

New technological trends in distance learning of data analysis courses

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Abstract

Nowadays data analysis of any kind becomes a piece of art. The same happens with the teaching processes of statistics, econometrics and related courses. This is not only because we are facing (and are forced to) teach online or in a hybrid mode. Students expect to see not only the theoretical part of the study and solve some practical examples together with the instructor. They are waiting to see a variety of tools, tutorials, interactive laboratory instructions, books, exams online. In this study I am going to show the latest technical solutions for instructors using R and/or Python in their online data analysis labs.

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R Studio

Teaching data science courses is much easier with an integrated development environment for R* and Python, with a console, syntax-highlighting editor that supports direct code execution, and tools for plotting, history, debugging and workspace management.

*Of course we should install R first.

Official R-Studio website: <https://www.rstudio.com/products/rstudio/>

 R Studio Desktop

 R Studio Server



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R Studio Connect

Working in the data science labs is more convenient with tools like R Studio **Connect** (we can publish and share data products like Shiny applications, R Markdown reports, Jupyter Notebooks, and more!)

Official R-Studio Connect website: <https://www.rstudio.com/products/connect/>



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R-Markdown reports

Thanks to R-**Markdown** documents we can organize our class in a different way. First analyze, teach, then you or you and your students can share notebooks/reports/exercises and their solutions/presentations online.

With just one button – directly from R Studio whenever the document is ready – students can publish their reports online on R Pubs accounts (free) and then share the link with the teacher.

R Markdown supports dozens of static and dynamic output formats including HTML, PDF, MS Word, Beamer, HTML5 slides, Tufte-style handouts, books, dashboards, shiny applications, scientific articles, websites, and more.

See R-Markdown quick tour: https://rmarkdown.rstudio.com/authoring_quick_tour.html

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R-Bookdown e-books and websites

With additional **Bookdown** R package we can organize our classes in a different way – publishing e-books online in R-Markdown format.

It is free for you to publish the static output files of your book, and you hold the full copyright of your own books on bookdown.org website.

Additionally, we can include interactive tutorials and dynamic content inside bookdown e-books.

See examples here: <https://bookdown.org/home/archive/>

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R-Exams

R-Exams package is a smart system for teachers that supports a one-for-all approach to automatic exams generation.

Teacher can create a static or dynamic exercise templates to perform large numbers of personalized exams/quizzes/tests.

Exams can be created for various systems: PDFs for classical written exams (with automatic evaluation), import formats for learning management systems (like Moodle, Canvas, OpenOLAT, or Blackboard).

See R-Exams examples and templates here: <http://www.r-exams.org/templates/>



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Interactive tutorials

With **learnr** and **webexercises** packages we can easily turn any R Markdown document into an interactive tutorial. Tutorials consist of content along with interactive components for checking and reinforcing understanding. Additional **gradethis** package may help teachers use a model solution as a template or write highly customized testing logic to provide specific feedback for common mistakes.

Tutorials can include any or all of the following:

1. Narrative, figures, illustrations, and equations.
2. Code exercises (R code chunks that users can edit and execute directly) with or w/o hints and solutions.
3. Quiz questions.
4. Videos (currently supported services include YouTube and Vimeo).
5. Interactive Shiny components.

See my own example here: <http://46.41.143.13:3939/connect/#/apps/26>

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Finally – course & course management

Finally, we can wrap our content into an online course!

If our university has its own learning management system like **Moodle**, **Canvas** or **OpenOLAT** you can include and even nest your reports, tutorials, ebooks and exams inside it.

Please note, that it can be used in a blended learning or traditional learning form as well!

Otherwise, we can freely create and manage our own course and batch of students using i. e. **GitHub** Classroom systems or other platform like DataCamp (free after register) or just use GitHub to exchange reports and treat it as repository.

There is one more solution – **ghclass** package. This package is designed to enable instructors to efficiently manage their courses on GitHub. It has a wide range of functionality for managing organizations, teams, repositories, and users on GitHub and helps automate most of the tedious and repetitive tasks around creating and distributing assignments.

More about GitHub Classroom here: <https://classroom.github.com/>
ghclass website and quick tour: <https://rundel.github.io/ghclass/articles/articles/ghclass.html>

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