

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
Ignition - Primary Space Education (1)

Author: Dr. Andreas Rienow
Ruhr-University Bochum, Germany

Mr. Niels Dedring
Ruhr-University Bochum, Germany

Mr. Jørn Alraun
Germany

Mr. Juri Wolf
Calliope gGmbH, Germany

Mr. Johannes Wepler
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany

Dr. Jan Grosser
German Aerospace Center (DLR), Germany

MICROCONTROLLERS IN SPACE AND IN THE CLASSROOM - THE "CALLIOPEO"
EXPERIMENT**Abstract**

In December 2021, the Calliope mini educative microcontroller was transported to the International Space Station (ISS). The star shaped microcontroller is part of the "CallioPEO" experiment. During ESA astronaut Matthias Maurer's "Cosmic Kiss" ISS mission, the Calliope mini is coupled with ESA's educative microcomputer Astro Pi IR. Hence, it is a demonstrator for an educational campaign to German Schools for primary students at the age of 10. Many students aren't taught any programming skills during their school education, even though, in the course of digitalization, skills in the fields of engineering and information technology are becoming increasingly important. The Calliope mini contains a number of sensors (e.g. light sensor), LEDs and buttons that students can program via a graphical interface. In this interface, students can create code in the form of blocks, whereby the program sequences are conveyed without complicated syntax, and can thus be used by students without prior programming skills. The wide range of tasks, existing teaching materials and the additional use of Java as a programming language allow for individual integration into primary lessons. Due to the different levels of difficulty and good documentation, students can autonomously improve their programming skills. So far, over 100,000 of these small computers are in use in German schools. The contribution introduces the CallioPEO's "Space Hack" campaign launched in German schools in September 2021. A total of 377 students from 36 classes and 28 individual entries took part during the "Space Hack" and submitted a total of 120 programs. Additionally, the microcontroller was equipped with further sensors and thus converted into a multi-measuring instrument and earth observation device. The experiments are divided into three categories: pre-installed non-window experiments, the above-mentioned student experiments, and pre-installed window experiments. The article presents the technical aspects of the CallioPEO experiment and its synergies with ESA's student campaigns "Mission Zero" and "Mission Space Lab". Finally, accompanying didactic materials are explained that can be used to learn programming techniques dealing with topics on CO2 measurement, multispectral imaging, and plant monitoring in primary schools. CallioPEO is carried out in the frame of the "KEPLER ISS" project at the Ruhr University Bochum and is funded by the German Space Agency at the German Aerospace Center (DLR) with funds from the German Federal Ministry of

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