Overview of the IDENTITIES project: Key-ideas of the project, Intellectual Outputs, the scientific management structure

Kick-off meeting, Bologna

November 19th, 2019

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

UNIVERSITÀ DI PARMA

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UNIBO & UNIPR

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GENERAL GOALS AND KA2 PRIORITIES

GO1. **Prepare a new generation of secondary school teachers able to develop, through their future interdisciplinary teaching in contexts of upper secondary schools**, “key competences to foster employability and socio-educational and personal development, as well as participation in civic and social life”. In particular, IDENTITIES will aim to promote the development of “language skills, critical thinking and creativity, as well as interdisciplinary and forward-looking skills in fields that are strategic for smart economic and social development.”

GO2. Promote **the creation of interdisciplinary research groups in computers science, mathematics and physics education,** able to support the process to align formal education (university and secondary school teaching) with a fast-changing world.

GO3: Design **new blended and e-learning courses for pre-service teacher education in computer science, mathematics and physics**.

GO4: Develop **new approaches, pedagogies and methods to foster interdisciplinarity among computer science, mathematics and physics**, with “links to STEM education and other fields”.

KEY-WORDS

Multidimensionality

Interdisciplinarity as different from a-disciplinarity, trans-disciplinarity and multi-disciplinarity

Emergent interdisciplinary knowledge and Curricular interdisciplinarity

Epistemological and linguistic activators

MULTIDIMENSIONALITY

Interdisciplinary in STEM fields represents a global, transnational and multi-dimensional challenge, touching **societal, educational, institutional, political** and **research** needs.

Societal dimension:
the relation between science and society is strongly related to the social, economical, political impact of interdisciplinary **STEM topics** like artificial intelligence, nanotechnologies and climatology. Smart growth and responsible citizenship require the development of multi- and inter-disciplinary knowledge and competences.

Specific Objective 1 (SO1):
to design innovative materials on STEM topics to enable secondary school teachers to equip the new generations with skills needed to grapple with societal challenges as citizens and/or future STEM professionals.

Educational dimension: Students perceive school scientific disciplines, including mathematics, as **irrelevant** and artificial forms of knowledge that do not impact them as persons, citizens or future professionals. In several institutional contexts (e.g. in the current Italian reform of the Lyceums final exams), interdisciplinarity is valued to give mathematics and physics **authenticity** and concrete contextualization.

Specific Objective 2a (SO2a): to design innovative materials able to give back relevance and authenticity to scientific disciplines

Interdisciplinarity raises **new educational needs**, among which epistemological and linguistic needs.

1. The **epistemological need** to overcome the instrumental approach and move to an educational approach that, in border inter-disciplinary curricular themes, stresses, compares and values the peculiarities of the forms of reasoning typical of each discipline.

2. **two different linguistic issues**: i. the linguistic difficulties that already affect disciplinary learning are amplified by the merge of **different intertwined discourses**; ii. in scientific disciplines, the already non-trivial relationship between informal and formal uses of language is made more complicated **by the stratification of even more languages**.

Specific Objective 2b (SO2b): to design innovative materials to enable the new generation to address the epistemological and linguistic issues raised by interdisciplinarity.

Institutional/political dimension: to manage innovative interdisciplinary materials in secondary school requires a specific **preparation of teachers**. So far, pre-service teacher education is based on disciplines and teacher educators are not used to collaborate to design real interdisciplinary courses for prospective teachers. Interdisciplinarity needs, hence, new institutional research and educational contexts, where professionals from different disciplinary fields can collaborate, co-operate and/or co-teach so as to form a new generation of secondary school teachers.

Specific Objective 3 (SO3): to foster the creation of new institutional contexts where professionals from different disciplinary fields collaborate to design, realize and manage innovative courses for preservice teacher education.

Research dimension: The meaning of interdisciplinarity among S-T-E-M fields or in "STEM education" is object of vivid debates within the research in science and mathematics education. Reports stress the need to identify consistent models where a clear position on interdisciplinarity in STEM is taken and where the contribution of STEM education to scientific literacy is argued.

Specific Objective 4 (SO4): to outline a coherent model of interdisciplinarity in STEM. This model will orient institutional, didactical and research strategies and will be used to provide a transnational solid research basis to the development of teaching materials.

INTERDISCIPLINARITY is not A-DISCIPLINARITY, TRANS-DISCIPLINARITY or MULTI-DISCIPLINARITY

"Relying on Thompson's definition (Frodeman et al, 1990), we speak of interdisciplinarity when disciplines mutually **integrate, interact and blend,** while we consider multi-disciplinary an approach in which disciplines are juxtaposed, sequential and coordinating.
In IDENTITIES we assume that the search for the meaning of interdisciplinarity cannot ignore the meaning of "disciplines" and their epistemological "identities". The term "discipline" contains the Latin root "discere", whose meaning is to learn. Disciplines are re-organizations of the knowledge with the scope of teaching it. In particular, disciplines ground their roots into the didactical necessity to re-organize knowledge in such a way that students, whilst building their knowledge, can also develop epistemic skills, like problem solving, modelling, representing, arguing, explaining, testing, sharing... Disciplines have been built to help student to make gradually sense of different categories of problems, approaches, tools and criteria to evaluate the correctness and efficiency of a procedure, a reasoning, an argument. **From this perspective, disciplines can still play a relevant educational role, provided that they are explicitly pointed out as forms of knowledge organization historically developed and grounded on specific epistemologies" …**

… IDENTITIES the interdisciplinarity will be used to mean the need to cross the boundaries among disciplines but also to mean the need to value disciplinary learning as a source of epistemic skills. In other words, **interdisciplinarity will offer a "bird-eye" perspective** that will guide us to develop modules where the different disciplines are critically compared and both their specific epistemic features and the transversal cross-cutting themes are fleshed out.

Frodeman, R., Thompson, J., Mitcham, C. (1990). The Oxford Handbook of Interdisciplinarity. Oxford University Press.

Disciplines  **Interdisciplinarity**

EMERGENT INTERDISCIPLINARY KNOWLEDGE AND CURRICULAR INTERDISCIPLINARITY

Emergent interdisciplinary topics refer to advanced topics like artificial intelligence, quantum computing and climate change
Curricular interdisciplinary topics concerning “border problems”.

Is this a ”rethoric” distinction or a deep one? Are there specificities in the two types of interdisciplinarity or they are epistemologically the same?

EPISTEMOLOGICAL AND LINGUISTIC ACTIVATORS

DRAFT DEFINITION: epistemological and linguistic concepts or themes able to activate a meta-level of analysis from which the disciplines can be observed, compared and intertwined, moving back and forth the details and the big picture.

Epistemological activators are **concepts or methods** that allow different disciplinary knowledge systems to be characterized and compared (e.g. modeling, problem-solving, proof, forms of argumentation and justification).

Linguistic activators refer to specific **linguistic concepts of categories** (implicit information, relationship between natural and formal logic and structures, levels of text analysis, interpretation) or to forms of linguistic representation (natural, formal, iconic) used differently in different communities. Activating a linguistic level of analysis of a text has been proved to foster deep conceptualization, thanks to its potentiality of scaffolding the reading approach, pointing out formal and informal aspects of the text, turning a cohesive “flat” text into a multi-layered backbone in which the connections between disciplines are embedded in the text structure.

RESEARCH QUESTIONS

- How can we describe and characterize that form of **integration, interaction and blending** among disciplines that we call **inter-disciplinarity**?
- How can we **characterize disciplinary knowledge**?
- What do we mean by "**epistemological and linguistic activators**"?
- Do we aim to achieve **definitions** or, "simply", **characterizations**? In both cases, what **case studies and examples** are we able to elaborate and how do we manage them to contribute to answering our questions??
- What **IDENTITIES teaching methods, materials and approaches** are we able to co-elaborate according to our aims and assumptions?
- How can we organize ourselves to share, discuss, co-design and co-analyse cases?

Intellectual outputs:

O2 - Teaching modules on emergent interdisciplinarity in **advanced STEM topics (UNIBO)**

O3 - Teaching modules on **curricular interdisciplinary topics (UM)**

O4 - **Guidelines to design and implement** modules on curricular interdisciplinarity and STEM emerging interdisciplinarity in pre-service teacher education **(UB)**

O5 - **Open Education Resources** for Blended modules and MOOCs **(UNIPR)**

O6 - **Recommendations for policy makers** to promote interdisciplinarity and innovate prospective teachers education for STEM challenges **(UoC)**

A transnational team - EST (Emerging STEM topics) team - in charge of revising, testing and producing the modules. The EST– team will be composed by: experts in Mathematics teacher education (UNIPR, UM, UB), Physics/Science teacher education (UNIBO, UoC, UB), Computer science teacher education (UNIBO, UM, UNIPR), experts in STEM emerging topics (UNIBO, UoC, UNIPR), linguistic (UNIBO, UM, UB), epistemology (UNIBO, UoC, UM, UNIPR).
The modules development will inform the elaboration and refinement of O4.

A transnational team “Curricular Interdisciplinary Topics (CIT) Team” (CIT- team) in charge of revising, testing and producing the modules. The CIT-team will be composed by: experts in Mathematics teacher education (UNIPR, UM, UB), Physics/Science teacher education (UNIBO, UoC, UB), Computer science teacher education (UNIBO, UM, UNIPR), in history and epistemology of the disciplines, also from the educational point of view and in an interdisciplinary perspective (UM, UoC, UNIBO, UNIPR), linguistic (UNIBO, UM, UB).
The modules development will inform the elaboration and refinement of O4.

Name of the project:	IDENTITIES: Integrate Disciplines to Elaborate Novel Teaching approaches to Interdisciplinarity and Innovate pre-service teacher Education for STEM challenges

PROJECT TIMETABLE

Project activity*	MONTHS	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36
A1: Project Management																																					
O2: Teaching modules on emergent interdisciplinarity in advanced STEM																																				
O3: Teaching modules on curricular interdisciplinary topics																																				
O4: Guidelines to design and implement interdisciplinary modules																																				
O5: Open Education Resources for blended modules and MOOCs																																				
O6: Guidelines & political recommendations																																				
M1: Kick-off Meeting (Bologna)																																				
M2: 2° Project Meeting (Creta)																																				
M3: 3° Project meeting (Montpellier)																																				
M4: 4° Project meeting (Barcelona)																																				
M5: 5° Project meeting (Montepellier)																																				
M6: 6° Project meeting (Parma)																																				
E1: National Multiplier Event (IT)																																				
E2: National Multiplier Event (FR)																																				
E3: National Multiplier Event (GR)																																				
E4: National Multiplier Event (ES)																																				
E5: International Multiplier Event at YESS (GR)																																				
E6: International Multiplier Event at CERME (IT)																																				
E7: International Multiplier Event (IT)																																				
C1: Summer School for prospective teachers (Crete)																																				
C2: Summer School for teacher educators (Crete)																																				
C3: Summer School for prospective teachers (Barcelona)																																				
C4: Summer School for teacher educators (Barcelona)																																				
A2: Dissemination																																				

*Project activity types:		
	An	- PROJECT MANAGEMENT AND IMPLEMENTATION ACTIVITIES
	On /*An*	- INTELLECTUAL OUTPUTS/ACTIVITIES
	Mn	- TRANSNATIONAL PROJECT MEETINGS
	En	- MULTIPLIER EVENTS
	Cn	- LEARNING/TEACHING/TRAINING ACTIVITIES
	n	- number of the activity

	Project Management
	Intellectual Outputs
	Transnational Project Meetings
	Multiplier Events
	Learning/Teaching/Training Activities
	Dissemination

Please enter all main project activities and meetings, intellectual outputs and related activities, multiplier events and training/teaching/learning activities. Use the reference numbers as they appear in the application form. Where no numbers exist in the application form (i.e. for activities included in project management and implementation), use reference numbers A1, A2 etc. For each activity, meeting or event, indicate the month(s) in which they will be produced/take place by colouring the corresponding cells.

ID		Activity Title	Leading Organis...	Activity Type	Field	Starting Period	No. of Participants	No. of Accompanying Persons	Grant
C1	☑	First IDENTITIES Summer School for Master Students on Interdisciplinarity in STEM education	PANEPI... KRITIS Greece (99958...	SP-HE-IPL Intensive programme for higher education learners	HE	06-2020	20		12,460.00 EUR
C2	☑	First IDENTITIES Summer School for teacher educators on Interdisciplinarity in STEM education	PANEPI... KRITIS Greece (99958...	SP-HE-SHORT Short-term joint staff training events	HE	06-2020	12		9,660.00 EUR
C3	☑	Second IDENTITIES Summer School for Master Students on Interdisciplinarity in STEM education	UNIVER... DE BARCEL... Spain (99998...	SP-HE-IPL Intensive programme for higher education learners	HE	06-2021	20		12,460.00 EUR
C4	☑	Second IDENTITIES Summer School for Teacher Educators on Interdisciplinarity in STEM education	UNIVER... DE BARCEL... Spain (99998...	SP-HE-SHORT Short-term joint staff training events	HE	06-2021	12		9,660.00 EUR
Total							64	0	44,240.00 EUR

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