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The PREFAM project: towards the European framework for continuous professional development in precision engineering for advanced manufacturing

Dishi Phillips¹, David Billington¹, Enrico Savio², Anna Serbati², Silvia Azzolin², Liam Blunt³, Katie Addinall³, Dominiek Reynaerts⁴, Jun Qian⁴, Francesco Giuseppe Biondani⁵, Giuliano Bissacco⁵, Jan-Willem Martens⁶, Pieter Kappelhof⁷, Stefan Sinzinger⁸, Katja Richter⁸

¹European Society for Precision Engineering & Nanotechnology (euspen), Cranfield, United Kingdom, ²Universita Degli Studi Di Padova, Padova, Italy, ³University of Huddersfield, Huddersfield, United Kingdom, ⁴Katholieke Universiteit Leuven & Member FlandersMake, Leuven, Belgium, ⁵Technical University of Denmark (DTU), Kongens Lyngby, Denmark, ⁶Dutch Society of Precision Engineering, ⁷Hittech Group, The Hague, Netherlands, ⁸Deutsche Gesellschaft für angewandte Optik (DGaO), Erlangen, Germany

dishi-phillips@euspen.eu

Abstract

The need to develop a European framework for training in Precision Engineering for Advanced Manufacturing was identified and implemented by the creation of the PREFAM project. Led by euspen, the project is supported with six renowned partners across Europe to increase the availability and recognition of short specialised training courses. This project will support course providers with guidelines and tools that are aligned to the European approaches and instruments for course design and learning assessment, as well as monitoring and improvement processes. The innovation of pedagogical approaches to learning will allow course providers and participants to recognise and promote their skills and competencies thus reflecting their wider knowledge of precision engineering. The systematic approach based on eight key deliverables is intended to support the precision engineering community with added quality assurance. By offering a standardised framework of training courses and guidelines, to monitor learning gaps and create new learning pathways for users and course providers, PREFAM will support the needs and sustain the pan-European market.

Precision Engineering, Advanced Manufacturing, Training, European Framework

1. Introduction

The EU manufacturing sector accounts for 2 million companies and 33 million jobs; it is the source of 15 % of EU GDP, 80% of our exports and 2/3 of investment in R&D. The Factories of the Future Roadmap of EFFRA – “Factories 4.0 and Beyond” has identified some key technologies and enablers for Excellence in Manufacturing, in particular for High precision manufacturing, Zero-defect manufacturing and Innovative production technologies. Strong emphasis is given to the human factor and the needs to support training/re-skilling people working in highly specialised domains. A key competence area for advanced manufacturing is Precision Engineering (PE), which is indispensable for advanced product/process engineering in B2B customer-supplier interactions. Precision engineering includes both multidisciplinary study and the practice of high accuracy engineering, metrology, and manufacturing of high precision machines, instruments and components.

The general aim of PREFAM is to support continuous professional development in PE in a European perspective, by offering high-quality learning opportunities to individuals with specialised competences to strengthen their employability and personal development in strategic industries. The main target group are industry employees who need to keep their skills up to date and in line with the precision industry requirements. In most cases, they hold an engineering degree and/or have gained some level of competence in PE related topics while working. Other groups that could as well benefit are PE newcomers and

teachers in mechanical and mechatronics subjects but with limited access to advanced courses in PE.

2. Aims of PREFAM

The general aim of this three year project is to fully develop a European framework for training in PE for Advanced Manufacturing and to increase the availability and recognition of specialised trainings in multiple European countries. The main focus is the valorisation and improvement of existing trainings, in addition to the development of new ones.

The overall strategy for project implementation is based on sharing national/international experience on excellence in training for PE as a common and strong basis to design, implement and test the innovative outputs.

This project joins innovation efforts towards EU-wide availability of training in PE, including recognition of qualifications and developing of learning outcomes, assessment criteria and innovative content, to be then implemented and tested at different levels.

Results include an integrated platform for one-point open access to the EU-wide training programme, good practice for developing new course content, and procedures for monitoring quality of existing and future courses and new courses on softskills, Additive Manufacturing for Precision Engineers, Precision Manufacturing, Machine Tool Metrology and Surface Metrology.

The key objectives are:

1. Define a strategy and guidelines for learning success design and evaluation.
2. Develop procedures for course management and monitoring in a European dimension.
3. Produce good practice guides for new courses development, including hands-on activities and innovative teaching methods.
4. Design, develop and validate new courses based on market requirements.
5. Monitor new training opportunities and new needs for precision engineers.

3. Project implementation and key deliverables of PREFAM

The overall methodology and the general workplan for the achievement of the project objectives and delivery of the planned results are split into the following eight Intellectual Outputs:

- O1 European framework for training in Precision Engineering*
- O2 Strategy and tools for learning success design and evaluation*
- O3 Procedures and tools for course management and monitoring*
- O4 Good practice guide and new courses on Entrepreneurship and Additive Manufacturing for Precision Engineers*
- O5 Hands-on training in multiple locations on Precision Manufacturing*
- O6 Short online taster courses and Summer courses on Machine tool metrology and Surface Metrology*
- O7 Integration of other European trainings in Precision Engineering within the ECP2 framework*
- O8 Monitoring of training opportunities and new needs for precision engineers*

4. Outlook

This three-year project PREFAM adopts a systematic approach and involves a wide consortium including relevant actors, both from universities and from industrial societies in Precision Engineering. The Università degli Studi di Padova, Danmarks Tekniske Universitet, Deutsche Gesellschaft Für Angewandte Optik, Dutch Society For Precision Engineering, KU Leuven and University of Huddersfield, led by Euspen, collaboratively contribute to the achievement of project outcomes. The dialogue between academia, organisations and training providers assures a well-balanced approach which fine-tunes the needs of diverse actors to create a framework for continuous professional development in PE in a European scenario. The partners, adopting the perspective of participatory research and practice as well as full collaboration, are developing the resources towards establishing models to design, monitor, innovate and recognise courses and training programmes in Precision Engineering.

In particular, PREFAM is developing tools, instruments and guidelines to accompany providers, trainers and learners in maximising their professional and learning experience within courses and training programmes.

Guidelines and tools are framed in the international literature for training design, delivery and evaluation (Anderson & Krathwohl, 2001; Biggs & Tang, 2007; Steinert et al., 2008; Kirkpatrick, 1998).

Drafts of materials are shared amongst all partners for feedback and to assure sustainability of their application to practice. This

project also aims at transforming and improving current practices, therefore it is the common interest to align tools with needs of trainers and trainees.

The approach to training design is aligned to European frameworks for identifying competences, skills and knowledge of Precision Engineering; the clear definition of each course learning outcomes is one of the key outputs of the project.

A strong emphasis is given to the innovation of pedagogical approaches adopted by trainers, based on the assumption that active learning (Freeman et al., 2004) increases learners' performance in science, technology, engineering and mathematics. In the framework of the PREFAM project, training and guidelines are offered to trainers to enhance their ability to engage participants in their learning pathway to maximise the learning opportunity and the transition to the workplace, in line with trends of teaching and training in Europe. Specific attention is given to approaches and methods that add value to every learner and his/her own learning, needs, styles and capabilities, including women who are still a minority in the context of precision engineering.

As for monitoring, quality assurance and enhancement, appropriate tools and instruments are under preparation, to offer a consistent and comprehensive approach of assessing both processes and products in training programs, in the perspective of accountability and continuous improvement and recognition of competences developed by trainees.

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