Module 2: Training design concepts

Contents:

Activity 1: Writing goals and objectives

In groups read the statement below and discuss the following

- Summary of the problem
- What is your proposed intervention?
- How do you set out to address this problem?
- What is your goal?
- What is/are the objective(s) - how will your goal be achieved?
- Whom will you target in the intervention?

(Make notes on a flipchart, or alternatively use the powerpoint template provided)

Viral genomics and bioinformatics training intervention case study

Viral diseases including zoonotic infections, are a major public health burden, causing millions of deaths worldwide. Challenges faced include limited access to resources and infrastructure for timely diagnosis and surveillance. In the UK, an upsurge of influenza deaths was recorded in 2018-2019. Apart from health risks, emerging viral infections and outbreaks also pose a huge financial burden, especially in the developing countries. For example, the SARS coronavirus outbreak in 2003 caused an economic cost of US$ 60-80 billion. Over 2 billion was lost in the West African countries affected by the Ebola epidemic in 2014. Dengue is endemic in at least 100 countries worldwide with high prevalence in Asia, Africa, the Americas and the Caribbean countries. SARS-Cov-2 was devastating to health systems, economies and communities. Rapid and accurate detection using genomics technologies enables early warning of circulating variants of concern and for appropriate interventions to be implemented and minimise death risk.

Advances in research technologies are enabling access to improved detection, surveillance and management of diseases. In recent years, next generation sequencing (NGS) technologies are playing an important role in the viral identification, classification, drug resistance and treatment and surveillance. Early identification of a virus and quick analysis of its genome will aid in better treatment and help in controlling the disease spread. However, expert knowledge of viral genome sequence analysis is required. However, there is limited knowledge and expertise in the analysis and interpretation of genomics data generated from large scale sequencing. Bioinformatics skills are in high demand among researchers and clinical staff, and yet training opportunities are few and often held as once-off workshops.

Activity 2: Needs assessment

In groups read the statement below and discuss the following

- What other information do you need?
- How will you collect it?
- Now refine your goal, objectives, target audience given the additional information from the needs assessment

Needs assessment survey results for viral genomics training

To demonstrate the need for training in viral genomics and bioinformatics, we conducted a survey targeted at microbiologists. Of the 170 respondents, approximately 85% stated that their work includes the use of genomics or bioinformatics. The vast majority of respondents perform basic bioinformatic tasks with 57% using NGS data in their work. However, a substantial fraction stated that at least part of their NGS analyses are performed outside of their own institution in other locations within and outside their country (Figure 1). For the small proportion of researchers that do not perform any genomics/bioinformatics studies, the majority (~65%) say they would like to include these topics in their research, but they do not have the expertise in house. We will use this data as a first step to address the bioinformatics skills gap targeted at helminths research.

Activity 3: Training strategies for genomics and bioinformatics

Refer to training outline for a course in AMR below

- Outline training strategies for your viral genomics training

Example course outline and training strategies

Antimicrobial Resistance of Bacterial Pathogens	
Target audience	Postgraduate students, (Masters or Ph.D.), clinical trainees or specialists in medical microbiology, postdoctoral scientists, senior technicians, or research assistants Formal application and selection process
Size of audience	Small-medium group 20-30 (no. of key instructors and assistants = 8-10)
Learning outcomes	1. Recognise the significance and challenges of AMR spread and evolution in low and middle-income countries. 2. Carry out standard laboratory methods for antimicrobial susceptibility testing (e.g., disk testing and MIC determination) 3. Apply molecular approaches and techniques for the detection and characterization of antimicrobial resistance genes. 4. Describe the principles and practice of quality assurance and control in AMR surveillance techniques, antimicrobial susceptibility testing, and reporting. 5. Discuss the range of different control strategies for AMR in human and veterinary medicine (e.g., antimicrobial stewardship, infection control and policies). 6. Use web-based and user-friendly computational tools for the monitoring and analysis of antimicrobial resistance.
Content/topics	Laboratory techniques for antimicrobial susceptibility testing (AST), molecular methods for detecting AMR and sequencing Computational techniques for analysing resistance from whole genome sequence (WGS) data and genomic surveillance methods Epidemiological aspects of antimicrobial resistance (AMR), surveillance methods and study design Clinical importance of AMR Resistance mechanisms in bacteria Internal quality control (QC) and external quality assurance (QA) for AST AMR pathogens in the region AMR in veterinary medicine and Antibiotic policies and stewardship Tackling AMR using a One Health Approach Acquisition and evolution of resistance Genomic surveillance of AMR Local AMR epidemiology – investigating transmission of clones and AMR Professional skills development - Train the trainer

Development of materials and resources	**Training materials** Lectures slides; Course manual with step by step laboratory and computational protocols; Training materials stored on closed website and accessible for up to 1 year post-course **Laboratory** Reagents and consumables; Health and Safety manual for BS Level 2 **Field work** Site map for developing field work project; Instructions for field work case study **Bioinformatics tools and software** -Genome browsers and databases; Genome sequencing analysis software; Epi-collect - field work data collection tool; Surveillance tool/platform MicroReact); Datasets for demonstration and analysis
Delivery - teaching strategies and activities	**Types of activities** - Lecture presentations - Trainer led teaching - Expert/guest seminars in specialist topics - Reflective activities - Hands-on experimental practicals in laboratory - Experimental data interpretation - Hands-on computational practicals analysing WGS data - Group field work on premises of outbreak scenario collecting own epidemiological data for analysis - Short course design project (Train the trainer) - Networking *Timetable/schedule* 8-10 hours per day over 5.5 days *Support staff on site* - Laboratory technicians - IT, System administrators - Instructor assistants
Venue, infrastructure and platforms used	Equipped microbiology laboratory BSL2 -equipment for molecular techniques - PCR, gel electrophoresis -Nanopore sequencing laptop and flow cell Adjacent room with computing infrastructure and internet facilities -Mobile phones for field work - Epi-collect

Activity 4A: How to use assessment for learning

- In groups of 4 – each choose a letter A, B, C
- Read the statements corresponding to your letter below
- Reflect on what this implies to you and your learning and training practice
- Report to your group members
- Discuss and challenge each other
- Remember group work behaviours

Assessment for learning statements

A. How do trainers determine what type of formative assessment strategy to use?

- Trainers need to determine what aspect of participant learning they want to assess. They then need to consider the learning preferences of their participants.
- Formative assessment strategies can be given to participants individually, as pairs, in small groups, or as a group.
- Trainers should not rely on one type of assessment strategy. A variety of individual and group formative assessment strategies should be used.
- Individual strategies allow trainers to get a clear picture of each participant and their understanding of the concept or skill being measured.
- Group strategies provide trainers with general information about participant learning that can be used to plan the training.

B. How can trainers use the formative assessment information?

- Trainers use the assessment information to assess how their current training strategies are working with their participants.
- If there are participants who are struggling, trainers may need to work individually with a participant, present information in other ways, or adapt their current training strategy.
- Participants, who have appeared to master the outcome or goal being formatively assessed, may need to be further assessed or have learning opportunities planned that challenge them and are designed at their level of understanding.
- Trainers are also able to identify misunderstandings that participants may have and adapt their training accordingly.

C. How can participants use the formative assessment information?

- Participants need to determine what aspect of their learning they want to assess and how best to do it considering their own learning preferences.
- Participants can use assessment information to determine what they need to do to achieve the goals or outcomes of the session.
- Participants may need to adapt or to change their learning to master learning outcomes.
- If participants are not achieving at an expected rate, they can look at the strategies they are using for learning and decide whether they need to change their current learning strategies or adopt new ways of learning.
- The information provided by formative assessment strategies can also be used to help participants reflect on current learning goals or set new goals.

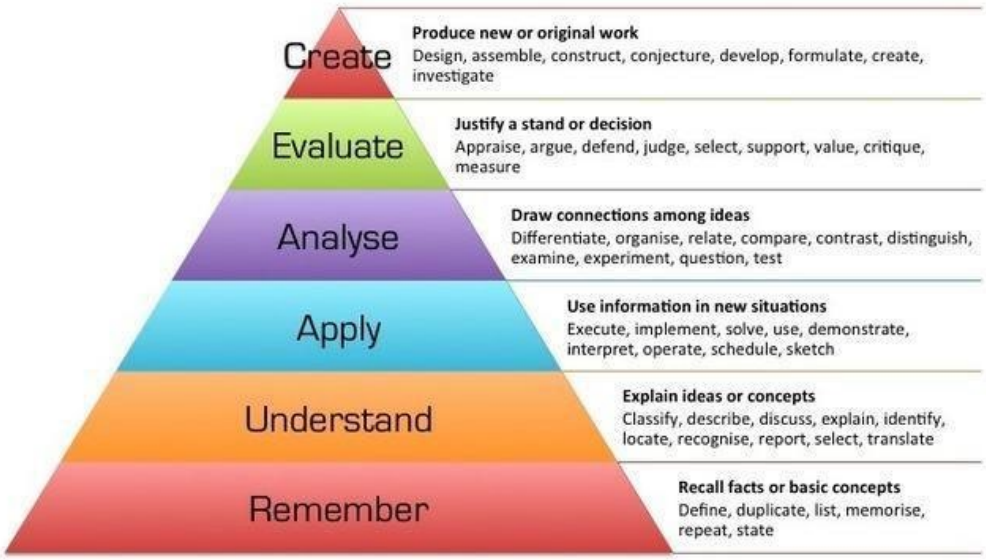
Activity 4B: Techniques to meaningfully assess learning

In your groups -

For each of the LO's listed below determine what techniques can learners and trainers use to assess learning (Remember Bloom's levels from remembering to creating)

- Discuss
  - Which levels of thinking do you think are the easiest/hardest to identify assessment techniques for?
  - Which of the techniques (that are new to you) would you like to try straight away in your training and/or teaching?

Bloom'sTaxonomy



Learning outcomes for assessment

- Identify appropriate training resources for use in training pathogen genomics and surveillance tools.
- Deliver pathogen genomic data science training to professionals working in genomic epidemiology, surveillance and outbreak investigation.
- Evaluate the self-developed training and knowledge sharing of pathogen genomic data science.
- Create sequencing libraries and analyse samples derived from patients with viral infections.
- Evaluate how to improve the efficiency of NGS by carrying out variations in library preparation technique e.g. target enrichment

- Demonstrate how viral WGS can be used to inform transmission patterns and evaluate the effectiveness of interventions

Example assessment techniques include
Simple techniques like question banks, quizzes, peer assessment (get them to frame and ask each other questions), bingo grids to debates, reflective journals, self-assessing work against checklists, one minute essays, learners explaining concepts in their own words, learners teaching each other a concept or skill to designing leaflets about an aspect of research writing, real world scenarios, designing posters as a guide, reflective writing tasks etc.

Activity 5: Draft a training outline

Referring to the viral genomics course justification in Goals Activity, draft a training outline using the fields below *(Remember you have already defined the goals and target audience)*

- Learning Objectives – summary of what will be taught and how everything ties together
- Content – what should be included – list possible topics
- Define Learning Outcomes
- Where will the training take place
- What will be the format of the course?
- Who will deliver the training?
- How long will the course run?
- What are the prerequisites?