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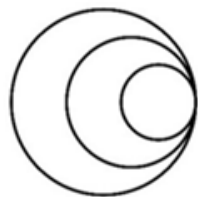# How to design and deliver pathogen genomics training for health and research professionals

Module 2: Concepts to training design and development

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Learning outcomes

Apply good practice in learning and training design for pathogen genomics and bioinformatics

Apply outcome-based and competency mapping methods for genomics skills development among healthcare professionals

Design training strategies, activities and resources for effective delivery of pathogen genomics training.

Outline a training and delivery plan for a short course in pathogen genomics

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Content

Training design overview

Defining goals and objectives

Learning outcomes and competencies

Training strategies, activities and resources

Assessment of learning

Writing a training outline/summary

Training Evaluation

Training and facilitation

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What you will need

- Access to the LMS
- Activity pack
- Competency spreadsheet
- Activity slides
- Training design Toolkit
- Evaluation exercises on LMS

Training design - from problem identification to delivery

Training Justification, goals and special considerations

- Justification

- Goal and objectives

- Defining target audience and understanding training needs

- Contextual issues and special considerations

Design and Development: structure and overall curriculum

- Design plan

- Learning outcomes

- Training strategies and learning design

- Planning, designing and developing activities, resources

- Assessment plan

Delivery and Evaluation

- Delivery plan

- Training and Facilitation skills

- Evaluation plan

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Why and how will you address the problem?

What is the problem you wish to address?
Burden of disease spread, inadequate skills or knowledge, new policy?
Emergence of new technologies, increased sequence generation?

What do you intend to achieve?

What will you do to address the problem?

Problem identification

Goal and objectives

Defining target audience

Justification

Who needs the training?

What are the training needs

Why the course is important e.g. for public health, advancement of science, capacity development; specific relevance in your region/country

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How to define goals and objectives

Activity 1

- **Goals Activity 1: Writing goals and objectives**
- In groups read the statement 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 the intervention

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

What is the purpose of a training needs assessment?

- Determine target audience needs and interests

- Determine skills gaps

- Methods for conducting needs assessment

Activity 2

- **Goals Activity 2: Needs assessment**

- **In groups read the statement and discuss the following**
  · What other information do you need?
  · How will you collect it?
  · Refine your goal, objectives, target audience given the additional information from the needs assessment

Genomics Training Needs Assessment Workshop

Slides

Training design and development

- Identify desired result

Goals, aims and learning outcomes

Design Assessment Tasks

- Determine acceptable evidence

- Plan training strategies and learning experiences

Learning design

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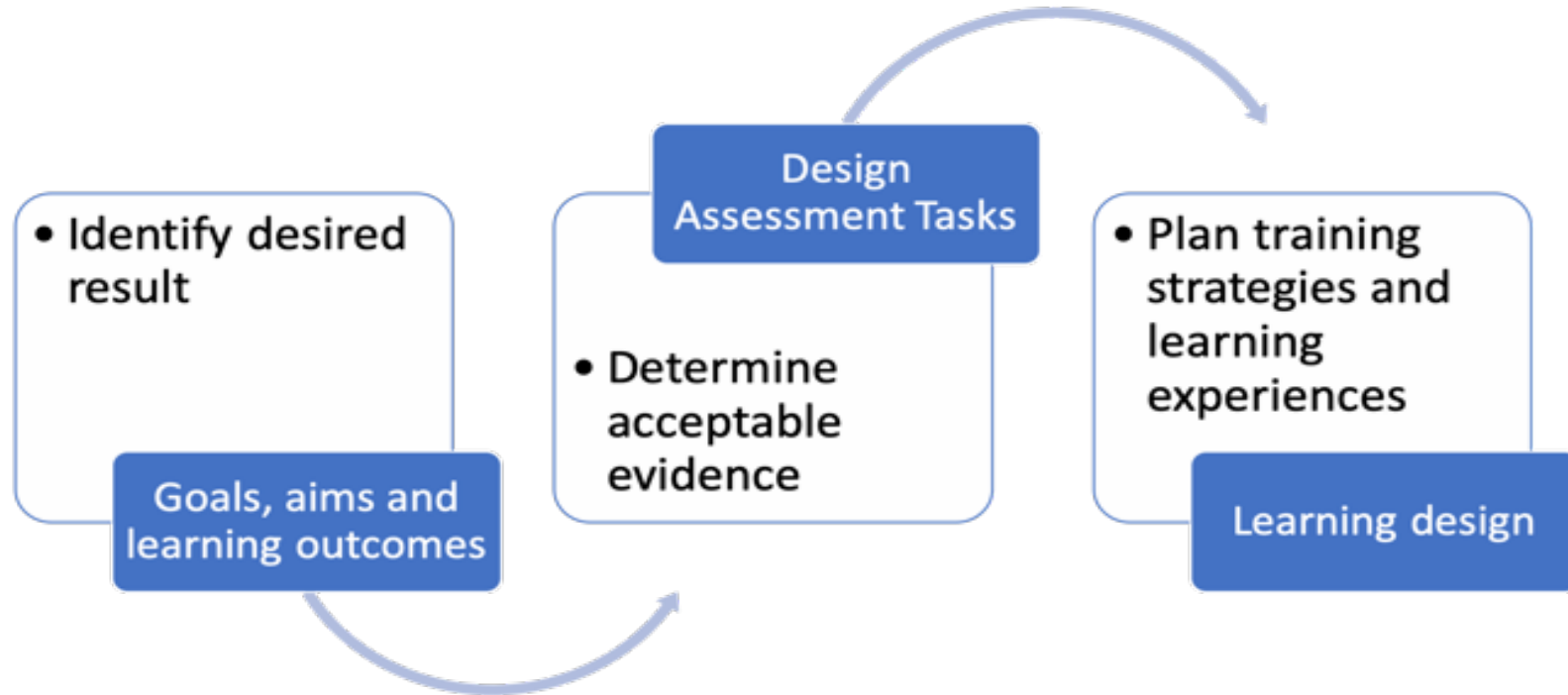
Learning outcomes and competencies -

Definitions

Competency framework in a particular filed for a particular job/profession defines a set of KSA needed to perform that job

KSA also require indication of the proficiency level

Knowledge – domain specific expertise: foundation of facts, ideas and concepts, in-depth understanding of subject matter organised in such way to facilitate retrieval and application

Skill- ability to perform an activity or task, as a result of training and practice. Practical application of knowledge

Attitude – behavioural aspect – ways of thinking or feeling about something that affects behaviour, such as approach or motivations towards something.

Learning outcomes and competencies -

Use of a competency framework:

- training others: designing/planning new training, courses and programmes

- revising existing (mapping);

- self-assessment or personal needs assessment;

- help harmonising training across domain so facilitates better communication and collaboration

- devising employment criteria

- **Context here** use primarily in training and course designing

Building competency framework for PG

Define audience/jobs/professions – personas

|

Define competencies (build from existing framework if exists)

|

Define KSA for each competency

|

Define level of proficiency for KSA (for example use Blooms taxonomy)

Your competency mapping

Overview of competency exercise:

Map your own competencies

Practical exercise aims to give you an insight into how a framework can be built, and an opportunity to think about and indicate proficiency levels of KSA for different PGS competencies for your own profession

Breaking down content and sequencing

Training and learning strategies considerations
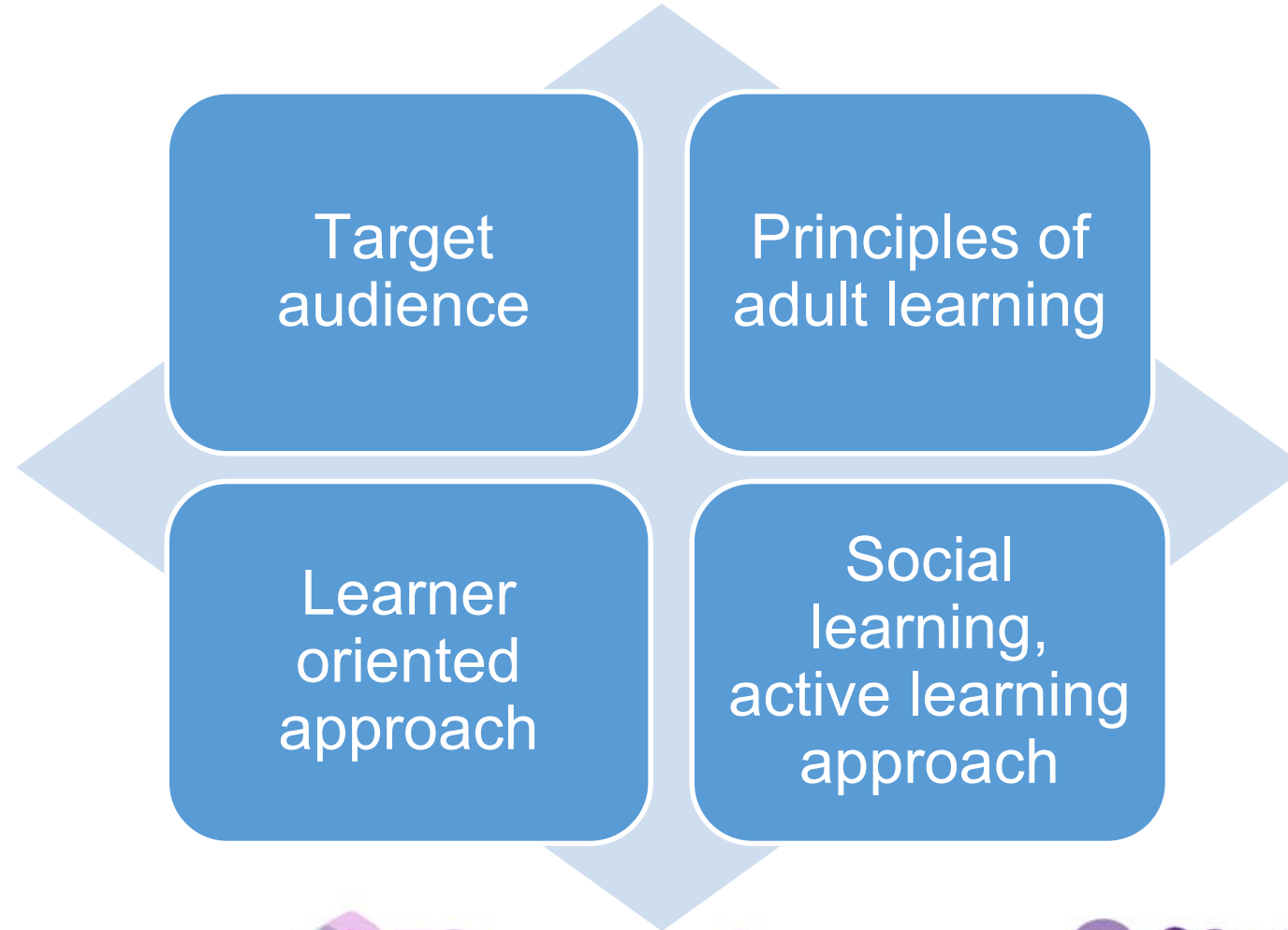
Understand and prepare your target audience

Who are my participants?

What are their expectations of the course? Of me?

What teaching methods are most likely to engage my students?

What is my maximum number of participants?

What are their interests? What are their needs? What are their goals?

How can I respect the diverse abilities and needs of the participants?

Do I need to assess their incoming skills? If so, how?

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Remember adult learning principles

Learning strategies active, self-directed, learner centred

- Since adults are **self-directed**, they should have a say in the content and process of their learning.
- Because adults have so much experience to draw from, their learning should focus on adding to what they have already learned in the past.
- Since adults are looking for practical learning, content should focus on issues related to their work or personal life/career.
- Additionally, learning should be centred on achieving higher cognitive levels beyond memorising content.

Universal Design for Learning (UDL

- Provide multiple means of **engagement** with the subject and learning environment, to support learners' interests. For example, provide varied classroom environments and opportunities to work both collaboratively and alone. Offer learners a choice of ways to learn.
- Provide multiple means of **representation** of learning materials, for example, by offering learning content in different formats so that learners can choose the format that suits them. Same content can be offered in text-based, audio and video formats, or learners could be asked to explore a subject using whatever resources they can find through an online search.
- Provide multiple means of **action and expression** in learning, to provide learners alternatives for demonstrating what they know. For example, by giving learners a choice to write an essay, give a presentation or record a video.

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Training strategies for genomics and bioinformatics

Activity 3

- View handout - *Example course outline and training strategies*

- Go to *Activity 3: Training strategies for genomics and bioinformatics*

- Outline training strategies for your viral genomics training

Designing and developing training materials

- Pre-course preparation (?)
- Itemise resources needed - reagents / equipment / computers / software / internet connectivity
- Course manuals
- Choose relevant datasets
- Pre-recorded lectures. Lecture slides
- Use a repository for developing, sharing and storing training materials

Designing training activities- Focus on the target audience

- establish the general context of your course, eg background knowledge, levels of experience and learning goals of prospective participants
- tailor training materials in Bioinformatics/Lab protocols to match specific audience interests, such as different organisms

Focus on the target audience

Dr Ben Moore
EMBL-EBI
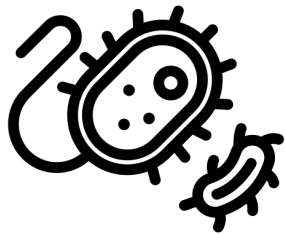
Created by Andre Buand

Created by Eucalyp

Created by KP Arts

https://training.ensembl.org/events/2020/2020-11-04-RoBioinfo

Active learning exercises in a T[rain the] Trainer course

Train the Trainer: Capacity building for genomic surveillance of AMR in low- and middle-income countries

NEW

Train the Trainer: Capacity building for genomic surveillance of AMR in low- and middle-income countries

06 - 11 October 2019

Wellcome Genome Campus, UK

Learn how to train others to use genomic technologies for the surveillance of antimicrobial resistance (AMR)

Active learning exercises - Example 1

Dr Anthony Underwood
Broken String Biosciences

Given a list of available computer components, build a server to satisfy certain computational requirements

Active learning exercises - Example 2

Starting with a list of steps, build a WGS pipeline.

Active learning exercises - Example 3

A course in programmatically accessing data from the ENA.

Imagine you need to teach a group of scientists how to access and use genomic data from Genbank.
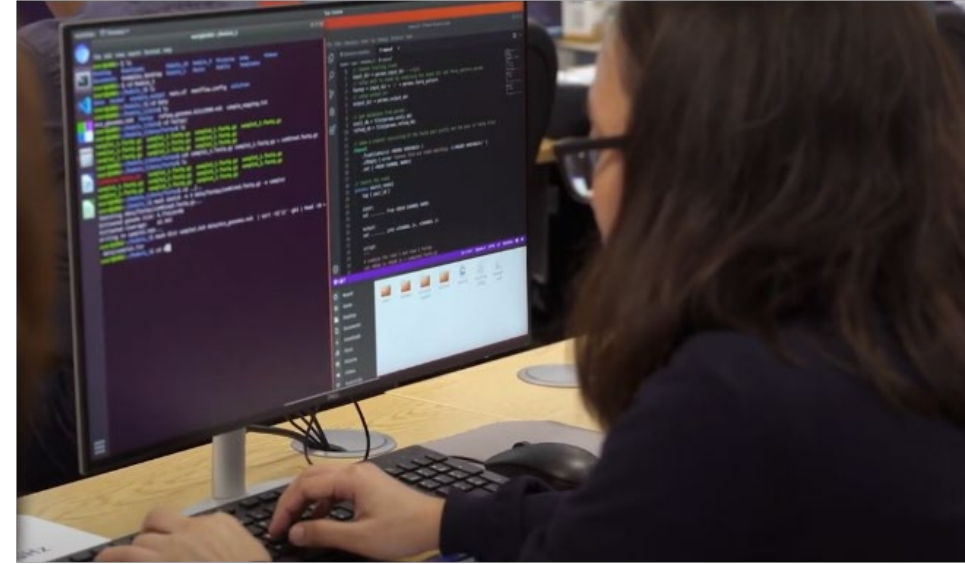
A scenario-based exercise

Mihir Kekre
Eagle Genomics

The learning outcomes addressed by the activity included the following: Learners should be able to

1. To design and deliver activities specific to laboratory work in genomic surveillance of antimicrobial resistance: plating live bacteria, bacteria identification and susceptibility testing.
2. To troubleshoot problems that might arise during NGS sequencing of bacterial genomes.
3. To budget appropriately a project on bacterial genomic sequencing.

A scenario-based exercise

Mihir Kekre
Eagle Genomics

"A scientist is assembling a team tasked with creating a surveillance network to monitor Methicillin-resistant Staphylococcus aureus cases originating from the local hospitals. He needs to establish a baseline for the kind of strains present in the country, as well as the antibiotic resistance patterns displayed. He is running a pilot study using a collection of 4,000 MRSA isolates sampled between 2014 and 2018. The ID and AMR profiles of these isolates have already been determined phenotypically. The aim is to perform whole-genome sequencing (WGS) and use genomic data to determine AMR trends. The budget of the project is $400,000, and the expected timeframe for the pilot study is 24-months. Your task is to submit a project plan detailing how the sequencing will be carried out in the lab, how long it might take to complete and what it will cost him to run this retrospective survey. The objective is to design a LABORATORY ACTION PLAN you wish to carry out in order to be able to sequence the 4,000 isolates of Staphylococcus aureus."

Online courses and resources

- Provide clear information
- Use free web tools
- Include pre-recorded webinars
- Mention date it was published

https://training.bactgen.sanger.ac.uk/#/

Assessment

How do we know if the learners have learnt?

- Assessment for learning

- Assessment of learning

What do you think is the difference?

Assessment for learning
Assessment for learning (formative) – normally qualitative feedback rather than scoring.
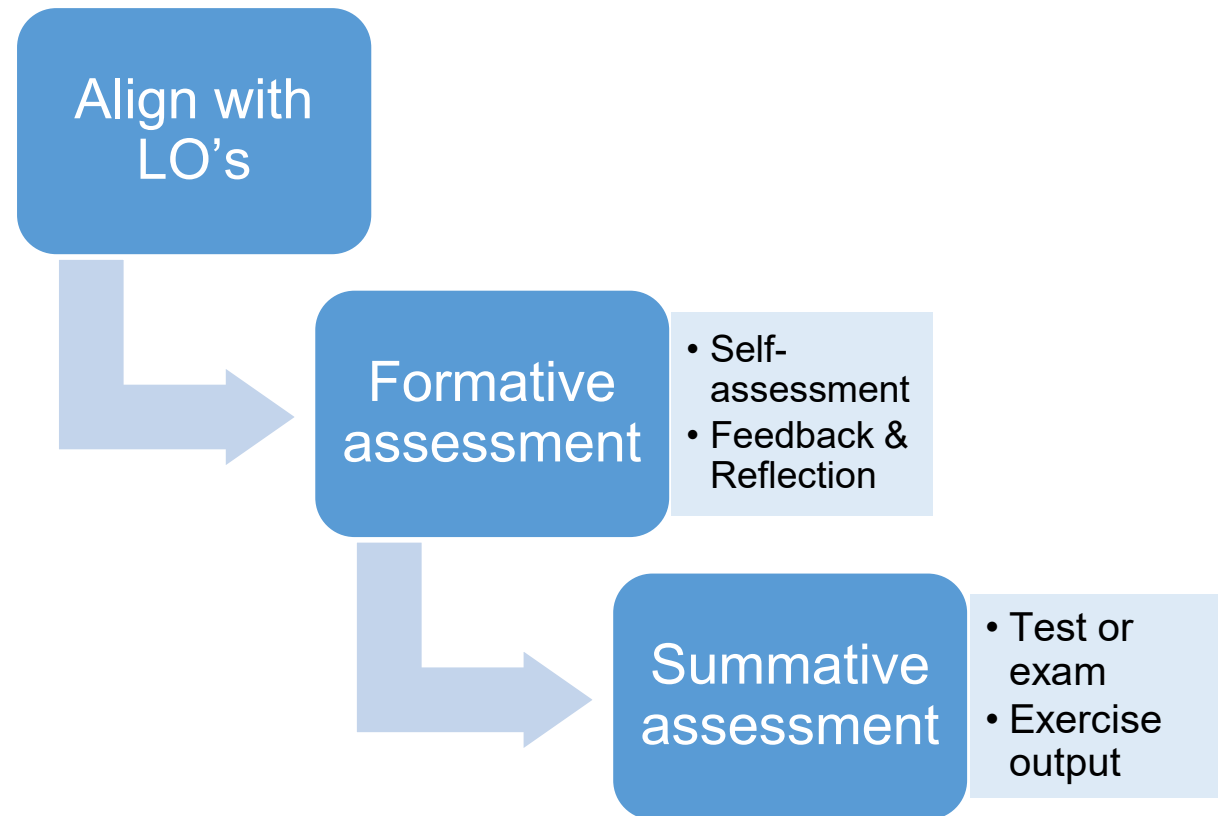Way of assessing learning formally or informally, for the purpose of checking learner's progress as well as effectiveness of the teaching (Bloom)

Assessment of learning
Way of assessing learning has a big impact on learners: students often try to learn what they think they will be assessed.
Assessment of learning (summative) – end of course or distributed throughout the course, normally involves grading.
Often for the purpose of external accountability

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Formative and summative assessment

Align with LO's

Formative assessment
- Self-assessment
- Feedback & Reflection

Summative assessment
- Test or exam
- Exercise output

Assessment methods

- Quiz
- Discussions
- Poll
- Peer review
- Practical exercises with expected output

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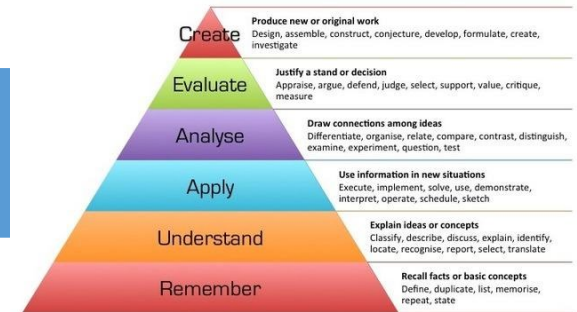
How to use assessment for learning

Activity 4A

- **View handout**
- Go to *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
- 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

Techniques to meaningfully assess learning

Activity 4B

- **View handout**
- Go to *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 Blooms 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?

(Consider some of the listed example assessment techniques)

Curriculum design template

Module Title	Training design
Module Lead(s)	Emma Alice
Length of session	3 hours with breaks
Module objectives/ summary	==what you plan to cover for this module== - *(Also important to show how the course in flowing and integrating with previous sessions and if appropriate later modules/materials – remind participants "before we did this", "now we will do this" which is related to "whatever will be done later")*
Learning outcomes	==Please list 3 - 5 Learning Outcomes here; see examples below==
Layout arrangements	==Anticipate how you would like the session to run (e.g. plenary, groups format, pairs, individuals or combinations)==A
Visual aids, equipment, and other resources	==Specific equipment which will need to be ordered or brought by participants== *(e.g. Blank white sheets of paper, Post-its, Powerpoint projector, Laptop/speakers?, Screen, Laptops? Flipcharts? Pen markers etc…? Indicate how many of e.g. laptops etc…, lab equipment/tubes etc?*
Resources, links, documents	==Any useful links, references or resources or materials which could be linked to this session==
Activities and timings or guidance to facilitating learning activities	==Provide a detailed session plan== *An overview of the session could include, safety briefing and house rules if applicable; quick intro of session objectives and LOs; how this session or module links to other parts of the course; You can include what participants are expected to get out of it – instructions, demonstrations, and level of autonomy, Invitation for questions/reflection.* Introduction to the session (5mins) Activity 1 (10 mins) Short description of the planned activitiy the activity and outline specific instructions if applicable – e.g. present slides or "in pairs" or "as individuals" etc… Activity 2…(20 mins) Activity 3…. Assessment exercises? Discussions? Presentations (5 -10 mins) Questions/reflections/ conclusions/wrap-up (2 mins)
Other materials/notes	

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Contextual issues

- Format - F2F, online delivered or blended

- Short course, module, workshop

- Pre-requisites

- Administrative requirements and organisational policies

- Trainer limitations and solutions

- Infrastructure limitations

- Health and safety requirements

Delivery plan considerations and checklist

- Delivery plan tailored to course format/model

- How to implement planned teaching and learning strategies (individual vs group work, lectures vs active learning, embedded formative assessment

- Include a session plan or structure for delivery

- Pre-course materials

- Manuals, computational protocols

- Training team to participants ratio

- Infrastructure and platforms for delivery

Training and Facilitation
Module 4

Making materials findable and accessible

FAIR principles for bioinformatics training: Sharing is caring:

For yourself - Provides a record (and recognition) of the training that you have developed

Other trainers - Provides inspiration, in terms of the content covered and method of delivery

Trainees - A navigable landscape in which to find relevant training resources and build personalized learning paths

Bioinformatics community - Facilitates systematic training-gap analyses and development of additional materials and courses.

Source: **Ten simple rules for making training materials FAIR**
Garcia L, Batut B, Burke ML, Kuzak M, Psomopoulos F, et al. (2020) Ten simple rules for making training materials FAIR. PLOS Computational Biology 16(5): e1007854.https://doi.org/10.1371/journal.pcbi.1007854

How to share online
Personal or institutional Web servers; cloud-based collaboration tools (e.g., Google Drive and Dropbox); cross-domain repositories (e.g., figshare, GitHub, and YouTube; or specialized data repositories

Activity Training summary and outline

Activity 5

- **View handout**
- Go to *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 targe 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 thr format of the course?

Who will deliver the training?

How long will course run?

What are the pre-requisites?

T3Connect Toolkit and upcoming sessions/modules

[#2 How to design and deliver pathogen genomics training: T3connect design toolkit (wellcomeconnectingscience.org)](#)

Acknowledgements

This module contains materials from the following sources:

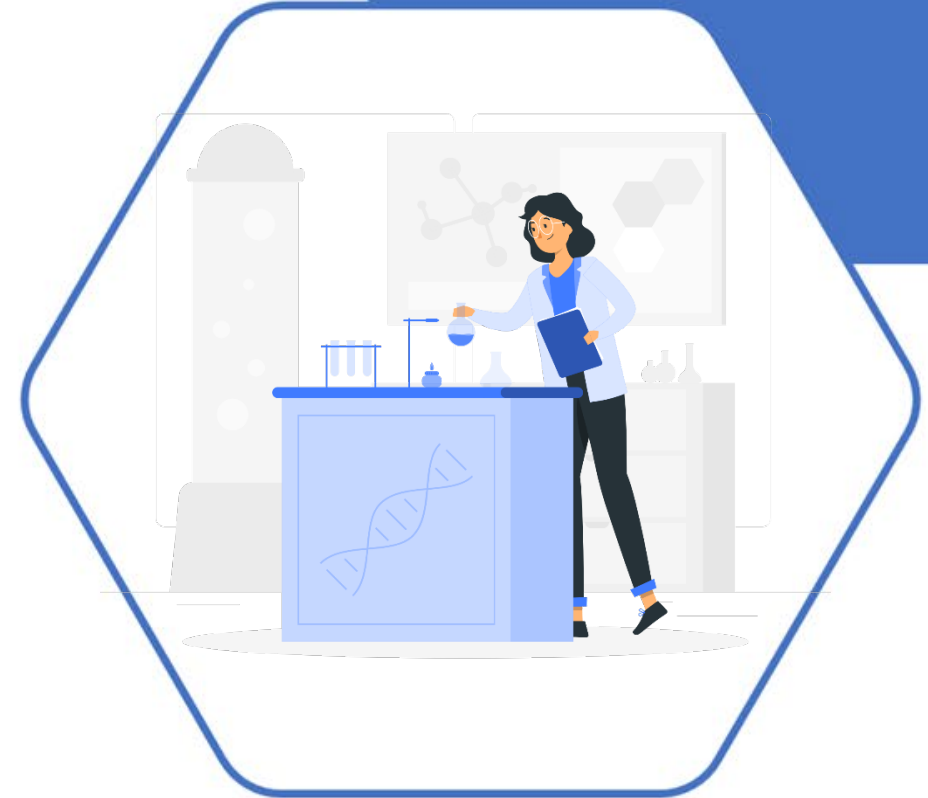- Storyset | Customize, animate and download illustration for free

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Thank you

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