Delivering a training course 101

Data fellowship program

PATH

Delivering a training course

One of the key objectives of the data fellowship program is to enable fellows to deliver data and analytics training courses to national malaria program staff.

Over the course of this module, you will learn how to **prepare for** and **deliver** a training course through the following methods:

- Review standards and guidance for PATH training courses
- Use a checklist for training planning, preparation, expectations, and outcomes
- Learn best practices for delivering and facilitating training courses
- Review an example of a previous training delivered at PATH

Review standards and guidance for PATH training courses

- Determine who your **audience** should be. This should impact your answer to many of the other considerations noted in this guidance as well as the tone and complexity of the training.
- Think through what the participants are **expected to learn**. What is their current technical knowledge or expertise? Make sure to tailor the training to their experience – for example, some may need policy-level insights from their data, while others may need more fine-grained implementation targeting or strategy training.
- Consider why your participants should be **excited** for the training. Think through who the audience is and ensure that the material is relevant and useful to their work.
- Set **clear learning objectives** for what participants will be able to accomplish. Use **SMART objectives** (Specific, Measurable, Achievable, Relevant, Time-bound) throughout your training wherever possible.
- Consider the **starting point** of the audience to determine how much background should be included. Over-explaining will waste time and sap excitement, while under-explaining will make it hard for trainees to advance through your materials successfully.
- Consider what **systems** are being used throughout the training (R, QGIS, etc.) and what participants will need to **download or register for in advance** to ensure timely delivery of training.
- Take time to consider the **logistics** of the training: Will you use powerpoint slides, remote presentations, or group examples to deliver the training? Will you have strong internet access? Do you have a backup plan if internet is not available (i.e. copies of all materials)? Do you have enough support to help with the technical components of the training if there are a lot of participants?
- Consider where you are **storing** and **sharing** your materials while preparing for the training course – **online versions** typically allow for easier version control and management.

Review standards and guidance for PATH training courses cont.

- To ensure that the training is engaging and participatory, cater your **training** and **delivery design methods** to your audience.
    - **Incorporate** adult learning principles. Engage trainees with interactive and problem-solving approaches.
    - **Leverage blended learning**. Use a combination of delivery methods such as in-person, virtual, or self-paced
    - **Utilize interactive techniques**, such as:
        - Case studies & real-world scenarios
        - Group discussions & role-playing
        - Hands-on exercises (e.g. data interpretations, field simulation)
- Make sure that your training considers **cultural** and **contextual relevance**
    - Use localized case studies to make examples more relevant
    - Carefully consider language barriers and translation needs
    - Be aware of sociopolitical and economic factors affecting implementation

Develop a checklist

Before you develop your training, create a checklist to ensure that you have thought through the key components of the training material as well as your own preparation needs and how you are going to track your progress.

Organize the process

- ☑ Create a folder to store all your work
- ☑ Develop of a timeline or schedule of when you need to prepare materials, share materials, receive feedback, confirm travel plans, and have final materials ready

Conduct a needs assessment

- ☑ Identify the skills gaps and training needs of the target audience
- ☑ Determine the specific technical topics and skills to be covered
- ☑ Engage any stakeholders and subject matter experts in the planning process and develop a communication plan for the duration of the training

Define objectives

- ☑ Develop your SMART goals for the training and determine what participants should be able to do after completing the training

Develop a checklist cont.

Develop the training content

- ☑ Build out training content – more details on slide 8

Lock down logistics

- ☑ Create an agenda for the meeting and confirm/share with the NMP/MoH prior to the meeting to incorporate contextual information
- ☑ Choose appropriate training venue, location, and timing for the training
- ☑ Arrange any technology or physical training materials as needed – name tags are great to have.
- ☑ Communicate training details (date, time, location, agenda) to all participants
- ☑ Send out calendar invites in a timely manner
- ☑ Prepare and share any pre-training materials or assignments if required before training takes place
- ☑ Prepare a sign in sheet (either on the computer or printed) and ensure participants sign in each day
- ☑ Address any accessibility needs or special accommodations for your participants
- ☑ Establish back-up plans for the training or for unforeseen circumstances (i.e. print materials in case of poor internet connections, remote call-in options, training materials on USB drives etc.)
- ☑ If possible, complete a check of the room prior to the start of the workshop to make sure that technology is working and that the room is set up appropriately
- ☑ Prepare certificates for participants who complete the workshop if applicable in the local context. Make sure to print in advance and that it fits the context of the training (i.e. the country and NMP program)
- ☑ Don’t forget to take photos! Participants appreciate them, and they are great for project communications and follow-ups

Develop a checklist cont.

Post training follow ups and considerations

- ☑ Shortly after the training, send a thank you email to all participants with the training materials, follow ups, and photos
- ☑ Consider developing a survey and sharing it with participants after the training to learn from trainees' experiences and see how you can improve your next training
- ☑ Share an update with your key stakeholders or project team with any photos and next steps from the training

Develop the training content

To ensure the workshop is efficient, successful, and valuable, allocate ample time to thoughtfully developing the training content. Collaborate with your mentor throughout the process, allowing sufficient time for feedback. Take advantage of existing resources developed by MACEPA to streamline your efforts and promote sustainability for future trainings. Additionally, consider incorporating the following elements into your preparation plan:

- Build out a **training content outline** so that you have a sense of all the materials that you need to prepare and how long it may take to develop
- Ensure you have a good **file, folder, and code structure** set up for maximum flexibility and sustainability.
- Define **scope** and **key guiding principles** (i.e. what packages to use, what style of coding - base or tidyverse)
- Determine what **datasets** you're going to use and the overall **structure** from your needs assessment (i.e. progressing from installation, to foundational dplyr basics, to more detailed sessions) and what will get covered in each timeslot
- Ensure **consistency** across the training – list all functions needed over the course of the training
- Review **examples** and **materials** from previous trainings to ensure that the duration is appropriate
- Prepare to provide **live demos** during the training, these are almost always the most effective way to teach R
- Ask for any **technical reviews** of the training from your mentor and **adjust** where needed
- **Proofread** all content and materials (nobody likes discovering a typo when presenting to 30 people)

Best practices for delivering and facilitating trainings

In addition to the guidelines for PATH trainings, here are a few additional best practices when delivering training courses.

- **Consider icebreakers.** Consider starting the training with an easy icebreaker to foster some initial discussion between participants prior to jumping into technical training materials.
- **Review expectations.** Make sure participants have a reminder of what they are expected to get out of the training.
- **Be engaging and dynamic**. Deliver the training in a way that would interest you if you were taking it. Get excited, make connections.
- **Encourage participation**. Foster a safe and interactive environment for participants to ask questions and share their experiences.
- **Manage the flow**. Make sure you or someone you assign is keeping track of time and making sure that you stay on track.
- **Provide clear and concise information**. Ensure that the information is presented clearly and concisely, using language that is easy to understand.
- **Summarize key points.** Take time throughout the training to summarize key points to keep participants on the same page and reiterate information.
- **Regular breaks**. Include regular breaks to maintain energy and focus.
- **Be flexible and adaptable**. Be prepared to adjust the training based on participant feedback and needs.

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Nigeria R workshop - Background

In March 2024, Hayley Thompson, William Sheahan, and Hannah Slater led a 5-day R workshop with the NMEP in Nigeria.

The objective of the workshop was to introduce participants to the fundamentals of R programming and its applications in data analysis and visualization, with a focus on malaria epidemiology.

On the next few slides, you will see a few examples of the training resources that were developed, as well as the agenda that was used and some key reflections from running the workshop.

Nigeria R workshop - Agenda

- Below is the agenda that was created for the 4-day workshop, with an additional half-day of optional support for workshop attendees.
- Always share the agenda with the NMP/MOH for input and approval prior to the workshop to allow for relevant, contextual information to be added
- Keep in mind that any schedule you create should be flexible. Trainees may progress at different speeds through the materials, and some may join late or leave early. It is helpful to have at least two instructors to maintain flexibility with hands-on support.
- Note that lunch and tea-breaks are standard operating practices for workshops, as they are key for maintaining focus while also building camaraderie and relationships with trainees.

Monday March 25th 2024	8:30am – 9:00am	Welcome and registration	PATH/ NMEP
	9:30am – 10:30am	Introduction to R and R studio	PATH
	10:30am – 10:45am	Tea break	
	10:45am – 12:30pm	Introduction to R and R studio	PATH
	12:30pm – 1:30pm	Lunch	
	1:30pm – 3:00pm	Introduction to R and R studio	PATH
	3:00pm	Day end	
	3:00pm – 5:00pm	Open session for additional support	PATH
Tuesday March 26th 2024	9:00am – 10:30am	Data manipulation with *dplyr* and *tidyr*	PATH
	10:30am – 10:45am	Tea break	
	10:45am – 12:30pm	Data manipulation with *dplyr* and *tidyr*	PATH
	12:30pm – 1:30pm	Lunch	
	1:30pm – 3:00pm	Data manipulation with *dplyr* and *tidyr*	PATH
	3:00pm	Day end	
	3:00pm – 5:00pm	Open session for additional support	PATH
Wednesday March 27th 2024	9:00am – 10:30am	Data visualization with ggplot	PATH
	10:30am	Photo!	
	10:30am – 10:45am	Tea break	
	10:45am – 12:30pm	Data visualization with ggplot	PATH
	12:30pm – 1:30pm	Lunch	
	1:30pm – 3:00pm	Data visualization with ggplot	PATH
	3:00pm	Day end	
	3:00pm – 5:00pm	Open session for additional support	PATH
Thursday March 28th 2024	9:00am – 10:30am	Analysis pipeline	PATH
	10:30am – 10:45am	Tea break	
	10:45am – 12:30pm	Analysis pipeline	PATH
	12:30pm – 1:30pm	Lunch	
	1:30pm – 3:00pm	Analysis pipeline	PATH
	3:00pm	Closing Ceremony	PATH/ NMEP
	3:00pm – 5:00pm	Open session for additional support	PATH
Friday March 29th 2024	8:30am – 11:30am	Optional additional support morning	PATH

Nigeria R Workshop - Materials

- The team created materials to guide workshop attendees through the installation and basic processes of R and R Studio before moving onto more advanced data manipulation techniques.
- All materials were developed and tested in R markdown/Quarto before being shared as **printed** and **digital** PDF files.

Topic 1: Introduction to R and Rstudio and basic functions

Hannah Slater, Hayley Thompson, Justin Millar, William Sheahan

2024-03-21

1) Introduction to RStudio

R is a statistical and graphical software package, and is the very commonly used in many disciplines, including data science, statistics and the environmental and biological sciences. The great strengths of R for the research community are:

- It is free, which means anyone can use it.
- It is open source, which means you can inspect and modify the code within in.
- It is a community, so researchers around the world have developed code for particular applications that they have made freely available. These are published as 'packages' which can be downloaded with just a couple of lines of code.
- Because of all the community-developed code, there are functions available in R for pretty much every data analysis, statistical method or model, graphic or chart you could ever need. Once you understand how to use R, you will be able to access these.
- There is an incredible amount of help to be found online for most problems (often on StackOverflow and Twitter #rstats).

By the end of this session we will have covered

1. Opening up Rstudio
2. Setting up a project in Rstudio
3. Exploring R, finding help, debugging and writing comments
4. Different data types
5. How to calculate basic operations on vectors
6. How to use dataframes
7. What packages are and how to install and use them
8. How to read in external data sources

Hopefully you have followed the tutorial we shared and have RStudio downloaded and installed on your computer
If you open up Rstudio, you will have 3 panels that look like this

Topic 2: Data manipulation with *tidyverse*

Hannah Slater, Justin Millar, Will Sheahan, Hayley Thompson

March 2024

The power of packages

One of the great things about using R are the thousands of available packages, which provide additional functions for many analytical tasks, such as data cleaning, statistical modelling, mapping, and much more. R packages are open-source, which means that they are free to use and maintained by the R community.

Installing and loading packages

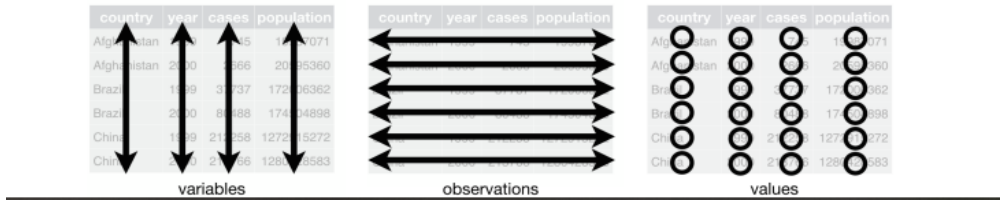
Throughout the rest of the workshop we will use a set of R packages for manipulating data and creating plots and maps. As we covered in the Day 1 lesson, we first need to install the package on our computer using the `install.packages()` function. This only needs to be done one time (you probably already did this earlier).

```
install.packages("tidyverse")
```

Once the package has been installed, we can load it into our current R session using the `library()` function. Unlike installing, you will need to load the library each time you want to use it. This is because some libraries may have functions with the same names as other libraries or as our variables.

```
library(tidyverse)
```

For the next series of exercises, we will be using a group of packages which have been designed to work together to do common data science tasks. This group of packages is called the "Tidyverse", because it is designed to work within the "tidy" data philosophy:



Nigeria R Workshop - Materials

- The second half of the week focused on the desired outcomes of the workshop such as data visualization and mapping.
- These are often the most exciting and sought-after techniques, but they are difficult to use without the thorough grounding in the basics that was delivered in the first section of the training.

Topic 3: Data visualization in R with ggplot2

Hannah Slater, Justin Millar, Will Sheahan and Hayley Thompson

March 2024

Plotting with `ggplot2`

The focus of today's session will be on data visualizations. There are many different approaches for making plots and other visuals in R. In addition to the base plotting functions that are directly built into R, there are hundreds of freely available packages for making just about any kind of chart or plot possible.

The package we will be focusing on today is called `ggplot2`, and is included in the `tidyverse` umbrella package.

For more information on ggplot here are some useful resources:

- ggplot2 Official Documentation: The official documentation provides a comprehensive guide to ggplot2 syntax, usage, and examples. It's a great place to start for beginners.
- R for data science: This online book by Hadley Wickham and Garrett Grolemund is an excellent resource for learning data science with R. Chapter 3 specifically covers ggplot2, and it's explained in a beginner-friendly manner.
- R Graphics Cookbook: This cookbook-style resource provides practical 'recipes' for creating various types of plots using ggplot2. It's a useful reference for learners at all levels.
- The R Graph Gallery: A collection of data visualisations made with ggplot - a good source of inspiration with code to recreate each plot.
- Data Visualisation with ggplot2 Cheatsheet: This cheatsheet provides a concise overview of ggplot2 syntax, including various geoms, aesthetics, and other essential functions in a handy PDF. You can also find this by clicking: `help > cheatsheets > Data Visualisation with ggplot2` in the Rstudio taskbar. I'd advise opening this up for today's session!

First let's load the `tidyverse` package, as well as the dataset containing monthly records from DHIS2.

```
library(tidyverse)
case_data <- read_csv("data/lga_monthly_data_long.csv")
```

Topic 4: Plotting and maps in R with ggplot2 and sf

Hannah Slater, Justin Millar and Hayley Thompson

March 2024

Making maps is `sf` and `ggplot`

The focus of Session 3 was using `ggplot` to make data visualisations (line charts, bar graphs etc). Another common data visualization task that can be done in R is making maps. There are many, many packages and tools for working geospatial data in R, enough to fill an entire five-day workshop series! In this section, we will cover making state- and LGA-level maps. Resources for making additional type of maps, such as point-level and raster data, will be included at the end.

The package we will use for working with spatial data is call `sf`, which stands for "simple features". If you're working on a Windows computer, you will have to install an additional program call RTools. We can check to make sure RTools has been properly installed using the `devtools` package.

```
devtools::find_rtools()
```

```
## [1] TRUE
```

If this returns FALSE then install RTools before proceeding:

1. Go to http://cran.r-project.org/bin/windows/Rtools/, and download the RTools installer.
2. Select the .exe download link from the table that corresponds to your version of R
    1. Note: If you're not sure what version of R you have, open or restart R and it's the first thing that comes up in the console. e.g. R 4.2.1 / R.3.1 etc
3. If you have the most recent version of R, you should select the most recent Rtools download (at the top of the chart).
4. Once the download completes, open the .exe file to begin the installation
5. After downloading has completed run the installer. Select the default options everywhere

If you have any issues installing Rtools - reach out to one of the facilitators!

Nigeria R workshop - Reflections

- Attendee engagement and excitement affects the training atmosphere. Make sure to focus on **measurable problem-solving** while allowing participants **to learn at their own pace**.
- **Multiple instructors** to provide hands-on support and **circling the room** to check in with participants who may be hesitant to ask for help is key to ensuring attendees have clear understanding of the training.
- Lecture-style coding trainings are ineffective. Trainees need to **see**, **break**, and **fix** code to learn. Remind trainees frequently that getting things wrong is an important part of learning how to code. Use slides to **highlight key objectives learned** each day and share **real-world examples** to provide context.
- Begin trainings with a '**best practices in coding**' demo at the start of the training course to reinforce good folder structure and code organization throughout the training.
- There are almost always 1-2 people at a workshop who already know R and will move through your materials faster than expected. **Encourage those people to help their neighbors in the room!**

Picture 1. Workshop participants working on data and analytics materials.

Picture 2. Hayley working with a workshop participant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