Negotiating tension points in the Spanish educational system towards a new model for STEM professional learning

A report on the processes and outcomes of the ELITe project Multiplier Event E8

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1. Introduction

The inquiry-based methodology (IBL) has begun to consolidate as one of these options that propose changing the current perspective of teaching. Unlike traditional teacher training, ELITe provides a flexible model of student-oriented teacher development based on inquiry, considering teachers as reflective and responsible professionals for their own learning.

The national policy that currently focuses on teacher competencies is reflected in the "Strategic Framework for the Professional Development of Educators". This is a holistic framework whose objectives are:

> (1) Structure the initial and in-service training of teachers around a new model of competence of 21st century education professionals,
>
> (2) Explore new training modalities that facilitate collaboration between teaching professionals and
>
> (3) Establish a common regulatory framework that allows the certification of professional competence and the certification of activities that demonstrate effective professional development for teachers and trainers.

The framework is composed of three main pillars: Professional teacher competencies (with the aim of redefining the profile of teaching professionals through a competency framework for education professionals, which should allow teachers to develop and evaluate the student competencies); New training modalities: (with the aim of incorporating the learning that is carried out in online practice communities and other innovative learning opportunities in the certified teacher training programs); Regularization of training (related to the update of the regulation on the certification of teacher training around professional competences).

The realization of this Multiplier Event of the ELITe project, has as a general premise to discuss the importance of providing STEM training routes for teachers in service in collaboration with different types of institutions, for example, science centers, research centers, Universities and government initiatives. Because at the level of practice for teachers, there is a surplus of subjects and contents, it hastens to finish the programs, as well as a tendency to use summative evaluation; while for the students, there is a lack of interest in the contents because they do not find connections with reality; and finally, parents need more information about the importance of implementing innovative strategies in the STEM field in schools, in order to participate in decision making in their private centers.

2. Implementation of the event

The fact that academic programs should be updated in terms of content and methods inspired the University of Barcelona to focus on the new STEM content areas, in accordance with regional, national and EU priorities, so it was proposed to address the following issues with participants:

- New emerging STEM content areas
- Strategies for the introduction of socio-scientific problems (based on this content) in the classroom
- Design of good practices based on inquiry learning
- Dealing with gender and STEM education issues, including the role of families

Main questions to be addressed and negotiated by area

The questions were open for participants to solve according to the proposed methodology of the event. In any case, the most important general issues were related to:

- What are the challenges facing the professional development of STEM teachers today?
- How do we introduce social challenges related to STEM as new content in teacher training programs and in school?

Participants

Participant profiles: academic and managerial staff of STEM teacher training programs, professionals, policy makers, representatives of professional development programs, innovators, teachers involved in the implementation of modules, researchers in STEM education, and international academic visitors.

What is the added value for participants to participate in the event?

For academics staff of both pre-service and in-service STEM teacher training programmes, the participation in the event allows to reflect on the necessary update of the course contents, and on the inclusion of new areas in the current programs, or as new optional areas. They also appreciated to be able to be in contact with a European project, as ELITe, and be able to discuss the latest trend in STEM teacher education.

For innovative teachers, they can exchange about the new trends in STEM, representing the voice of practitioners; for policy makers in charge of promoting STEM supporting actions in education is useful for defining new measures supporting these policies, aligning the programs that have been recently started in some themes (as robotics and computational thinking in schools).

Event Structure

1. Plenary Session

a. Presentation of the ELITE framework.

b. Presentation of the platform and modules.

c. Example of good practice

d. Advertise, discuss and select questions for discussion about STEM content areas that reflect current trends and policy orientation

Individual / Group work

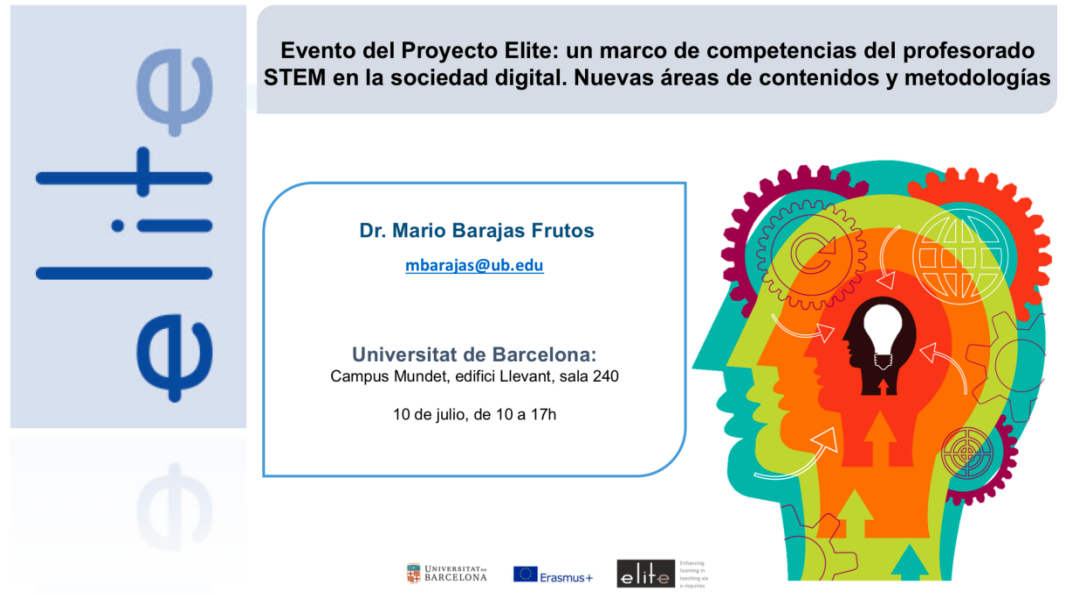
2.1 Announce, discuss and select questions: The invited people selects 2-3 key challenges of STEM teacher education in Spain to be prioritized. The owners of the selected questions hosted the discussion tables.

2.2 Challenging the questions: Participants from each group are invited to challenge the host of the table, and different facets of the question are explored

2.3 What is missing? The objective of the participants is getting the whole picture of the issues, redefining and deepening the discussion on the question.

3. Plenary session: What did we learn? What are the possible actions?

Event invitation



Work plan

Planning, networks and commitment		
	Helpful to achieving objectives	**Harmful to achieving objectives**
Internal	- Clear picture on the stage and the objectives of the event. - Ready material - Great interest from all those interested in the thematic areas of STEM to discuss - The date is appropriate since there are no academic duties.	- Variety of profiles of the participants. - Intensive preparation -Strong event time management.
External	Great interest from all those interested in the thematic areas of STEM to discuss In principle the timing is appropriate since there are no academic duties.	The fact that not all participants will be face to face (some participated via Skype)

ELITe project presentation

Work agenda

3. Documentation of outcomes of the negotiation process

3.1 SWOT for the adoption/adaption of the ELITe approach in STEM CPD in Spain

		STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
	Contextual dimension				
Dimensions & components of the ELITe framework negotiated in the ME	Critical factors	The new educational policies (such as the organic law for the improvement of educational quality) focuses on the development of teachers competences The curriculum is now organized according to a competency	There is some tiredness from teachers facing the continuous legal changes and also dealing with short budgets in education. The lack of examples of good practice in IBL applied to STEM CPD programmes	The STEM practice is more content oriented and less on methodology, more on instrumental areas and less on optional subjects. There is an increased demand for CPD courses for in-service teachers, as well as for the access to the teaching profession are common More and more news in the media about improving scientific literacy	As a result of political instability and lack of consensus, the application of new educational policies is delayed and giving a sense of instability Lack of funds and support for modernizing the academic programs The attitude of teachers is not

		approach, in which knowledge, skills and attitudes have been identified in all subjects and at all levels. The STEM teacher education programs at Universities are now organized according to competences			proactive in terms of agency.
	National requirements	The possibility of being able to establish a common regulatory framework that allows the certification of professional competence and the certification of activities that demonstrate effective professional development for teachers and trainers.	The lack of structure for initial and in-service teacher training around a new competence model of 21st century education professionals.	ELITe explores new training modalities that facilitate collaboration between teaching professionals, as well as online training opportunities	In current policies, teachers have a surplus of subjects and content that hardly allows an effective teacher training and skills development plan.
	Methodological dimension				
		STRENGTHS	**WEAKNESSES**	**OPPORTUNITIES**	**THREATS**
	CPD under IBL	IBL provides deep and active knowledge and understanding of the subject; as well as pedagogical and curricular knowledge.	Low adaptation of the methodology to educational contexts.	Contextual, institutional, organizational aspects of educational policies, inclusion and diversity issues are now on demand by teachers; Teachers demand effective use of technologies in learning	Lack of solidity in the planning, management and coordination of education
	Process indicators	Flexibility; commitment to promote the learning of all students;	Little willingness to work as a team and encourage student participation.	Acquisition of transversal competencies, such as critical thinking, diversity management, creativity and communication skills.	Do not contemplate the development of cognitive skills within the teacher training plan.
	Links between IBL and competences	Regulation of training (related to the update of the		Establish a common regulatory framework that allows the	The lack of willingness and resources of the

		regulation on the certification of teacher training around professional competences).		certification of professional competence and the certification of activities that demonstrate effective professional development for teachers and trainers.	institutions to explore new training modalities that facilitate collaboration between teaching professionals.
	Thematic dimension				
		STRENGTHS	**WEAKNESSES**	**OPPORTUNITIES**	**THREATS**
	Thematic areas	The development of the thematic areas considered responds to the need to introduce the DojoIBL learning environment that allows STEM teachers to address the basic principles for organizing and managing teaching-learning according to the IBL methodology.	Lack of interest in the appropriation of innovative methodologies that address the proposed themes for the development of teacher training if they do not succeeds in the classroom.	In this sense, STEM teachers are expected to develop knowledge, skills and attitudes about the use of new methodologies in the classroom. The provision of ready-made materials is a plus for the teacher training programs	
	Sample digital scenarios	Teachers have found in the scenarios under IBL methodology a good way to achieve active and constant student participation.	Poor students' performance could limit confidence in the participants and the scope of the expected result.	The development of strategies that change the regular class schedule allows students to become more involved in their learning process and the experience could be positive.	Neglect the development of critical thinking and the lack of solid arguments on the part of students to encourage group work.
	Outcome dimension				
		STRENGTHS	**WEAKNESSES**	**OPPORTUNITIES**	**THREATS**
	Outcome indicators Self-evaluation tool	Teachers show a clear interest in the development of new teaching methodologies for improving students' learning and for having more interest in STEM. They seek to remain informed about the possibility of professional training that provides them with	Some teachers might not be willing to provide arguments or be decisive in the use of innovative teaching models. It can also be seen that not all participants have openness to share their experiences and opinions to improve the	The scope of the exploration of the Spanish context is to identify the intervention space to support the professional learning of STEM teachers for the development of teaching skills using the DoJo platform and the resources created	

		the necessary tools to meet the current requirements of the students.	current education system.		

3.2 Critical issues for the adoption/adaption of the ELITe approach in STEM CPD

At the end of the event, a questionnaire was filled in by 25 attendees (63% of participants) to know their perception about the ELITe model in reference to their professional practice, the results were useful to analyze the general perceptions after the presentation and discussion of the topics. The teachers' responses built a list of key points that must be considered for further analysis and evaluation of the ELITe model.

- The need to train teachers in digital skills, especially to those who lack experience and have resistance to change.
- A better alignment between new digital tools and learning needs of current students.
- Coordinate training actions with regional educational initiatives related to STEM (e.g. STEMadrid, STEMCAT, STEAM Euskadi, etc)
- Establish an effective system of professional training so that teachers are updated on IBL and other active approaches to learning.
- Use of tools and digital platforms for training with didactic elements.
- Organization and policies that help to the inclusion of technology in educational centers.
- Development of new methodologies, apart from IBL, that include innovative learning strategies, as PBL, design thinking, etc.
- Sensitize teachers about the need to improve current teaching strategies and systems throughout press campaigns, science fairs, etc
- Inform teachers about the benefits of using a system as the one in ELITe to increase students' learning outcomes, and interest in STEM
- Specify how to improve teaching practice according to the subjects.
- Know how to adapt the contents and curriculums of the subjects to the IBL platform.
- Awareness raising of the specific benefits for teachers and students of implementing the IBL methodology for STEM
- Establish clear criteria for implementation strategies by STEM subjects (since not all are the same).
- Establish compulsory CPD programs for teachers, so no one is left back and teachers can work as prepared teams
- Better combine the relationship between the current educational curricula organization, and the proposed IBL methodology.

4. Results of the validation questionnaire

{Please report results of the validation questionnaires, in the dimensions of: relevancy of the ELITe approach; Usefulness of the resources produced; feasibility for adoption/adoption; challenges for adoption/adaption – see table below on the questions/items of the validation tool that address each dimension. This section will feed the Validation Section of IO8}

						Relevance			
Participante	Género	Institución	Edad	Experiencia profesor	Experiencia formador	1a	1b	1c	1d
1	F	UB	45	17	4	5	4	1	1,4,5,6,
2	M	MIPE	36	7	0	5	3	5	1,2,5,6,7
3	F	MIPE	29	2	0	3	4	4	2,3,6,8
4	F	CONSELL ESCOLAS DE CATALUN	52	19	8	5	4	5	3,4,5
5	M	UMUB	38	5	4	4	5	4	4,7,8
6	F	UB	43	13	0	3	5	2	1,3,6,7
7	F	UB	39	11	0	5	5	3	3,4,5,6
8	F	MIPE	48	12	0	3	4	4	2,7,8
9	F	UB	41	6	6	4	5	5	3,5,6,8
10	F	MIPE	40	7	0	3	3	4	1,2,4,7
11	F	UNIVERSIDAD DE LOS LAGOS	34	3	2	5	4	5	2,5,6
12	F	MASTER DE PROFESSORAT	33	6	0	2	5	3	3,4,5,6
13	F	UNIDAD DE INNOVACIÓN EDUCAT	45	17	14	5	3	4	2,6,8
14	F	MIPE	40	18	0	3	5	5	4,5,7
15	M	MIPE	44	22	0	4	3	5	2,6,7
16	F	DOE	35	13	7	5	3	4	1,2,6,8
17	F	CREATIC	38	14	9	5	4	2	2,5,7
18	M	ESCOLA SANTÍSSIMA TRINITAT	47	15	12	4	3	5	1,3,6,7
19	F	INS RIBERA BAIXA	38	13	8	5	5	4	1,2,4
20	F	ESCOLA SANT JOSE	43	7	4	4	5	5	4,6,8
21	F	ESCOLA SANT JOSE	42	8	0	5	3	3	2,5,7,8
22	F	L'EXTRA ESPAI EDUCA	51	22	6	3	5	2	1,2,5,6,7
23	M	UNIR	34	10	0	5	3	5	1,3,6,7
24	F	COLEGIO SANTO ANGEL	39	8	0	4	5	5	2,5,7,8
25	F	URG	40	6	2	3	3	4	1,2,5,7
			40,6	11,24	3,44	4,08	4	3,9	4,5,7,8
					Average:	4,01			

Utility							Viability									
2a-I	2a-II	2a-III	2b-IV	2c-V	2d-VI	2d-VII	3A-I	3A-II	3BA-III	3BA-IV	3BA-V	3BB-VI	3BC-VII	3BC-VIII	3BD-IX	3BD-X
5	5	5	4	5	4	5	5	4	4	5	3	4	5	4	4	5
5	5	1	5	5	4	5	3	4	5	3	5	4	5	5	5	3
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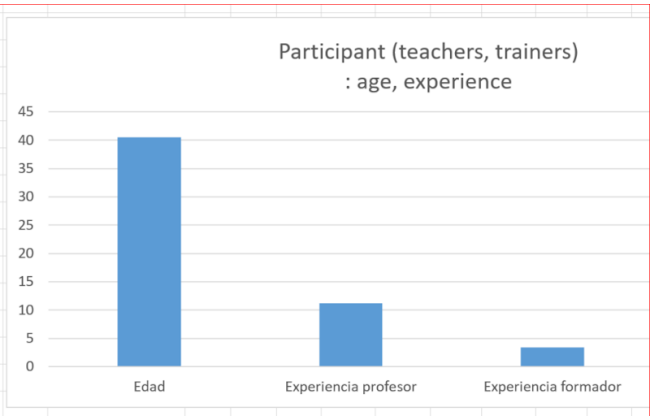
3	4	5	4	5	4	4	5	5	2	4	2	2	5	4	5	4
4,24	4,52	4,2	4,4	4,08	3,56	4,2	4,24	4,3	4,08	4,2	4,16	4,12	4	3,96	4,28	4,12
				Average:		4,17							Average:		4,147	

MALE	5
FEMALE	20
RELEVANCE	4,01
UTILITY	4,17
VIABILITY	4,14

PREFERENCE BY THEMES	PEOPLE
1	10
2	14
3	8
4	10
5	13
6	15
7	15
8	9



5. Policy recommendations – added value

Policy recommendations can be divided into three levels: a) National and Regional educational authorities; b) Responsible of University STEM preservice teacher training programs; c) Institutions involved in STEM CPD training programs

National and Regional educational authorities

As with respect to the first one, it is important that the initiatives involving STEM consult with all societal stakeholders and institutions in charge of preservice teacher training and CPD programs. This is important for awareness raising on the need to update contents, renew teaching and learning methodologies, and support of teachers in this effort. This will allow to make visible this need and introduce in the discussion parents associations, science centers, private companies providing real scenarios about socio-scientific issues, e.g. climate change, transition to clean energies, health issues, gender and STEM, etc., meaning STEM contents that connect learning and society. In these sense the initiatives taking in Spain in the area of STEM education in the whole educational system, and in society, are a good scheme for integrate ELITe approaches within the actions for updating STEM in-service teacher training. The contents proposed by ELITe were well accepted, as well as the IBL methodology, both as a training methodological approach and as a learning strategy most adequate for STEM.

Responsible of University STEM preservice teacher training programs, and university trainers

As with respect to responsible people of University STEM preservice teacher training programs, including teacher trainers, the issue most present in the event was to make compatible a the current STEM official training programs that depend on the universities and have been approved by the national educational authorities. Assuming that these programs allow for proposing optional courses, a possibility is to introduce new courses (or modules, depending on the number of ECTS credits), which include socio-scientific issues of interest for both trainers as students.

Another option was the fact of include the ELITe approaches within the courses currently running. For this to happen, there should be a negotiation process with trainers, and within the limits imposed by the national laws, for redesign these courses, or use ELITe contents as examples of innovations and good practices.

In all cases, since the official course are designed according to a competence model, is the very important to reinforce those competences already in the programs with those proposed within the ELITe courses in order to make them compatible.

Institutions involved in STEM CPD training programs

These institutions maintain a greater flexibility in terms of defining CPD courses, which mean that are very appropriate as a target for ELITe innovations and with those courses that are new in content and methodology. These institutions however need to make an effort for the ELITe-type contents provided in their offer, being supported and recognize by the regional authorities who are the ones who can certify these courses.