

Image: NASA

Implementing and measuring quality in STEM teacher Professional Development

A route to leading improvements in STEM education. Ready-to-use guides for:

- High Quality STEM Professional Development
- Culture, Equity and Diversity in the STEM classroom
- How to measure the impact of a Professional Development activity

STEM is the acronym for Science, Technology, Engineering and Mathematics. The aim of this document is to provide policy makers and STEM Professional Development Centres (PDC) with information that can inspire to improve STEM Professional Development (PD) by strengthening existing, or developing new, methods and activities.

Focusing on how to raise awareness concerning aspects of quality and diversity in STEM PD this document presents a summary of contemporary research and examples of best practices in a ready-to-use way.

When striving towards better quality in STEM PD it is important to also consider what measures are necessary to take for the everyday practice in respect to impact factors

concerning culture, equity and diversity. Parallel to this the question on how to evaluate the quality in the STEM PD projects and activities is important to address.

The here presented three overviews are results of the work within the STEM PD Net Erasmus+ project. The full versions of the documents you will be able to find and download from the STEM PD Net website.

<http://stem-pd-net.eu/en/project/>
<http://stem-pd-net.eu/en/pd-materials/>

There you will also find them in different languages to support collaboration across country borders.

The STEM PD Net website is a rich source!

Within the Erasmus+ Project ‘European Network of STEM Professional Development Centres’ partners from 14 organisations, who are involved in STEM professional development activities all over Europe, have worked together to produce different support materials.

So, if you are representing an actor group, a company, an organization or a STEM related PD provider of any kind these materials can be valuable for both the development of your own work, policy making and the opportunities for cooperation with others.

Ready-to-use guide for HQ STEM PD

What constitutes high quality (HQ) STEM professional development?

Building on a review of academic research literature and the Erasmus+ STEM PD Net partners experiences the guide for HQ STEM PD present concrete examples on how to set up criteria that should be both (a) easy to apply in daily STEM PD contexts and (b) challenging to initiate reflection about and beyond STEM PD.

The guide is not explicitly offering the only way to successful STEM PD. Rather, it offers opportunities for reflection. In particular, it aims to set an impulse to reflect on relevant criteria regarding STEM PD on a high-quality level.

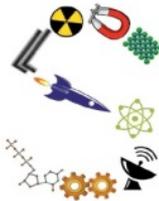


Image: U.S. Department of Energy

In this guide, quality criteria are divided into two main categories-

Firstly, within the category **PD centre** quality criteria refer to the levels of

- philosophy,
- learning
- organization,
- resources,
- networking, and
- evaluation.

On each of these levels, several questions can be discussed. For example: What does it mean for a PD centre to be a learning organization? What vision leads the PD centres’ aims and actions? How can methods of evaluation improve the PD centres’ practices?

Secondly, within the category **PD offer** quality criteria refer to

- the levels of competence,
- methods and
- sustainability.

On the structural level, STEM competences and relevant phases of PD offers are in the focus. The methods level encompasses questions about participants’ needs and concrete didactical methods. Issues of long-term impact and participants’ empowerment are provided within the sustainability level.

In day-to-day practice, it might be challenging to fulfil each of these quality criteria. However, reflecting on relevant quality criteria on both theoretical and practical level can support the development of high quality STEM PD.

This guide aims at supporting these practices and reflections.

Culture, Equity and Diversity in the STEM classroom – a ready-to-use guide

Diversity reflects intersecting patterns of how key demographic factors like race, gender, and social class are situated inequitably in our society.

This catalogue of possibilities offers a collection of useful practice-oriented research literature (short summaries and references) and provides insight into individual learning experiences.

The aim is to inspire policy makers, different actors and STEM Professional Development Centres all over Europe to explore ways how to improve science, technology, engineering and mathematics education to engage increasingly diverse learners.

A diverse society is a source of inspiration and thus diverse learners in a classroom are an advantage, not an obstacle, for good STEM teaching. STEM education provides a wide range of opportunities for all students and every learner should have equal opportunities to access it.

The recent OECD PISA 2015 results has also shown that this is an important issue to handle, not at least for helping disadvantaged immigrant children to reach better knowledges and skills.

Therefore “dealing with diversity” by meeting the needs – and using the assets – of a diverse range of students with different cultural backgrounds and experiences, as well as the different interests of boys and girls, are important factors for motivating students to learn.

In the same vein STEM PD Centres all over Europe are expected to accept the challenge and offer research informed professional development courses which are not only particularly designed to address issues of diversity in the STEM classroom, but they have to include diversity sensitive teaching and learning as a generally valid principle into all their training activities.

This catalogue represents a collection of useful, practice-based research literature addressing various aspects of diversity relevant in STEM education settings. Short summaries and reference are grouped into categories so that one can use this information as a starting point to dig deeper into a particular field of research. It is designed to offer insight into practice-oriented research and does not aim to be complete. We offer a range of possibilities to deal with diversity issues from different perspectives.



Image: unclclkt

How can we measure the impact of a PD activity? Ready-to-use guidelines.

When training practices need to respond to rapidly changing technological and social structures, professional development is the main means of meeting this challenge. Strong information is needed to make careful decisions on how to change direction.

In order to achieve effective professional development, it is necessary that its activities are directed in a specific direction in order to achieve a specific objective, that is measurable.

This guide presents methods and discussions for how to evaluate and analyze STEM professional development. It is designed to assist

- professional development coordinators,
- administrators at all levels,
- instructors, and
- other interested practitioners

in the development and implementation of ongoing evaluations of professional development activities.

Efficiency must be measured by the extent to which professional development fulfills the objectives it intends to achieve. Expressing and agreeing on clearly defined goals is important. What examples of specific goals in professional development can help teachers become more

proficient in teaching science, technology, engineering and mathematics?

Among the specific examples described you will be able to:

- understand what a successful professional development is,
- plan, identify indicators for change and assess PD through different methods,
- find illustrative, measurable and achievable professional courses and other PD activities,
- see how assessment can affect PD at different levels,
- find how to determine the implication itself at the given level.

For each method the guide gives an overview, a description of how to use the method including pragmatic tips on the details as well as a pro and con discussion.

Summing up, by offering a rich catalogue of different evaluation methods and analyzing them from the perspective of their practical use this guide is a real help for all actors involved in professional development.

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