

## Session 3A: DEVELOPMENTS IN SCHOOLS

### *3A01 – The Daily Life of a Researcher Introduced with an Online Data Analysis Experience Based on Visual Programming*

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#### Introduction and Theory

A common criticism for the Italian higher education system is the gap that separates it from the employment landscape [1]. To improve this situation, our department and schools are sponsoring internships, to expose the students to the work life. Groups of two high school students are invited to work with researchers for a week. A tutor introduces them to the research theme and proposes related activities. In order not to require previous experience with programming languages, the visual programming language Blockly is used as the development toolkit [2], for its suitability for educational activities. We developed new functionalities for Blockly purposely for the project: online reading data from a real detection system, interactive analysis, and online data visualization.

#### Concept and Implementation

The proposed program follows the daily activities of a researcher: problem understanding, setup, data acquisition, analysis, understanding of the underlying Physics and presentation of the results. At first, the prerequisite learning of histograms is recalled. A practical activity (e.g. throwing two dice) is employed to ease the comprehension of the operative construction of a histogram. The Physics of radioactivity and nuclear detectors are then introduced, and the histogram is contextualized to its application as an energy spectrum. A real detection system is used to measure the natural gamma ray radiation background. The students are asked first to discuss between themselves on how to develop an histogram calculator, then they actually implement an analysis program to produce the gamma rays spectrum. An introduction to the methodologies of spectra analysis follows. Then they are asked to determine the natural occurring radioactive sources detected in the spectrum. The results are presented by themselves, to the assembly of all the tutors and students in an oral presentation.

#### Objectives and Assessment

The goals are multiple: we want to expose the students to the daily life of a researcher, by following all the steps required to perform an experiment and finally present it to peers; we can apply the research methodology to study a modern Physics subject; the request of writing the analysis software develops the computational thinking. The activity was successfully experienced by two students, hosted in our group. The actual implementation of the analysis algorithm was quickly achieved, even with no prior experience with data analysis. We bypassed the difficulties related to the syntax of programming languages, by employing Blockly and our added features; this allowed us to focus on the fundamental concepts. The students enjoyed the whole experience and were very proactive asking relevant questions and proposing ideas. We are presently proposing to secondary school teachers to repeat this activity in a classroom environment.

#### References

[1] La buona scuola, Legge 13 luglio 2015, n. 107

[2] <https://developers.google.com/blockly/>