Instructions on How to Develop a CREATIONS Demonstrator

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Introduction / Instructions

1. Summary of the CREATIONS approach

As a result the CREATIONS approach is informed and grounded on three closely interrelated aspects: a) the CREATIONS features, b) the RRI principles and c) the IBSE principles.

CREATIONS Pedagogical Framework		IBSE	
CREATIONS features	**RRI aspects**	**Essential features of IBSE**	**Effective learning environments**
• Dialogue • Interdisciplinarity • Individual, collaborative and communal activities for change • Balance and navigation • Empowerment and agency • Risk, immersion and play • Possibilities • Ethics and trusteeship	• Governance • Public • Science education engagement • Gender equality • • Open access/open science • Ethics • Sustainability • Social justice/inclusion	➢ QUESTION ➢ EVIDENCE ➢ ANALYSE ➢ EXPLAIN ➢ CONNECT ➢ COMMUNICATE ➢ REFLECT	• Communities of practice • Simulations • Arts-based • Dialogic Space / argumentation • Experimentation (Science laboratories and eScience applications) • Visits to research centres (virtual/physical) • Communication of scientific ideas to audience

Although the key aspects of the CREATIONS approach are presented in a tabular format, the process is in practice highly organic, enabling the dialogue among students, teachers, researchers, ICT media and creative representation, drawing on a range of personal and disciplinary knowledge to thread across and between these features

2. The Demonstrators' Generic Framework

The design of **Demonstrators' Generic Framework** is mainly based on IBSE Best Practice of Pathway (Summer school, 2013), Scenario of Metafora EU project (e.g. 3d juggler (Smyrnaiou et al., 2012a; 2012b)) and Implementation Scenario of CREAT-IT EU project (such as Science Theatre Implementation Scenario, M. Sotiriou, 2015).

There are different ways to approach inquiry. Reflective inquiry seeks to draw attention on the coupling of metacognition and inquiry in the context of solving open-ended, ill-structured investigations in science (Kyza & Edelson, 2003). The Shimoda et al (2002)'s generic inquiry cycle is made explicit to students and

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is presented as a sequence of goals to be pursued. The Bruce & Bishop (2002) circle aims for students to learn how to learn and metacognitive skills, and stresses the need to engage children as active learners to collaborate and to understand the perspectives of others. Schwartz et al (1999) circle is implemented as a technology template to guide learners through case-, problem-, project-based learning. Although many versions of the inquiry cycle have been presented by various authors (de jong et al., 2002; Pedaste et al., 2015), the IBSE Best Practice of Pathway cycle was chosen as the most suitable for Creations. Besides this core cycle, there is a place for Question, Evidence, Analyse, Explain, Connect, Communicate and Reflect (figure 1). This circle stresses the need to engage children as little scientists, creative learners and science communicators.

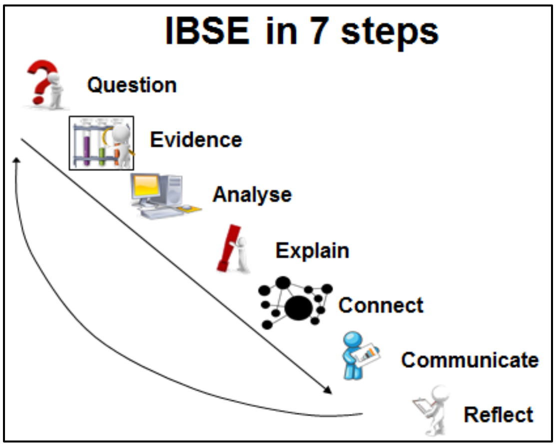

Figure 1: IBSE Best Practice of Pathway, Summer School, (Rosi, 2013)

The Demonstrators' Generic Framework structures the description of the pedagogical intervention around what we called "Introduction" or "Demonstrator Identity" which includes information about the : author, subject domain, type of activity, duration, setting and effective learning environment. The second element of the structure is the "Rationale of the Activity/ Educational Approach" which focuses on: the teaching and learning problem (challenge) addressed by this demonstrator and the added value of using the Creation Project for implementing this demonstrator. Challenge-based learning builds on the successes of problem-based learning models where students engage in self-directed work scenarios (or "problems") based in real life (Johnson, Laurence et al., 2009). By giving students the opportunity to focus on a challenge of global significance, challenge-based learning creates a space where students can direct their own research into real-world matters and think critically about how to apply what they learn (Smyrnaiou, et al., 2015; Johnson, Laurence et al., 2009). An example could be an art & science event (performance, paintings, etc.).

The third element of the structure involves the learning objectives which are divided to two categories which involve domain specific learning and general learning skills which is supported by the Creation

Framework. The fourth element of the Demonstrators' Generic Framework involves the "Demonstrator characteristics and Needs of Students" and aims at collecting information about the issues explored and the real needs of students. It is very important because the literature of Science Education offers important data concerning the students' attitudes towards science and underlines the continuing decline of interest the young people show in pursuing scientific careers (S&M) in a way that threatens the future of Europe (ROSE, Osborne et al., 2003; Osborne & Dillon, 2008).

The fifth element provides information about the Sequence and description of the activities focusing on a detailed description of each activity and the effective learning environment (s) involved and the sixth additional information. Finally, some assessment suggestions are requested along with possible extensions and list of suggested sources/references. For example, inter-workgroup assessment: after performing a theatrical stage on / represents a scientific concept or cultural elements, the workgroups may exchange their ideas / performances/ representations and ask their peers to evaluate them. The criteria for the evaluation may be set collaboratively by the workgroups as they discuss in class /stage, etc.. Concerning the possible extensions, after having performed a theatrical stage on scientific concept or cultural elements putting into effect their own ideas, the students share their performance and ask the students of another team to perform on the same scientific concepts (or cultural elements). At this phase of the performance, the workgroups decide on the representation of scientific concept (or cultural elements) through embodiment (gestures, facial expressions, full body movements, sentiments), music, choreography, narration, or using digital tools or other objects.

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