Enhancing learning in teaching via e-inquiries

Supporting STEM teachers' professional learning for competence development

Insights on the space for intervention in *Greece*

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The background

Science, Technology, Engineering and Mathematics (STEM) teachers' competence development is currently a prevailing area of EU policy discourse focus, in the view of the challenging roles of STEM teachers to equip future citizens to apply scientific knowledge and skills so as to form evidence based opinions (EC, 2015).

In Greece, the pedagogical and professional training of secondary educators (among them STEM teachers) has been a longstanding issue (Sarakinioti & Tsatsaroni, 2015). Recently, the discourse articulated at EU policy level on improving teacher quality and teacher education has been one the basic drivers of educational change. The issue of improving teachers' competences is inscribed in both the rhetoric of contemporary political discourse on education (expressed for example in the frame of the establishment of the "Certificate of pedagogical & teaching competency for secondary teachers"), and the recent attempted reform initiatives (New school and Social school reforms).

Against this background, this document aims to provide insights on the the space of intervention for supporting STEM teachers' professional learning for competence development in the Greek educational context. Presented are results of work conducted in the frame of the ELITe ERASMUS+ project[1] pertaining to the investigation of the following questions:

- Which are the ***competences required*** from STEM teachers in Greece, as evident explicitly in policy documents and teachers training curricula, and implicitly in students STEM curricula?
- Which are the ***systemic opportunities and challenges*** for supporting STEM teachers' professional learning for competence development in Greece?
- How could we ***take advantage of the opportunities and how could we address the challenges*** towards ensuring STEM teachers capacity building?

The questions were investigated through an analytical perspective between context and policy intentions, and a negotiation process between policy mediation and practice.

Presented results aim to serve as a basis under which education stakeholders can reflect on and consider how best to support STEM teachers' professional learning for competence development in the country.

[1] **ELITe - Enhancing Learning in Teaching via e-inquiries** (2016-2019) is a European project, financed by the ERASMUS+ programme of the European Union Key Action 2 – Agreement No. 2016-1-EL01-KA201-023647.

ELITe aims to support STEM teachers' professional learning for competence development via inquiry methodology. For more information visit the project website: ***learning-in-teaching.eu***

STEM teachers' competences in Greece: Requirements & identified issues for consideration

A review of Greek policy documents, STEM teachers training curricula and students' STEM curricula under the EC (2013) framework resulted to the identification of the competences required from Greek STEM teachers, ***explicitly*** (as environed by policy and implemented by policy mediation), and ***implicitly*** (as demonstrated in students curricula), which are presented here below. The ***most emphasized aspects*** of competences in the policy documents are highlighted.

Requirements for STEM teachers' competence development in Greece

Knowledge & Understanding required…	*explicitly*	*implicitly*
Subject matter knowledge		○
Pedagogical content knowledge		○
Pedagogical knowledge	○	○
Curricular knowledge	○	
Educational science foundations	○	
Contextual, institutional, organizational aspects of educational policies	○	
Issues of inclusion and diversity	○	○
Effective use of technologies in learning	○	○
Developmental psychology	○	○
Group processes and dynamics, learning theories, motivational issues	○	○
Evaluation and assessment		○

Skills required …	*explicitly*	*implicitly*
Planning, managing and coordinating teaching	○	○
Using teaching materials and technologies	○	○
Managing students and groups		○
Monitoring adapting and assessing teaching/learning objectives and processes	○	
Collecting, analyzing, interpreting evidence and data for professional decisions	○	
Using, developing and creating research knowledge to inform practices	○	
Collaborating with colleagues, parents and social services		
Negotiation skills (social and political interactions with multiple educational stakeholders, actors and contexts)		
Reflective, metacognitive, interpersonal skills for learning individually and in professional communities	○	
Adapting to educational contexts		

Dispositions & Attitudes required …	*explicitly*	*implicitly*
Epistemological awareness	○	
Teaching skills through content		○
Transferable skills		○
Dispositions to change, flexibility, ongoing learning and professional improvement, including study and research	○	
Commitment to promoting the learning of all students	○	○
Dispositions to promote students democratic attitudes and practices as European citizens	○	○
Critical attitudes to one's own teaching	○	
Dispositions to team working , collaboration and networking	○	
Sense of self-efficacy		

Prominent ***issues for consideration*** pertaining to systemic educational levels that were identified from the review of the Greek national context through the documentary analysis include:

At policy level, STEM teachers' competence development is currently a prominent issue in the policy agenda as a warrant of quality in education, in line with the priorities of the EU policy agenda for education and training. Major aspect of teacher competences (knowledge & understanding, skills, dispositions & attitudes) as defined in EC (2013) framework are emphasised in national policy documents.

At policy mediation level (teacher training provisions), recent legislation concerning secondary teachers' pedagogical competence is at an early stage of implemeмation by university departments. Currently, there seems to be a lack of coherence between was is envisioned in policy rhetoric and what is evident in teacher training curricula.

At practice level, there seems to be a high level of coherence between the competences required by teachers as expressed at educational policy level, and the competences that students are aimed to develop through STEM studies.

Overall, the main challenge identified in respect of STEM teachers' competence development in the country lays on the grounds of policy mediation, i.e. on how teacher education institutions and providers implement policy envisions and requirements.

Emergent systemic opportunities and challenges for supporting STEM teachers' professional learning for competence development

The results of the exploration of the nation context through the documentary analysis were communicated and negotiated with 30 educational stakeholders (responsible for STEM teachers' training and STEM teachers), in the course of the ELITe's project Greek multiplier event[2]. The aim of the event was to validate the results of the documentary analysis, and to gain insights from policy mediation representatives and practitioners on how to support more effectively STEM teachers' professional learning for competence development.

[2] The ELITe project multiplier event E1 took place in June, 2017 in Heraklion, Crete.. The event was conducted under the EASW workshop methodology, which *allows for interaction between stakeholders* and *aim for consensus building rather than instructional approach &* the Group Concept Mapping methodology. A report on the event can be found in: **learning-in-teaching.eu** (→ Outputs→Intellectual Output #3)

In the course of the negotiation process, the responsible for STEM teachers' training emphasized the opportunities rather than the challenges in the country to support teachers' professional learning (organized by the ministry of education, University Departments, STEM teachers' advisors, EKFE, research institutions in the frame of EU funded projects). The important role of mediation, connection and cooperation among policy and practitioners was highlighted. *The main challenge identified by teacher trainers was the lack of an overall framework STEM teachers' professional development*.

The practitioners (*STEM teachers*), on the other hand, focused more on the challenges for professional learning in the country. While they agreed with teacher trainers on the provided opportunities, *they emphasized that there are issues with accessibility, and with the content and the methodology of training activities*. Teachers emphasized *the lack of motivation* and *the lack of culture for change and for lifelong learning*.

An outline of the emergent systemic opportunities and challenges for STEM teachers' professional learning from the perspectives of stakeholders ***responsible for designing and delivering STEM teachers' training activities and of practitioners*** is presented here below:

	STEM teachers' professional learning for competence development	
	Opportunities	**Challenges**
From the perspective of policy mediators	➢ Programmes for teacher training provided by University Departments (Master and PhD programmes) ➢ Programmes for enhancing teachers pedagogical knowledge provides by ASPAITE ➢ Opportunities for professional development in the course of EU funded projects ➢ Seminars conducted by STEM teachers' advisors ➢ Seminars conducted by EKFE ➢ Courses for professional development provides online ➢ Science educational festivals and competitions ➢ Professional development activities delivered in the course of 2nd level TPD: Training of teachers for the exploration and implementation of digital technologies in the teaching practice	➢ STEM teachers' training is fragmented without an overall framework on which trainers can be based on ➢ Organizational challenges for coherent CPD activities among various providers ➢ Financial issues ➢ Training is on volunteering basis and it is not compulsory

From the perspective of practitioners	➢ Seminars conducted by STEM teachers' advisors ➢ Seminars conducted by EKFE ➢ Professional development activities delivered in the course of 2nd level TPD: Training of teachers for the exploration and implementation of digital technologies in the teaching practice ➢ Online courses organized by research centers (for example "mathesis") ➢ Master programmes at the Universities' STEM Departments ➢ Conferences on science education & didactics ➢ Opportunities from international organisations (CERN, ESA) ➢ Open resources in the web (best practices and teaching/ learning resources)	➢ Limited access for current professional development opportunities (not everywhere and not from everyone, for example not for teachers from private education) ➢ Issues of time ➢ Financial issues ➢ Luck of motivation for participation in CPD ➢ Luck of a culture for change and for lifelong learning ➢ Difficulty to implement what has been learned in the teaching practice mainly due to curriculum constrains ➢ Need for modernization of the theoretical subject and the methodology of delivery of the training activities

As an outcome of the negotiation process, identified were the following **critical factors that affect STEM teachers' professional learning for competence development** in the country:

- ***Lack of effective communication of policy priorities to policy mediators and practitioners***

  The review of the national policy documents provides evidence that teachers' capacity building is seen as an essential component of recent and current reforms for improving quality in education. Efforts for the establishment of a regulatory framework for teachers' competence development are also evident in the country. However currently educational reforms seem to remain at the level of policy rhetoric, and have not yet introduced at policy mediation level. A need for better coordination between educational policies and actors responsible for teacher training is needed. In addition, measures and incentives for boosting practitioners' motivation to participate in continuous professional learning activities are required.

- ***Fragmentation of training provisions & lack of coordination between policy mediation actors (providers of STEM teachers' professional development)***

  Initiatives to support STEM teachers' professional development are in place in the country, for example programmes organized by University Departments, ASPAITE, regional Peripheral Educational Centers, School Science advisors. The initiatives though are fragmented, and there is a lack of partnerships that could foster networking, practice-sharing and programmes co-development towards the common goal of teachers' capacity building.

- ***'Top-down' approach for teachers' professional development rather than a 'partnership approach'***

  Good practice in teachers' professional learning increasingly propagates the adoption of 'learning communities' paradigm. In this model, teachers along with families, informal science providers and community stakeholders are engaged in ongoing work and dialogue together to share knowledge and expertise. Initiatives for such learning communities' partnerships are rare, while more bureaucratic top-down approaches to teachers' professional learning are in place.

- ***Continuous professional development for STEM teachers is in practice optional and there is a luck of culture for lifelong professional learning***

  Although the complexities of the teaching profession require a lifelong learning perspective to adapt to fast changes and evolving constrains and needs, in-service training is not mandatory. As emerged from the negotiation process in the ELITe workshop, access and financial resources are limited and there is luck of culture for lifelong learning from practitioners.

- ***Current teacher training provisions are not aligned with practitioners learning needs in respect to practice requirements – both from content & appropriate training methodologies perspectives***

  As an outcome of the negotiation process in the ELITe workshop, concerns were raised by STEM teachers on current teacher training activities in terms of: the content focus, the content delivery methodology, the duration of training, and the opportunities for active learning and co-learning between teachers from various disciplines. The need for modernization of teacher education provisions so as them to enable informing teaching practice was emphasized.

Policy recommendations towards supporting STEM teachers' professional learning for competence development

The defined opportunities and challenges presented above, and the identified critical factors were discussed in the course of the ELITe's project multiplier event in mixed groups of policy mediators and practitioners, under the scope of suggesting proposals for enhancing STEM teachers' learning provisions.

The understandings gained from this process facilitated the formulation of ELITe's project recommendations on how to support Greek STEM teachers' learning for competence development, aligned to the emergent critical issues, which are presented here below:

1 Enhancement of communication of policy priorities, towards facilitating policy implementation and policy ownership from teacher trainers and practitioners

Indicative actions proposed: The establishment of an overall framework for in-service & pre-service STEM teachers' competence development is a first step for ensuring coherence between policy expectations and policy implementation. Towards policy ownership from teacher trainers and practitioners, there is a need to ensure participation of teachers' education and school education stakeholders in decision making processes, for example by setting up mechanisms for providing feedback on implemented policies.

2 Promotion of partnerships among STEM teachers' education providers that can foster networking, practice-sharing and programmes co-development for supporting teachers' capacity building

Indicative actions proposed: Actively involve policy mediators in policy debates to help co-shape strategies at national and regional levels. Support the co-creation of innovative curricula for STEM teachers training with defined learning outcomes for competence development involving various providers of STEM teacher education.

3 Develop a 'partnership approach' under the 'learning communities' paradigm for professional learning within schools in which parents, informal science providers and community stakeholders become real partners in school life

Indicative actions proposed: Open-up schools to communities, value non-formal and informal learning, support pilot projects which help develop the capacity for greater school-family and school-community partnerships.

4 Ensuring that continuous professional development and learning becomes a requirement and a right for all teachers throughout their teaching career

Indicative actions proposed: Ensure adequate resourcing and facilitate access by developing the supply side to enable leaning by anyone and anywhere, exploiting the potential of digital technologies. Creating a culture of leaning by increasing learning opportunities at school level and regional level, raising participation levels and stimulating demands for learning.

5 Modernizing STEM teacher training provisions from content and methodology perspectives

Indicative actions proposed: Gain insights into the needs of the learners, along with the learning needs of schools and communities. The role of innovative training methodologies – as a means towards supporting teachers' competence oriented objectives - should be re-considered by teacher training institutions.

The above recommendations are aimed to provide the basis for the establishment of a dialogic process between policy, policy mediation and practice, towards a renewed approach and curriculum for STEM teachers' professional learning.

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