

# “Using New Technologies to Improve Contents Accessibility”

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**Abstract.** We recently started to design and realize an interactive, multimedial, multistyle, inclusive ebook to be freely distributed to kindergarten and primary teachers and very young children. During the first phases of the design proces, we realized that this kind of multimedia product can be accessible and deeply inclusive in its own nature and it can hence be suitable also for students with Learning Disabilities and/or Autism Spectrum Disorders and in variuos situations of learning difficulties.

**Keywords.** astronomy, interactive ebook, digital learning, inclusion, universal design for learning

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## 1. Digital learning resources: introduction

As outreach officers working frequently with teachers and students, we are often requested to provide some educational/outreach materials easibly accessible and usable in classrooms. So, starting from a recent educational project in kindergartens (Casu et al., 2019), after a contextual and target analysis and taking advantage of the collaboration of a professional instructional designer (A. Luca), we decide to design and realize an interactive, multimedial, multistyle, inclusive ebook to be freely distributed to kindergarten and primary teachers and very young children.

Our main goal was to develop an ebook with a good grade of accessibility, usability and engagement, keeping at the same time a well-balanced cognitive load. We hence set up our work upon the basic principles of the *Universal Design for Learning* (UDL, Rose & Meyer 2002, Hall, Meyer & Rose, 2012)), which state that a good educational product should be designed in multiple formats to allow **representation**, it should foster **action and expression** (and so it should provide users of many ways to interact with it) and last but non least, it should provide many ways to **motivate and engage** learners. In the same time, the resource should be designed using a learner-centred approach, which assures an active and responsible learning in order to develop learners autonomy and independency with a anytime/anywhere and self-motivated learning, and finally it should consider what emerged from research on Evidence-Based digital Learning. Here we present a new multimedial and inclusive educational resource developed by the Italian National Institute for Astrophysics (INAF) to be used by kindergarten and first years of primary school children.

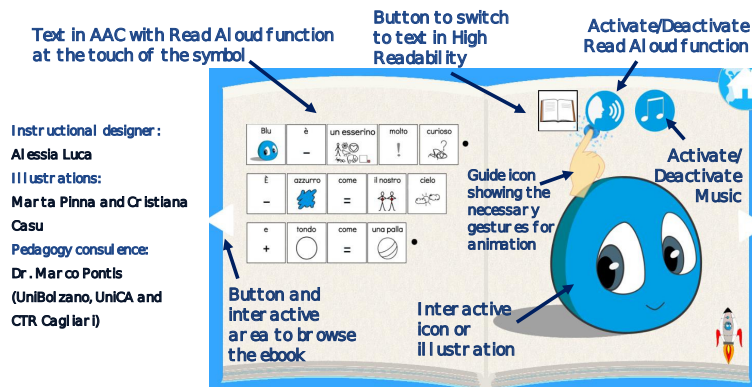
## 2. The INAF e-book project: the design process

In the framework of a more complex educational project targetted to young children, we recently began to design and develop an interactive multimedia ebook, with the aim

to promote a collaborative environment and a user-driven/student-centred learning style. Making a digital book instead of a paper book allows a lower-cost production and distribution widespread both for the web and for different types of devices. Moreover, it allows you to create a more accessible, attractive, engaging and rich in content book, with a lot of additional educational resources and games. An interactive ebook is not a simple text in a digital format but a book with multiple modes of use. Thanks to ICT (Information and Communications Technology), in fact, multiple modes of communication are available (voice, text, video, illustration, graphic). Children get into a "microcosm" to explore, touch, hear, read or just understood in immediate and intuitive ways, just choosing the one most suited for their functionality and preferred learning style.

The new INAF ebook, "*The adventures of Blue: Welcome on Earth!*", has been designed using a storytelling context builded around the no-gender character of Blue, a blue sphere coming from a very distant and extremely small (and bare) rocky planet. Being bored of this small planet, Blue decides to leave it and, traveling through the Galaxy, discovers the existing great variety of cosmic objects. At a certain point, Blue sees a little pale blue dot and decides to get closer, being captured by its gravity. Once landed to Earth, Blue meets two children and starts to explore our world: Blue is completely unaware of anything, makes a lot of questions and it is up to the children to find effective ways to explain how things work. The story-telling contest is an essential part of the project: teachers/tutors can use it as a scheleton of the activity, creating an emotional relationship with the children and facilitating the process of empathy and identification.

In Fig.1 you can find an example of one internal book page. To improve the us-



**Figure 1.** An example of one internal page of the INAF ebook *The adventures of Blue: Welcome on Earth!*. The present version is in Italian, but a English version is planned.

ability and accessibility by children, in any page the user can decide to read the text (OpenDyslexic high readability font, <https://gumroad.com/l/OpenDyslexic>), to listen the text (activating the Read Aloud function, a synchronized reading of the text in a natural voice), to activate or deactivate soundtrack and to interact with the page. Some interactive icons are present in any page and an intuitive hand "guide icon" suggests the gesture to interact with different contents. Simple one-finger interactions (tap, drag&drop) are designed to underline and show elementary abstract concepts, to promote reflective thinking, to help remember some notions, to stimulate curiosity and motivation to learn, in an autonomous and self-directed way already from an early age. This is possible thanks to immediate feedback which sets up a strong connection between child

and digital book. All these features are shown to be very effective in the presence of Learning Disabilities (LDs) such as dyslexia and/or Autism Spectrum Disorders (ASDs). Another possible choice provided in the ebook is the use of the Augmentative Alternative Communication (AAC) symbols, a form of communication that people use if they are unable, or unwilling, to use standard forms of communication such as speech. AAC may use pictograms or iconic symbols like the Widgit or, as in our case, the Picture Communications symbols, to transcribe a text and it is often used to help people with ASDs to improve communication skills (see Iacono, Trembath & Erickson, 2016). In this sense, the ebook is extremely accessible and inclusive as it adapts to the needs, the different learning styles, possible disabilities, impairments or difficulties of the reader.

The final product will be completed by multimedia contents (whose creation is presently in progress) to be downloaded - such as the printable version of the story and the audio book, cards for educational activities, games and didactical videos - and it will be easily upgradable and expandable for future uses.

### 3. Conclusions

We took up the challenge to create an efficient and effective ebook easily adaptable to the wide spectrum of possible users and situations. Our main goal is to define and validate an interactive and accessible ebook reference format. This will help us to improve the skills and resources we need to design and produce next Ebooks about Blue's adventures and discoveries. We planned to start a pilot experiment aimed to evaluate accessibility and effectiveness of our eBook and how it could really improve children's Universe Awareness and understanding of elementary astronomy. We expect to observe that:

- Blue, as a guiding character, promotes metacognition, self-directed learning, motivation to learn and collaborative knowledge building process. Moreover, Blue allows children to directly experience the scientific method process;
- the implementation of AAC would make the eBook suitable for students with special needs (LDs and/or ASDs), for very young children as a pre-reading tool, and for young foreign children to better overcome linguistic and cultural barriers;
- the use of this kind of multimedial product will be useful also for young foreign children (helping to overcome linguistic and cultural barriers), or again, in any situation of traditional learning difficulties (like, for example, for long-term hospitalized children). We plan to conclude, test, evaluate and release in 2020 summer the ebook "*The adventures of Blue: Welcome on Earth!*" as a first chapter of a series using Blue as the main character. We will release it with a Creative Commons license, in Italian and English, through the new INAF **edu.inaf.it** and the **astroEdu** platforms.

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