MESE 1
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Why does Integrated STEM education not fit: Pinpointing the breaking points.

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Despite of countless financial resources at the European and Italian national level, the availability of training and many best practices as teaching resources, STEM education struggles to be integrated in the school system in holistic way. Starting from a reflection on the key points and actors involved with STEM practices in schools this contribution intends to highlight the critical points in the educational system that may hinder the process of their integration. A minimalist version of STEM integration would require the combination of at least two STEM subject areas STEM integration can also extend beyond STEM disciplines to incorporate art or any other subject and the interest and development on interdisciplinary STEM education is increasing. STEM integration could be represented as a gradient, which at one extreme is defined by a multidisciplinary approach of two or more disciplines taught and learned separately but within a unifying theme, and at the other end a transdisciplinary approach, the learning goals of the different disciplines are designed through a learning scenario based on real-world problems. Yoder and colleagues define six key elements of a student-centred and evidence-based educational STEM ecosystem including: effective teachers, high standards and quality curricula, formal and informal learning of STEM subjects, integrated use of technology. Aside for teaching resources, teachers need to be trained in STEM pedagogical design, implementation, and evaluation. To improve teachers' self-efficacy in teaching STEM professional development programs also need to address teachers' needs for instructional practices and provide opportunities for peer collaboration. The Scientix report on educational practices in Europe disposes a different picture. The responses show that for STEM subjects, the frontal and transmissive lecture remains the most reported pedagogical approach and most STEM teachers interviewed have not undergone any professional training of STEM subject-related methodologies or technologies. In daily practice also the lack of time required for instructional design and pedagogical implementation and a formative-oriented integrated STEM approach which does not always fit easily into the curriculum. To overcome these barriers a school curriculum ready to promote an integrated STEM approach and a shift to distributed leadership to support and promote STEM practices and teaching at the whole-school level could enable teacher collaboration and stakeholder engagement in STEM education. The school leadership should support and promote a professional development with collective and active participation, consistent with the guidelines and curriculum of an extended duration to ensure accompaniment in the application of new skills in teaching practice; as the active collaboration with the territory, like industry or museums, in classroom activities, to contextualise the learning content to a real-world application. Policy makers should encourage professional development of teachers and school leaders, as foster the introduction of also student-centred methodologies and formative assessment in learning.

Research Strand

Network Analysis in Education and Learning Processes

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