

Implementation and evaluation of the ReMOULD VET programme for retraining of ageing technical workers to the injection moulding industry.

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ABSTRACT: As Europe's population ages and the retirement age continues to be pushed backwards, there is a need for older technical employees to be able to re-orient themselves towards physically less demanding jobs. A changeover to a career in the injection moulding industry could offer such an opportunity. The ReMOULD project has developed a vocational re-education course towards the injection moulding industry for these ageing technical staff (e.g. people with careers in construction, maintenance or production). The course content focuses on expanding their technical skills towards polymer processing by injection moulding, as well as mould making and mould maintenance. The training is made up by three modules, each focusing on a different entry level and output profile. The course's teaching style is explicitly hands-on and as practice-based as possible. All of the modules were extensively evaluated by trial trainings in injection moulding or mould making companies, with a variety of trainees profiles and age levels. Both content and teaching style were well-received by these companies and their feedback has resulted in the final, commercially available, version of ReMOULD. It is expected that this training package will contribute to the continued activation of ageing workers whilst addressing the industry's need for experienced technical staff.

1 INTRODUCTION

Due to its SME-based character and its relatively wide end-application portfolio, the European plastics converting industry is still doing quite well, despite the recent crisis years. The companies remain largely anchored within Europe with their production facilities. As such, the EU production of rubber and plastics articles has been increasing again since 2010 and is currently at over 95% of the pre-crisis level of 2005 (PlasticsEurope, EuPC et al. 2014). Nonetheless, a lot of sectoral job-vacancies for technicians remain open for a long time (Flemish_Government 2011). This is attributed to the following reasons, of which the second is the main focus of the project: (i) young people are not finding their way to technical studies preparing for this sector, forcing the industry to hire either graduates from other technical tracks or even people without the necessary technical background (trained on the job) and (ii) for experienced technicians, there are no known offerings for re-training these people towards the plastics processing industry. Unlike larger companies (e.g. automotive or chemical industry), the plastics convert-

ing SME's have very few in-house (re)training possibilities and rely on VET (vocational education and training) programmes offered by external (education or sector-representative) organizations. Filling this gap will aid the industry in filling vacancies much quicker and more effectively, an objective which is compatible with the EU Commission's definition of a more skilled workforce as one of four key priorities in raising employment rates within the framework of the Europe 2020 goals (European_Commission 2010).

Framed by the European Year for Active Ageing (2012) at the time of submission, the project aims at the retraining of ageing technical employees. One of the main challenges defined within the European Year was the tackling of early retirement (European_Commission 2010) and the Council has invited the member states to encourage companies to make use of the experience of older workers and to effectively raise their employment rates (European_Commission 2010). Both document mention the potential of the lifelong learning tool, and the Life Long Learning Programme (LLP) has been

identified as one of the most relevant funding instruments to promote active ageing in employment (AGE PlatformEurope 2011).

ReMOULD is a LLP project under de Leonardo Transfer of Innovation programme. The consortium is made up of the engineering departments of academic institutions who have complimentary expertise regarding injection moulding (polymer processing at Ghent University, BE and mould making at University of Maribor, SI), sector-representative organizations with both a feel for the industry's needs and experience in industry-oriented training (Flanders' Plastic Vision and Centexbel-VKC in BE and Centimfe, PT) and some companies with activities in injection moulding (Pezy, NL) and mould making (Moliporex, PT and Kaldera, SI).

Following the ReMOULD course is meant to make the retrained employee suitable for hiring as an experienced, specialized worker in an injection moulding-related company.

Furthermore, the project aims for injection moulding companies to benefit from hiring graduates of the ReMOULD course, (i) because it will allow these companies to hire ageing employees, a strategy to which they are often encouraged (financially or otherwise) by government and (ii) because these employees will have a sound technical background and experience base, which is lacking in just-out-of-school young employees. This knowledge they can transfer to their younger colleagues, all-round strengthening the company.

It is our aim to have this demand-driven development of vocational training lead to improved opportunities for the companies (employees trained to their needs), the institutes who offer VET (increased number of students because of tailored course) and the employees themselves (better career perspectives).

2 MODULES AND PROFILES

The training programme is divided into 3 modules, each of them suitable for different intake and out-flow profiles. In general, the training builds on an existing understanding of basic technical concepts with the trainees, so a previous technical schooling or career is required. An overview of the different profiles and their flow through the modules is given in Figure 1.

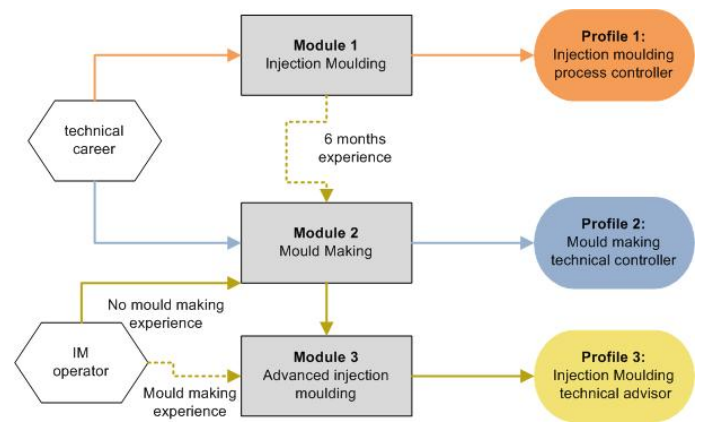


Figure 1: profiles and modules of Re-Mould.

2.1 Module 1: Injection moulding process controller

The injection moulding process controller has a keen grasp of the injection moulding process and a basic understanding of related aspects like the properties of the polymer material, the injection mould and the part geometry. He is able to supervise a production of injection moulded parts, to start up a new mould by following a digital checklist and to restart an interrupted production series.

By following module 1, a trainee with a technical background can acquire the necessary skills and knowledge to become an injection moulding process controller. Within the programme, the trainee is taught the following skills:

- The principle of injection moulding and the workings of an injection machine
- Which additional equipment is used
- The components and working of an injection mould
- The relevant properties of polymer materials
- The running of a moulding cycle, including start-up and shutdown
- How to change to a new mould on the machine

2.2 Module 2: Mould making technical controller

The mould making technical controller works at the mould maker. It is his mission to deliver a good quality mould. He understands the proper workings of a mould, the purpose of all its composing parts and how mould geometry (and finish) will affect the final product. He is able to take into account factors such as cost and production time and can execute relevant mould (making) simulations. Using a digital checklist, he can supervise the assembly of the final mould and can correct any oversights at this stage.

By following module 2, a trainee with a technical background in tooling or production techniques can

acquire the necessary skills and knowledge to become a mould making technical controller. Intake profile for this module is either someone with a technical background in mechanical production techniques or injection moulding. If the trainee's only relevant prior experience is the following of module 1, an effective working experience of at least 6 months in injection moulding is required.

In module 2, the trainee learns the following skills:

- Understanding of the workings of a mould
- Identifying the different parts of a mould and understanding their function of mould
- Understanding the process of making the mould and the related information flow within the company
- Being able to select a mould material and mould finish
- Understanding the opportunities and threats of flow simulations
- The ability to perform production simulations and integrate CAM techniques into the mould making process
- Assembling of a mould with the use of a digital checklist and knowing where it can go wrong

2.3 Module 3: Injection moulding technical advisor

The injection moulding technical supervisor is a more advanced profile. He can function as a technical link between the mould maker and the injection moulder by taking a new mould into production. The skills of the technical advisor include reading a 2D mould drawing, troubleshooting and optimizing an injection moulding process, and adapting an existing injection moulding process for small changes. By following module 3, a trainee with the necessary basic skills (an injection moulding operator or a trainee from modules 1 and 2), can acquire the necessary skills and knowledge to become an injection moulding technical advisor.

In module 3, the trainee learns the following skills:

- Reading a mould 2D drawing
- Starting up a new mould, guided by a digital checklist
- Troubleshooting the injection moulding process
- Analyzing occurring faults on the product and linking them back to mould, process, geometry or material
- The use of relevant apps and available information sources
- Understanding the impact of small changes like the use of a new material and adjusting the process for these changes.

3 REMOULD METHODS

3.1 Teaching style

Ageing workers typically experience reduced self-confidence when it comes to learning (Maurer 2001). As self-perception strongly affects vocational learning (Smith and Kling 2001), it is our intention to keep the threshold of the course low and to build upon the trainee's prior knowledge and (technical) ability. The Re-MOULD trainee must clearly experience that he/she is not starting over again from zero at a later age but instead that his/her existing technical knowledge is being applied to and expanded towards injection moulding.

Therefore, only a limited part of the course consists of text material. It serves solely as supporting material for the practice-oriented part of the course, which will take place not in classroom but in injection moulding-related workshops. The learner is then placed in the production environment, which is either at the injection moulding machine or in the mould making/assembly toolshop. Participation of the learner is essential at this stage: the actual performing of tasks will lead to an improved understanding of the technology and increased confidence in the learner's own capacity to master the subject. It has been found that such an informal method of learning in the workplace largely compensates for (negative) cognitive ageing effects (Schulz and Rossnagel 2010).

3.2 ReMOULD materials

The innovative character of the project lies not so much within the subjects that will be taught within the Re-MOULD retraining course, but in the format in which it will be brought. The training is not developed as a course book (of which many are available), but as a scenario for the sector-competent trainer. This detailed scenario will guide the trainer step-by-step in teaching the ReMOULD modules. The scenario is supported by a trainer manual, PowerPoint presentations, movies, posters, practical examples and handouts for the trainees.

All materials meant for the trainer are developed in English. All materials which are meant for the trainee are translated to the native tongue. In the initial stage this includes English, Dutch, Slovenian and Portuguese.

The teaching materials were developed by the academic partners, based on input from the industrial and sector-representative partners. All materials were reviewed extensively before their first trial and after every trial.

4 MODULE TRIALS

4.1 *ReMOULD trial setup*

All modules had at least one trial in an injection moulding or mould making company prior to their final release. The trials were taught by sector-competent trainers from Ghent University, University of Maribor or Centimfe, depending on the location. These trials were free of charge, given the development stage of the materials. An overview of the companies who participated in these trials is given in Table 1. Trials were conducted with trainees of different age groups and knowledge intake levels. Prior to the training, an intake conversation with the company was organised to better understand their needs and expectations, as well as work these into the training.

Table 1: Overview of companies which implemented a ReMOULD trial

module		company
1	trial 1	Gevaplast, BE
	trial 2	Moliporex, PT
2	trial 1	Kaldera, SI
	trial 2	Moliporex, PT
3	trial 1	M&G Flues, NL

In these trials, an evaluation was made by the trainers themselves, the trainees and the company. The trainees were queried in an open feedback conversation as well as questionnaire. The company was queried in an open feedback conversation.

4.2 *ReMOULD industrial trials*

As a whole, the companies were well pleased with the training. They considered it well worth their investment ('lost' production time and in some cases paid overtime for trainees from different shifts). The production managers indicated they would still consider the training if they had to pay for it.

It was experienced as a great plus that the timing format was adapted to the company's specific requirements (based on shifts) and that the training was within their own production hall (on their Machines, with their moulds) and not in a remote training centre. Finally, they appreciated the strong focus on practice instead of theory.

All companies involved feel that the employees have evolved, in that their confidence is increased because they now have a better understanding of the working principles of the machines. This leads to more initiative on their part, both in terms of actions and the asking of technical questions.

From the questionnaires and feedback talks, it was apparent that all the trainees mainly appreciated

the practice-based character of the training and the balance between theory and practice. Also the working in small, interactive groups and the training style (practice-based approach with many questions) were very well received. They generally found the training interesting and a useful application of their work time. In the early trials, trainees did indicate a wish for handouts with a summary of some training themes, useful information and terminology. While this was originally not planned, such handouts were later developed based on this feedback.

5 CONCLUSIONS AND OUTLOOK

The ReMOULD modules were very well-received by both companies and trainees during the trials. Based on feedback from these trials, final versions were developed both in terms of content and form.

The ReMOULD course will be made available to the industrial public as either a stand-alone package or the complete training, offered by one of the project partners. It is our firm expectation that the ReMOULD programme will contribute to the successful retraining of (ageing) technical workers in Europe to the injection moulding industry.

Towards the future, it may be considered to further expand the scope of target countries or to adapt the training for use by government (un)employment agencies seeking to (re)train unemployed technical workers for a specialist career in injection moulding industry.

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7 REFERENCES

- AGE PlatformEurope, C. o. t. R. a. E. C. (2011). How to promote active ageing in Europe.
- European Commission (2010). Accompanying document to the decision of the European parliament and of the council on the European Year for Active Ageing. COM(2010)462. Strasbourg: 5-8.
- European Commission (2010). An agenda for new skills and jobs. COM(2010)682. . Strasbourg.
- European Commission (2010). Council conclusions on Active Ageing. . Luxembourg.
- Flemish Government (2011). Witboek Nieuw Industrieel Beleid.
- Maurer, T. J. (2001). "Career-relevant learning and development, worker age, and beliefs about self-efficacy for development." Journal of Management **27**(2): 123-140.
- PlasticsEurope, EuPC, et al. (2014). "Plastics - the Facts 2013. An analysis of European latest plastics production, demand and waste data."
- Schulz, M. and C. S. Rossnagel (2010). "Informal workplace learning: An exploration of age differences in learning competence." Learning and Instruction **20**(5): 383-399.
- Smith, L. and M. Kling (2001). The Impact of Self-Perception and Vocational Learning. Vocational Learning: Innovative Theory and Practice. R. Catts, I. Falk and R. Wallace, Springer.