

“Bridging soft skills and neuroscience”

The SPIRIT framework meets the neuroscience of learning.

Grazia Serantoni, Psychologist, PsyD

Patrizio Paoletti Foundation, Rome, Italy

“The brain is not a vessel to be filled, but a fire to be kindled.”

Adapted from Plutarch, *On Listening to Lectures* (De Auditu), 46 AD

Why neuroscience matters for teaching transversal skills

Three questions frame the connection between brain science and the teaching of transversal competences:

- 1. Why are these competences trainable?** Because the brain physically changes every time a child practises a new skill. This process, called neuroplasticity, means that transversal competences are not fixed traits: they are capacities that can be built through deliberate practice (Pascual-Leone et al., 2005; Draganski et al., 2004).
- 2. When is the brain most ready?** Between the ages of 6 and 10, the prefrontal cortex, the region responsible for planning, self-control, and flexible thinking, is undergoing massive structural changes. The brain is selecting which neural connections to keep and wrapping them in myelin, making them faster and more efficient (Gogtay et al., 2004). The peak window for executive function development is ages 5 to 12 (Best and Miller, 2010).
- 3. How do we activate the right brain circuits?** Through experiential, reflective learning and teacher modelling. Mirror neurons in students’ brains activate the same neural patterns when they observe a teacher demonstrating empathy or calm problem-solving (Rizzolatti and Craighero, 2004).

The SPIRIT framework: three axes, one centre

The SPIRIT framework organises the teaching of transversal skills along three axes.

- 1. What to teach:** 10 transversal competences, identified through surveys with over 500 European teachers and interviews with developmental psychologists: emotional awareness, regulation and communication; creativity; problem-solving; critical thinking; resilience; flexibility; curiosity, sense of wonder and openness; empathy; valuing people and nature; connectedness.
- 2. When to teach:** Three developmental levels for each competence (emerging, consolidating, advanced) across the K1 to K4 age range, covering children aged 6 to 10.
- 3. How to teach:** Three complementary methods: structured learning activities (specific or integrated into core subjects), traditional games (promoting collaboration, creativity,

rule-following), and STEAM activities (interdisciplinary projects combining creativity and technology).

At the centre of the model sits teacher awareness. The handbook states explicitly: teaching soft skills is not just about knowing, it is about being. Teachers are living examples of the competences they aim to nurture.

The 10 competences through a neuroscience lens

When viewed through a neuroscience lens, the 10 SPIRIT competences fall into two natural groups (Tab. 1).

Cognitive-executive group	Socio-emotional group
Problem-solving Creativity Critical thinking Curiosity, sense of wonder and openness Flexibility	Emotional awareness, regulation and communication Resilience Empathy Valuing people and nature Connectedness
Rely heavily on the prefrontal cortex: planning, flexible thinking, impulse control.	Engage the “social brain”: stress recovery, emotional resonance, moral reasoning.

Tab. 1 – 10 SPIRIT competences: reorganisation, from a neuroscientific perspective

For each competence, identifiable brain processes are at work. Creativity involves the interaction between the prefrontal cortex and the default mode network (Beaty et al., 2016). Critical thinking requires inhibitory control (Miyake et al., 2000). Empathy engages the anterior insula and the mirror neuron system (Decety and Jackson, 2004). Resilience involves adaptive coping (Masten, 2014), supported by the prefrontal-amygdala circuit

SPIRIT's three teaching methods naturally engage both cognitive and emotional brain networks. Research shows that emotion and cognition are deeply integrated in the learning process, and that lasting learning depends on this integration (Immordino-Yang and Damasio, 2007).

Three neuroscience principles

1) Neuroplasticity

The brain physically changes when we practise something repeatedly. Every time a child resolves a conflict, imagines a creative solution, or pauses before reacting, they strengthen neural pathways. Hebb (1949) described the principle that repeated co-activation of neurons strengthens their connections, later summarised as “neurons that fire together wire together.” This is why SPIRIT’s use of Kolb’s experiential cycle (1984) (experience, reflect, conceptualise, try again) is so effective: it engages multiple brain networks in the sequence that produces durable change (Zull, 2002).

2) Executive functions

The prefrontal cortex manages three core skills: the ability to resist impulses, to hold information in mind, and to shift flexibly between tasks (Miyake et al., 2000). Structured activities, the kind SPIRIT proposes, improve these skills more effectively than free play (Diamond and Lee, 2011). Executive functions represent one important set of processes underlying several of the SPIRIT competences.

3) The social brain

Mirror neurons fire both when we perform an action and when we observe someone else performing it (Rizzolatti and Craighero, 2004). When a teacher models empathy, calm, or curiosity, the students' brains activate the same neural patterns. Teachers' emotional competence directly shapes classroom climate and student wellbeing (Jennings and Greenberg, 2009). Your emotional state is part of the curriculum.

SPIRIT and “Envisioning the Future”: a developmental continuum

The “Envisioning the Future” programme (“Prefigurare il Futuro”), developed by Fondazione Patrizio Paoletti in collaboration with the Università di Padova, works with adolescents aged 11 to 19 using “Pedagogy for the Third Millennium” (“Pedagogia per il Terzo Millennio”) (Paoletti, 2008).

Several conceptual overlaps exist between SPIRIT competences and the dimensions addressed in “Envisioning the Future.” Resilience maps onto resilience. Self-regulation maps onto emotional regulation. Empathy maps onto self-compassion. Creativity maps onto the ability to reframe difficult experiences.

Both frameworks share three core principles: teacher awareness at the centre, experiential and reflective learning, and observation of competences rather than just testing. Together, they form a continuum: SPIRIT builds the foundation at ages 6 to 10, “Envisioning the Future” deepens it through adolescence.

What the research shows

Data from over 1,100 Italian adolescents (Serantoni et al., 2025a; Serantoni et al., in Paoletti & Di Giuseppe, Eds., 2025b) reveal that resilience is medium-low and declining. Self-compassion scores show a troubling pattern. A regression analysis showed that emotional regulation, positive coping, and life satisfaction together explain over 50% of the variance in resilience.

The “Envisioning the Future” programme, tested on over 700 students, demonstrates that these competences can be improved: participants showed greater self-compassion, stronger emotional regulation, and less tendency to be overwhelmed (Paoletti & Di Giuseppe, Eds., 2025; Paoletti et al., 2024; Di Giuseppe et al., 2023).

If these competences are already weak in adolescence, building them in primary school is a developmental necessity.

Four things you can do tomorrow

1. **Name the brain.** Teach students that their brain grows when they practise. “I can’t do this yet” instead of “I can’t do this” engages the brain differently (Dweck, 2006).
2. **Model what you teach.** When teachers are more resilient, students judge themselves less harshly (Perasso et al., 2023). Mirror neurons mean your emotional state directly shapes students’ development.
3. **Trust the experiential loop.** SPIRIT uses Kolb’s cycle (1984). Let children do, reflect, make sense of it, then try again. The hippocampus consolidates learning through experience and reflection (Zull, 2002).
4. **Help children observe themselves.** When a child notices their own thinking and behaviour, they activate the brain circuits responsible for self-regulation. SPIRIT’s observational levels are tools for building this capacity.

Three messages to take home

1. **Soft skills are brain skills.** Resilience, empathy, creativity, and self-regulation are real capacities that can be trained, measured, and strengthened through practice.
2. **SPIRIT competences match critical brain development windows.** Ages 6 to 10 are exactly the right time, because the brain regions that support them are developing most rapidly.
3. **When teachers grow, students grow.** Mirror neurons make it a biological fact. Your growth as an educator is the single most powerful intervention you can offer your students.

Please watch the video of Grazia Serantoni: „FROM THE ELEMENTARY CLASSROOM TO THE FUTURE WELLBEING”
<https://tinyurl.hu/0g3n>

References

- Beaty, R.E. et al. (2016). Creative cognition and brain network dynamics. *Trends in Cognitive Sciences*, 20(2), 87-95.
- Best, J.R. & Miller, P.H. (2010). A developmental perspective on executive function. *Child Development*, 81(6), 1641-1660.
- Decety, J. & Jackson, P.L. (2004). The functional architecture of human empathy. *Behavioural and Cognitive Neuroscience Reviews*, 3(2), 71-100.
- Di Giuseppe, T. et al. (2023). A neuropsychopedagogical training for adolescents. *Journal of Psychological and Educational Research*, 31(2), 59-70.
- Diamond, A. & Lee, K. (2011). Interventions shown to aid EF development in children 4 to 12. *Science*, 333(6045), 959-964.
- Draganski, B. et al. (2004). Neuroplasticity: changes in grey matter induced by training. *Nature*, 427, 311-312.
- Dweck, C.S. (2006). *Mindset: The New Psychology of Success*. Random House.
- Gogtay, N. et al. (2004). Dynamic mapping of human cortical development. *PNAS*, 101(21), 8174-8179.
- Hebb, D.O. (1949). *The Organisation of Behaviour*. Wiley.
- Immordino-Yang, M.H. & Damasio, A. (2007). We feel, therefore we learn. *Mind, Brain, and Education*, 1(1), 3-10.
- Jennings, P.A. & Greenberg, M.T. (2009). The prosocial classroom. *Review of Educational Research*, 79(1), 491-525.
- Kolb, D.A. (1984). *Experiential Learning*. Prentice Hall.
- Masten, A.S. (2014). *Ordinary Magic: Resilience in Development*. Guilford Press.
- Miyake, A. et al. (2000). The unity and diversity of executive functions. *Cognitive Psychology*, 41(1), 49-100.
- Paoletti, P. (2008). *Crescere nell'eccellenza*. Armando Editore.
- Paoletti, P. & Di Giuseppe, T. (Eds.) (2025). *Osservatorio adolescenza*. Roma: Fondazione Patrizio Paoletti.
- Paoletti, P. et al. (2024). Neuropsychopedagogical training and the mediating role of "The Other." In *Mental Health and School Adjustment*, Intech.
- Pascual-Leone, A. et al. (2005). The plastic human brain cortex. *Annual Review of Neuroscience*, 28, 377-401.
- Perasso, G. et al. (2023). Resilience predictors in the post-pandemic era. *Ricerche di Psicologia*.
- Plutarch (c. 46 AD). On Listening to Lectures (De Auditu). In *Moralia*.
- Rizzolatti, G. & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience*, 27, 169-192.
- Serantoni, G. et al. (2025). Resilience, emotional regulation, and self-compassion in adolescence. 18th HPSS Conference, Berlin.
- SPIRIT Consortium (2024). *Comprehensive Handbook for Teachers*. Erasmus+.
- Zull, J.E. (2002). *The Art of Changing the Brain*. Stylus Publishing.