

# Lesson 04 — Teaching Notes

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## Conditional Statements, Loops, and Functions in GNU Octave

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**Course:** GNU Octave with GX-TXT

**Lesson:** 04 of 16

**Framework reference:** GX-TXT 0.9.8.10-dev-111, patch P019

**GitHub branch:** maintenance/dev111

**Verified commit:** 3f516f5b726183ea8f53041888bd67438ee050ee

**Source verification date:** 2026-10-25

**Status:** Script draft created; GX-TXT runtime acceptance pending.

### 1. Lesson purpose

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This lesson introduces program control flow and reusable functions through a physically meaningful experiment: the cooling of a warm body in a constant-temperature environment. Students will move from one arithmetic statement to an iterative numerical simulation, validate its results, and prepare them for publication as canonical GX-TXT Datasets.

### 2. Prerequisites

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- Basic GNU Octave expressions, variables, scalars, vectors, and indexing (Lessons 01–03).
- Elementary temperature conversion between degrees Celsius and kelvin.
- Understanding that a GX-TXT Session contains canonical Datasets with stable identities and scientific metadata.

### 3. GNU Octave concepts

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- `if`, `elseif`, and `else`: evaluate decisions and classify simulation states.
- `for`: run a fixed number of time steps and fill preallocated result vectors.
- `while`: repeat until a defined temperature tolerance is reached.
- `break` and `continue`: understand controlled loop exits and iteration skipping; use only when they improve clarity.
- `function`, input parameters, return values, and local scope: isolate the cooling step, the analytical reference, and status classification.
- Input checks: reject invalid step size, rate constant, time interval, and non-finite data.

### 4. Scientific model

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Newton's law of cooling, with a constant ambient temperature, is

$$dT/dt = -k * (T - T_{\text{ambient}}).$$

The explicit Euler update is

$$T_{\text{next}} = T_{\text{current}} - k * dt * (T_{\text{current}} - T_{\text{ambient}}).$$

The analytical reference is

$$T_{\text{exact}}(t) = T_{\text{ambient}} + (T_{\text{initial}} - T_{\text{ambient}}) * \exp(-k * t).$$

The simulation uses minutes, `k` in `1/min`, and absolute temperature in kelvin for published scientific data. Temperatures may also be displayed in degrees Celsius for instructional clarity. The analytical model assumes a uniform body temperature, constant ambient conditions, and constant `k`; it is not a general heat-transfer solver.

## 5. Proposed teaching sequence

1. Explain the model, parameters, units, and the difference between continuous and discrete time.
2. Implement one Euler step and test it using scalar values.
3. Build a `for` loop that records a complete time/temperature series.
4. Add conditional validation and classify the difference from ambient temperature.
5. Implement a `while` loop that stops when a user-defined tolerance is met, with a maximum-iteration safeguard.
6. Refactor repeated logic into documented Octave functions, then compare with the analytical solution.
7. Introduce GX-TXT Script Bridge discovery, canonical Dataset publication, and Plot Dataset only after verifying runtime descriptors and call arguments.
8. Discuss numerical discretization error and the role of step size.

## 6. GX-TXT public API teaching plan

The following interfaces are documented on the pinned GitHub commit. Their **runtime availability and exact operation arguments must still be checked in the active GX-TXT Session** before final runtime acceptance:

| Public interface                                         | Educational purpose                                                                                             |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| <code>gtxtt_context()</code>                             | Obtain the registered script execution context without inspecting private Session paths.                        |
| <code>gtxtt_api_require(...)</code>                      | Declare and enforce required public API capabilities.                                                           |
| <code>gtxtt_api_has_operation(...)</code>                | Check whether a named operation is exposed to the Octave Script Bridge.                                         |
| <code>gtxtt_api_describe(...)</code>                     | Inspect provider-owned argument and result contracts before invocation.                                         |
| <code>gtxtt_api_call(...)</code>                         | Invoke a registered public API operation; it does not access private CORE functions.                            |
| <code>DATASET_PUBLICATION_API_v2 / publish_series</code> | Publish time and temperature as canonical X/Y series, with IDs, units, and provenance.                          |
| <code>PLOT_DATASET_API_v4</code>                         | Build or update a scientific plot from published canonical Dataset identities, not from private renderer files. |

GNU Octave language primitives ( `if`, loops, functions, `exp` ) are language features, not GX-TXT API calls. Plot API v4 is the modern target; deprecated plotting interfaces are excluded from the new example. No direct edits to Dataset Registry files, Session storage, or CORE internals are permitted.

## 7. Intended article structure

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Start with the scientific question, introduce each Octave language construct in the order it is required, explain the difference between fixed-step and stop-condition loops, and present the results with scientific units. Provide a dedicated “GX-TXT API explained” section for every public API actually invoked. The final WordPress article will cite the precise commit above and include execution evidence, not just source-level expectations.

## 8. Verification status and source references

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Source-level documentation and the script-callable coverage catalog were inspected on GitHub. **The Lesson 04 script has been drafted, but it has not yet been executed in GX-TXT.** No claim is made that Dataset publication or Plot rendering has passed a live Session test.

- [Octave Script Bridge API v1](#)
- [Dataset Publication API v2](#)
- [Plot Dataset API v4](#)
- [Script Bridge operation coverage](#)

## 9. Publication checklist (to complete when preparing WordPress)

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- Link the two downloadable Markdown files directly in the English and Italian articles:
  - `Lesson_04_Teaching_Notes_DEV111_P019.md`
  - `Lesson_04_Experiment_Objectives_DEV111_P019.md`
- Confirm the WordPress media attachment URLs after uploading them; do not construct links from filesystem names.
- Include tested script download: `GXTXT-Octave_L04_DEV111_P019.m`.
- Lesson 04 screenshot source directory on the author's workstation:  
`H:\GUIDA\CORSI GXTXT\CORSI SCRIPTING\OCTAVE\CORSO BASE\Lezione04\screenshot`
- Capture the script workspace, Session Dataset list, final Console results, and Plot Dataset v4 graph after a successful live test.
- Indicate the exact GitHub commit and label the live GX-TXT test status explicitly.