!

Pictures should be as small a file size as possible for the dimensions of the picture that you require. This keeps memory requirements down and upload speeds as fast as possible.

Some software does this for you as you add the picture to the site.

Otherwise, you will need to prepare your pictures before adding them into the software and make them in the dimensions you require. This is much better than trying to resize once they are in the software (the picture looks smaller but is in fact still the same file size so slowing down the upload time for the page and using up memory.)

You should get to know what your software/VLE is doing with images and what image resolution is required (usually 72 pixels per inch – ppi)

2. Direct import of questions from Microsoft Word/Excel

Moodle

Simple, one answer Multiple Choice questions can be uploaded into Moodle from a Word document converted to plain text. Specific formatting and layout is required. They are imported using the Aiken format.

Text files of 'Embedded answers' and of 'Missing word format' can also be imported using their specific format options.

All are limited in their layout and images cannot be imported. The title of the question is created from the text, which is not ideal. But if you have many questions of these types, importing them this way is worth considering. You need to plan ahead: only questions of the same type can be in the text file.

To find out more, view the demonstration below:

https://youtu.be/iLPVsqJYjzk

Socrative

Socrative provides an Excel template for uploading a quiz, though this is only for multiple choice questions or open-ended questions. True/False and Short Answer cannot be uploaded this way. Images cannot be uploaded through the template.

Again, if you have many multiple-choice questions to import, the template may be worth considering. Plan this from the outset, as the team's development document should make the use of the Excel template a time-saver!

3. Microsoft Word pasted into Moodle/VLE/software

Word does a good job as a tool for the development of questions. However, when it comes to uploading to an online platform, Microsoft Word brings with it a lot of extra and unnecessary formatting that can upset the layout of Moodle and other software pages. It needs to be converted to Plain Text (.txt). Many applications have their own conversion to .txt now built in to save you a lot of time and trouble.

For example, when your questions created in Word are pasted into Moodle use the 'Paste from Word' icon.

If they are coming from other software to be pasted into Moodle, use the 'Paste as Plain text' icon.

- Check the software that you are using.
- Never paste straight from Word.
- If necessary, you may need to use the 'TextEdit' or 'Notepad' programme to convert to plain text before pasting.

Comparison of question types in Socrative and Moodle

Question Type	Present in Socrative	Present in Moodle
Multiple choice (Select one answer)	✓	✓
Multiple choice (Multi answer, marks taken off for wrong answers)		✓
Multiple choice (Multi answer, All or Nothing)	✓ (Limited)	
True or False	✓	✓
Select missing words (drop down boxes)		✓
Short answer - Type in the answer	✓	✓
Two or more questions in one (Embedded answers)		✓
Drag and drop words into text		✓
Drag and drop onto image		✓
Drag and drop markers/target		✓
Drag and drop text / images to create a sequence		✓
Matching		✓

An example of a question development format in Word
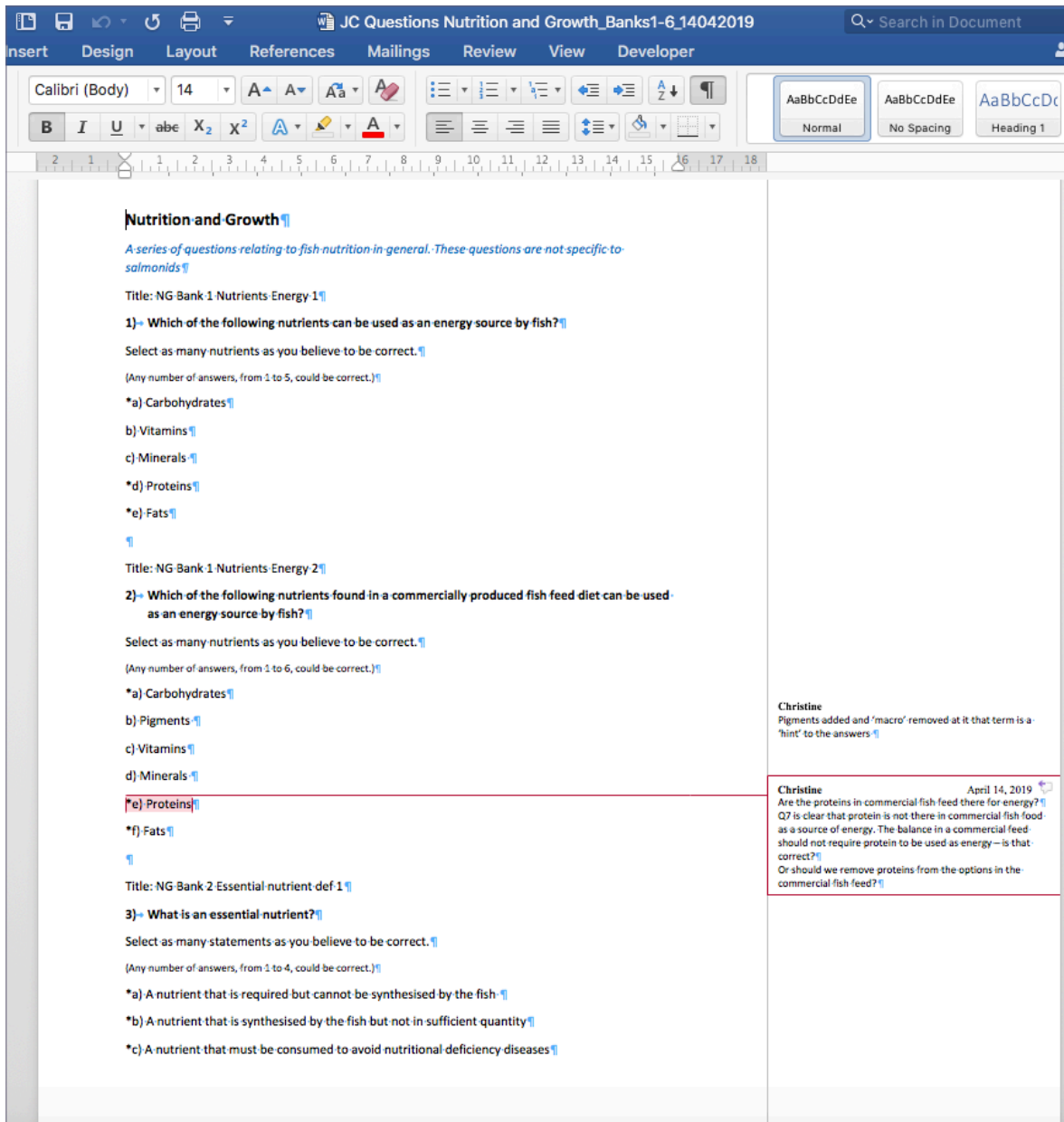
* indicates correct answer

- Word files are duplicated and renamed with the current version before fresh work and feedback begins. Feedback and notes are made through the 'Comments' so they can be explained and followed.
- Questions on the same topic and of the same 'weighting' of difficulty are placed in the same Bank.
- Each question has a unique name or 'title' for recognition, including in software such as Moodle.
- Questions themselves are numbered through formatting as a numbered list so that questions can be easily added, moved and removed.

Resources and References

- Caldwell J. (2007) Clickers in the Large Classroom: Current Research and Best-Practice Tips, *CBE Life Science Education Spring Vol. 6(1): 9–20*
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1810212/

- CEDEFOP (2009) *European guidelines for validating non-formal and informal learning*
http://www.cedefop.europa.eu/files/3073_en.pdf .

- CEDEFOP (2015) *European Guidelines for the validating of non-formal and informal leaning*
http://www.cedefop.europa.eu/files/3073_en.pdf

- CEDEFOP (2017) *Validation of Non-formal and Informal Learning*
http://www.cedefop.europa.eu/en/events-and-projects/projects/validation-non-formal-and-informal-learning.

- European Commission EPALE Project (2018) *Validation of non-formal and informal learning*
https://ec.europa.eu/epale/en/themes/validation-of-prior-learning .

- European Council
Recommendation of 20 December 2012 on the validation of non-formal and informal learning 2012/C 398/01
https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32012H1222(01)&from=e

- International Labour Organisation (2017) *How to facilitate the recognition of skills of migrant workers: Guide for employment services providers*, International Labour Organisation

- Murphy, A. (2009) *RPL Matters in the Dublin Institute of Technology: policy and practice guide for staff*.

- Neilsen K., Hansen G. and Stav J. (2013) *Teaching with student response systems (SRS): teacher-centric aspects that can negatively affect students' experience of using SRS, Research in Learning Technologies, Vol 21, 2013*
https://journal.alt.ac.uk/index.php/rlt/article/view/1340/pdf_1

- Quality Qualifications Ireland (2015) *Recognition of Prior Learning in Irish Further Education and Training*
https://www.qqi.ie/Downloads/Prior%20Learning%20Report.pdf

- Quality Qualifications Ireland (2018) *Recognition of Prior Learning*
https://www.qqi.ie/Articles/Pages/recognition-of-Prior-Learning-RPL.aspx

- Stoica G., Biorki K., Thoeseth T. Stav J. (2015) *Using Response Technology to Make Lectures More Engaging, Fun and Interactive*, Høgskolen i Sør-Trøndelag, Avdeling for teknologi, Bergan,
https://www.realfagsrekruttering.no/wp-content/uploads/2014/10/13-stoica_etal.pdf

References used in the development of **Part 6** of this Guide

1. COLEG (2005), COLA Project Writing Objective Test Assessment Items

2. SQA (Scottish Qualifications Authority) (2003), SQA Guidelines on Online Assessment for Further Education
(https://www.sqa.org.uk/files_ccc/GuidelinesForOnlineAssessment(Web).pdf)

3. SQA (2017), Guide to Assessment

4. https://www.sqaacademy.org.uk

5. Phil Butcher (The Open University), Brief Guide to the Moodle iCMA Reports

6. https://docs.moodle.org/36/en/Quiz_statistics_report