

## INNOVATIVE FOCUS – A Program to Foster Innovative Problem-Solving in Schools

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### 1. Introduction

As we navigate the complexities of the 21st century, global challenges such as climate change and environmental degradation necessitate transformative changes in our lifestyles and mindsets. The educational system plays a pivotal role in moulding future generations equipped with the necessary skills and values to promote sustainable, inclusive growth and a peaceful community. Education for Sustainable Development (ESD) is recognised as a critical pathway that equips learners to address these complex sustainability issues through innovative thinking and problem-solving (Rieckmann et al., 2017).

In order for ESD development to succeed, the following 8 key competencies are considered a necessary prerequisite. (Wiek et al.; 2011; de Haan, 2010; Rieckmann, 2012):

- **Systems Thinking:** Recognizing and understanding the interconnectedness within systems to analyse complex problems.
- **Anticipatory Skills:** Envisioning future scenarios and assessing the potential consequences of actions
- **Normative Skills:** Reflecting on and negotiating personal and societal values in the face of conflicting interests.
- **Strategic Skills:** Developing and implementing innovative, localised strategies that enhance sustainability.
- **Collaboration Skills:** Engaging empathetically with others, understanding diverse perspectives, and managing conflicts effectively.
- **Critical Thinking:** Questioning norms and practices critically and reflecting on one's values and actions in sustainability discourse.
- **Self-awareness:** Understanding one's role within the community and society at large, continuously evaluating one's actions.
- **Integrated Problem-solving:** Applying varied approaches to complex sustainability challenges to devise effective solutions.

These eight competencies are promoted through interactive, experiential, learner-centred, and action-oriented pedagogies, which emphasize collaborative and real-world problem-solving activities (Glavič, 2020). Furthermore, transformative teaching significantly contributes to effective ESD by fundamentally altering how individuals perceive themselves and their interactions with the world (Slavich & Zimbardo, 2012).

Addressing future challenges necessitates a skill set that includes not only cognitive abilities but also interpersonal and intrapersonal skills, encapsulated as the four Cs: critical thinking, creative thinking, collaboration, and communication. The promotion of creative behaviour, as a crucial form of human capital, is more important than ever. Creative performance depends on multiple factors including cognition (like mental flexibility and associative thinking), personality traits (such as risk-taking and tolerance for ambiguity), emotional intelligence, and environmental factors (Runco & Acar, 2012; Sternberg & Lubart, 1995).

Particularly, divergent thinking—a key aspect of creative cognition—is vital for generating varied solutions to open-ended problems. This form of thinking is characterised by fluency (the generation of numerous ideas), flexibility (the variety of ideas), and originality (the uniqueness of ideas) (Guilford, 1967; Runco & Acar, 2012).

The Innovative FOCUS program, shortly InFOCUS program, is a strategic initiative to incorporate these essential skills and competencies into the educational framework. Through a comprehensive, two-stage program involving in-service teacher training and direct student engagement in real-world sustainability projects, the initiative aims to transform educational practices to align with global sustainability goals.

This article introduces the concept and one technique of the InFOCUS program, which aims to foster creativity, innovation and practical problem-solving skills in the context of sustainability education to prepare students to be proactive and creative agents of change.

## **2. The *Innovative FOCUS* Program**

### **2.1 Goals**

Education for sustainable development (ESD) necessitates a transformative approach, emphasising key competencies that prepare students to navigate and address complex global challenges. The InFOCUS program, developed by the authors, aims to foster such transformative education, equipping students with essential problem-solving and innovative thinking skills (Haim & Aschauer, 2024).

The primary goals of the InFOCUS program include:

- 1. Raising Awareness:** The program seeks to instil an understanding that prosperity, peace, and environmental integrity are deeply interconnected. It emphasises the importance of sustainable development as the foundation for our thinking and actions.
- 2. Promoting Divergent Thinking:** InFOCUS aims to teach students divergent thinking strategies, enabling them to challenge conventional approaches and generate innovative solutions to real-world problems. This includes abandoning traditional ways of thinking to address sustainability challenges creatively.
- 3. Developing Anticipatory Skills:** The program focuses on enhancing students' abilities to foresee and evaluate potential future scenarios. This anticipatory skill is crucial for designing desirable and sustainable futures.
- 4. Strengthening Metacognitive Skills:** Students are encouraged to develop self-awareness and reflection skills, enabling them to adapt their thinking and actions to implement innovative solutions effectively. This metacognitive aspect helps students understand their cognitive processes and improve their problem-solving strategies.
- 5. Enhancing Cooperation Skills:** The program fosters students' abilities to work collaboratively, manage conflicts, and respond empathetically within a team setting. This cooperation is vital for tackling sustainability issues that require collective effort and diverse perspectives.
- 6. Encouraging Creative Personality:** InFOCUS encourages students to recognise and develop their creative personalities, boosting their confidence and self-efficacy. By nurturing creativity, the program helps students become more innovative and resilient.

**7. Building Strategic and Entrepreneurial Skills:** The program includes training in strategic planning and entrepreneurial skills, enabling students to launch projects that promote sustainability locally and globally. This aspect prepares students to take practical actions and turn their innovative ideas into reality.

To achieve these objectives, the InFOCUS program is structured in two stages. The first stage introduces students to the Sustainable Development Goals (SDGs) and divergent thinking strategies. Through specially developed cognitive tasks and creativity techniques, students learn to generate unconventional ideas by shifting perspectives (Haim and Aschauer, 2022). Reflection tools are also employed to help students acquire metacognitive skills and improve their team competence.

In the second stage, students apply the knowledge and skills acquired in the first stage to tackle real-world SDG challenges. This stage involves a complete creative process, from problem identification and brainstorming to prototype development and implementation (Haim and Aschauer, 2024). By working on practical projects, students not only deepen their understanding of sustainability issues but also develop concrete strategies for addressing them.

The InFOCUS program aims to transform students' thinking and actions towards sustainable development by promoting key skills such as divergent thinking, metacognition, cooperation, and strategic planning. Through a combination of theoretical knowledge and practical application, the program prepares students to become innovative problem solvers and active contributors to a sustainable future.

## **2.2 Contents of the InFOCUS Program**

The InFOCUS program is structured around five core domains: flexibility (F), originality (O), creative personality (C), unconscious mind (U), and strategies (S). These domains form the acronym FOCUS and collectively aim to foster essential skills for sustainable development by promoting creative and innovative thinking and acting.

A key aspect of the InFOCUS program is the variety of tools available. The program is holistic, with tools for every phase of the innovative process. They are used individually—for instance, promoting divergent thinking (cognitive), metacognition of creative traits (emotional), team competence (social), and specific creativity techniques (strategic). With the help of this program, students therefore learn step-by-step how to use creative thinking skills and problem-solving strategies to tackle and solve real-life challenges.

The five domains are described in more detail below and exemplary techniques are briefly presented.

### **Flexibility**

Flexibility in thinking is crucial for problem-solving in real-world contexts, allowing individuals to approach problems from multiple perspectives. In order to specifically promote flexible thinking, cognitive tools from the SCIP (Scientific Creativity in Practice) program are used. This program was also developed by the authors and a team from the University of Education Upper Austria and was formerly called the Flex-Based Learning program (Haim & Aschauer, 2022). One such tool, Thinkflex, involves tasks designed to promote divergent thinking by encouraging students to shift their perspectives and think across different categories. These tasks are used both in preparation phases and while working on specific challenges, fostering mental flexibility essential for innovative problem-solving.

### **Originality**

Originality refers to the ability to generate unique and novel ideas which is essential for innovation (Zwicky, 1969). The program includes creativity techniques like morphological analysis, reverse brainstorming (Evans, 2012) and APIFOS (developed by the authors) to foster this skill. Morphological analysis, for instance, breaks down problems into fundamental parameters and explores all possible variations, encouraging students to think beyond conventional solutions (Allen, 1962). The APIFOS tool developed by the authors is an acronym that stands for the following three processes: **Analyse Product - Identify Faults - Offer Solutions**. This tool makes it possible to improve existing products or services. The APIFOS tool can be used to uncover weaknesses that are easily overlooked. First, the product is examined carefully, analytically, and objectively. The second step is to look for obvious problems and hidden weaknesses. In the final step, specific weak points are selected and original solutions are sought.

### **Creative Personality**

The ability to work creatively is largely determined by personality such as self-awareness competency and cooperation competence (Kozbelt, 2010). Both represent important key competencies for sustainability (Rieckmann, 2012). Therefore, the developing of a creative personality includes the promotion of qualities such as self-awareness, openness to new experiences, and resilience. The InFOCUS program employs reflection tools like "BE A COMET" and "Mission: Possible" to enhance these traits. "BE A COMET" helps students reflect on their creative behaviors (Haim & Aschauer, 2022), while "Mission: Possible" uses a card set to guide students through the creative process from brainstorming to project execution (Haim & Aschauer, 2024). These tools support students in recognizing and strengthening their creative abilities, thereby boosting their self-efficacy and confidence.

### **Unconscious Mind**

The unconscious mind significantly contributes to creativity by enabling spontaneous idea generation and emotional processing. To tap into this resource, the InFOCUS program includes embodiment tools such as asynchronous exercises, juggling, meditation, and Qigong. These activities help students enhance their creative performance by improving cognitive processes like attention, working memory, and emotion regulation. Studies have shown that mindfulness and physical activities can positively influence creativity by fostering better cognitive control and flexibility (Henriksen et al., 2020, Beaty et al., 2016; Beaty et al. 2018).

### **Strategies**

Real problems cannot be tackled without suitable strategies and project management. Strategic skills are essential for planning and implementing innovative projects. The program incorporates recognised strategies from innovation management, including design thinking and dragon dreaming. Design thinking, for example, is an iterative process that involves empathising with users, defining problems, ideating solutions, prototyping, and testing. This method promotes critical and creative thinking, leadership, cooperation, and project management skills. By practising these strategies, students learn to navigate complex challenges effectively and bring their innovative ideas to fruition (Brown, 2009; Knoll, 2013).

## **2.3 The Implementation of the InFOCUS program in Schools**

The above techniques are used specifically in the program to solve a specific task. This challenge, which is an integral part of the Innovative FOCUS program, guides students through a multi-step process to creatively tackle these challenges. First, students either identify a problem themselves or choose one

from a predetermined list that aligns with the Sustainable Development Goals (SDGs). The focus is on topics that promise original solutions and can be implemented in their educational context.

Once a problem is identified, students move to brainstorm innovative solutions, using a variety of creativity-enhancing techniques taught during the InFOCUS teacher training. These sessions are supported by their teachers, who act as facilitators throughout the creative process. Following ideation, students design and develop conceptual prototypes, typically through a design-thinking approach that emphasizes user-centric problem-solving.

The culmination of the challenge is a series of presentations where students pitch their prototypes and proposed solutions. This phase not only showcases their creative output but also enhances their communication and project management skills. Some schools may extend the challenge to realize a prototype, turning conceptual designs into tangible outcomes.

This structured challenge is more than just an academic exercise; it is a critical component of the InFOCUS program's goal to foster effective problem solvers equipped to tackle sustainability challenges through innovative thinking and creativity.

To enable teachers to become familiar with the techniques of the InFOCUS program and thus lead their teams through an innovative process, the authors have developed a one-year training program for teachers. The InFOCUS teacher training program is a multi-stage educational project designed to enable teachers to effectively implement the InFOCUS curriculum. The program begins with a three-day kick-off event where teachers are introduced to the methods and core concepts of the program through workshops and presentations. In the following months, they apply the newly learned techniques through practical problem-solving tasks at their schools, gaining first-hand experience of creative teaching strategies. The program then moves into a second semester where teachers come together for another three-day session to improve their skills in project management and organizing professional pitches. In this phase, the practical focus is intensified as teachers guide students in selecting and solving current challenges related to the Sustainable Development Goals (SDGs), culminating in the development and presentation of a project prototype. Throughout the program, teachers are supported by regular online sessions that provide a platform for reflection and discussion on their experiences and challenges using InFOCUS techniques. This ongoing engagement is designed to refine their teaching methods and improve their effectiveness in promoting innovative and critical thinking among students.

In 2020, the authors developed a label for schools that are willing to embed innovative problem-solving in their school profile and thereby establish think tanks and maker spaces for students. The "School of Creative Solutions" label is awarded to schools whose teachers use the SCIP program (previously known as Flex-Based Learning) and the InFOCUS program in their lessons, showing students a way to solve the challenges of the future with optimism, know-how and self-confidence. This label also makes the special orientation of a school visible to the outside world, enabling us to network these schools both nationally and internationally.

### **3. Research Results about the Effectiveness of the InFOCUS program**

#### **3.1 Materials and Methods**

As the InFOCUS program was offered to teachers for the first time in 2020, only some results of a pilot study can be presented (Haim & Aschauer, 2024). This study utilized a mixed-methods evaluation approach to assess the effectiveness of the InFOCUS program at both student and teacher levels. The evaluation was structured around a set of four main research questions, aiming to determine how well

the program enhanced creativity, problem-solving capabilities, and engagement with the Sustainable Development Goals (SDGs). Participants included a total of 270 students and 20 teachers from various secondary schools who were actively engaged in the InFOCUS training during the 2021/2022 academic year. To evaluate the feasibility and effectiveness of the individual InFOCUS tools in the classroom, continuous reflection meetings were held with the teachers. Data collection was conducted via online surveys, teacher logs, and direct observation of classroom dynamics and student project work. Teachers and students were asked to rate the utility of the tools and methods provided by the InFOCUS program and to reflect on the program's impact on their teaching and learning experiences. To assess the students' motivation to participate in the project, the Intrinsic Motivation Inventory (McAuley et al., 1987) questionnaire was used at the end of the project work. The overall effectiveness of InFOCUS was assessed by determining how many teams succeeded in generating ideas for the respective problem and realising them in the form of a prototype.

### **3.2 Results**

#### **Student Outcomes:**

The study highlighted significant achievements in student engagement and project completion. Out of 270 students who participated, a vast majority successfully developed and presented prototypes that addressed real-world sustainability challenges. These projects reflected a wide range of innovative solutions to environmental and social issues, underscoring the program's effectiveness in fostering creativity and problem-solving skills. Students demonstrated improved competencies in designing and implementing projects that were both practical and impactful, aligning closely with the Sustainable Development Goals (SDGs).

Feedback from students was overwhelmingly positive. They reported enhanced motivation and a deeper understanding of sustainability issues. The hands-on nature of the projects allowed students to apply theoretical knowledge in practical settings, which not only increased their problem-solving skills but also their personal commitment to addressing global challenges. Many students expressed a heightened sense of empowerment and confidence in their ability to make a difference, which is a key indicator of the program's success in fostering proactive and responsible future citizens.

The teachers reported a high level of interest and motivation among the pupils during the reflection meetings. This is also shown by the results of the IMI questionnaire. Here, the students were asked to indicate on a 5-part Likert scale whether certain statements "not at all true" (1) to "very true" (5) to them. All subscales used show high mean values for the sum scores. For example, for the interest/enjoyment subscale, which captures intrinsic motivation per se, the agreement for "I really enjoyed doing this project activity" reached a mean of 4.4 (SD = 0.56). In the case of the perceived competence subscale, which is assumed to be positive predictors of both self-assessment and behavioral measures of intrinsic motivation, approval for "I am satisfied with my performance on this project", for example, reached a mean of 4.02 (SD = 0.74). In the case of effort/importance, the statement "I put a lot of effort into working on this project" was given a mean value of 4.02 (SD = 0.76). Regarding the overall effectiveness of the InFOCUS program, the result is also very positive as 97 % of the student teams were able to develop a prototype.

#### **Teacher Outcomes:**

The first results of these pilot studies are very promising. During the reflection meetings, all teachers reported that the InFOCUS tools proved to be very efficient. This is also confirmed by the results of the

survey, where teachers rated the effectiveness of each InFOCUS tool on a 5-point Likert scale (from 1 "very low" to 5 "very high"). All implemented techniques were rated on average as high (mean = 3.98 and SD = 0.92).

Teachers who participated in the InFOCUS training program reported significant professional development benefits. The training enhanced their instructional skills, particularly in integrating ESD (Education for Sustainable Development) into their teaching practices more effectively. Educators noted an increase in their ability to facilitate project-based learning, which is critical for engaging students in complex problem-solving tasks.

The training sessions were highly valued by teachers for providing them with the tools and strategies necessary to guide students through the creative process of developing sustainable solutions. Teachers appreciated the structured yet flexible approach of the program, which allowed them to tailor the projects to fit their specific classroom contexts and student needs. This adaptability was crucial in ensuring the relevance and effectiveness of the projects across different educational settings.

#### **4. Conclusion**

The InFOCUS program has demonstrated considerable success in achieving its goals of enhancing creativity, problem-solving skills, and sustainability awareness among students, while also empowering teachers with innovative educational tools and methods. The integration of ESD into the curriculum has proven effective, with student projects directly contributing to the SDGs and fostering a sense of global responsibility.

These results provide a compelling case for the continued expansion and adaptation of the InFOCUS program. By further refining its methodologies and extending its reach, the program can continue to play a vital role in preparing students and teachers to tackle the complex challenges of the 21st century.

Even though we are yet to launch the impact of the InFOCUS program on gifted students, we are convinced that our program can make a major contribution to the promotion of gifted students. Several authors emphasise the urgency of fostering scientific creativity, especially in gifted students (e.g. Cevher et al. 2014; Stoltz et al., 2015). A high IQ alone does not provide a satisfactory explanation for gifted achievement, but the interaction between intelligence and creativity must be considered (Crompton, 1993). Divergent thinking, originality, creative personality traits and a stimulating environment play a central role (Stoltz et al., 2015), especially in gifted underachievers (Kim, 2008). Concerning divergent thinking, the findings of Cevher et al. (2014) show that the originality of gifted students and the ability to turn abstract ideas into realistic solutions (elaboration) must be encouraged. By encouraging their scientific creativity and giving them the opportunity to solve real-world challenges as part of the InFOCUS program, we enable them to tackle complex problems with confidence and ingenuity, empowering them to become future innovators.

More information about the InFOCUS program and the related in-service teacher training course, which is also offered for ERASMUS teachers, can be found at: <https://www.school-creative-solutions.at/en/>

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