Workshop

Calculate like our ancestors...

Design and construct a slide rule, based on logarithms, to determine one's own weight or the weight of any object on the surface of the planets and main satellites of the solar system and on the potentially habitable extrasolar planet Kepler-22b

The laboratory activity is an introduction to analog computing, completely different, conceptually and for execution methods, from the prevailing digital calculation.

After a few theoretical remarks and a very brief description of the methods of graphic calculation and nomography (the purest form of analog computing, which takes place on the surface of a graphic, even without moving parts), it is taught to make a circular logarithmic slide rule for numerical calculations.

In addition, it is pointed out that a calculator rule can be designed to solve any problem involving multiplications and divisions (as well as other calculations, which are not dealt with in this project).

The participants, each of whom is provided with the necessary materials (mostly paper/cardboard), are guided step-by-step in the design and construction of the instrument.

Among the multitude of possible problems to be faced, one seems suitable for our purpose: the calculation of one's own weight or the weight of an object on the surface of various celestial bodies. In practice, a slide rule is made to solve the problem as a function of the weight of the object on Earth and the acceleration of gravity on the celestial body considered. A "light" and fun theme, suitable for this type of teaching activity, reminding that the typical problems for which slide rules were designed were, for example, the forces exerted by a fluid in pipelines as a function of a series of parameters or the dimensioning of double-T beams in the construction of industrial halls.

The participants, after having understood the simple solving algorithm and realized the instrument for the technical aspects, are invited to design the graphic part according to their personal taste, to be perfected then with comfort, at home.

The final object is a circular slide rule made up of two discs of different diameter, perforated centrally and joined with a screw or rivet.

Finally, participants are invited and guided to identify new problems to solve with a slide rule and find the way of designing the instrument in order to solve those problems; these activities are discussed briefly but will be carried out at home or in school.
For this purpose, the participants are given pre-photocopied cards, showing the basic scales to be used as a template to create the new instruments, which will be completed with appropriate inscriptions and graphics.

Participants are also given a pack of two pre-photocopied template cards to make a slide rule for the resolution of rectangular triangles, two angle measuring instruments and the instructions needed for executing simple topography experiments. An activity only presented in the laboratory, to be carried out at home or at school.

These activities, implicitly or explicitly, allow to explore various interesting concepts and to apply them in the production of a finished product made with the participants' own hands.

In particular:

- Understanding the difference between analog and digital.
- Understanding the features of logarithmic calculation empirically (with quite few theoretical hints).
- Application of a general technique to solve a specific problem.
- Be able to return home or to school with an intriguing object of which one knows the whole production process - from concept to final graphic embellishment - to be shown to relatives and friends.
- Mastery, albeit embryonic, of a specific technique applicable to a wide range of different cases.
- Example of re-use of obsolete technology for purposes other than the original (more examples are shown).
- Approach to "soft technology", which is feasible in all places and times with simple materials available everywhere, provided that one possesses the necessary knowledge.

Participants are shown, for the purpose of general knowledge, some interesting slide rules from the past (real objects or images).

Curious stories are also told in which slide rules have played a role that was worth the life, as the famous flight of Sir Francis Chichester from New Zealand to Australia with a small seaplane.

Age of participants: 12 – 18 (+ interested adults)

Materials:

- A4 cards of 200 g/m2 pre-photocopied with basic scales;

- screws or rivets;

- pens, coloring materials, scissors, punch-cutter.