

# Process Improvement - Barriers and Opportunities for Teaching and Training

Margaret Ross  
Southampton Solent University  
Faculty of Maritime and Technology,  
UK  
margaret.ross@solent.ac.uk

## Abstract

Barriers and opportunities associated with professionals are considered. Practical possibilities for increasing the understanding and implementation of process improvement are discussed, including the use of webinars, possibly with open badges to record and encourage participation. The use of MOOCs, potentially leading to on-line assessed qualifications, could increase the number of practitioners with the relevant knowledge, particularly in more remote regions. Changes to SFIAplus could enhance awareness of process improvement, and so encourage employers to authorise relevant training.

The lack of relevant knowledge and experience of teachers and lecturers is considered, together with the problems of pressures by other topics on academic courses. The actions that could be undertaken to promote and assist the teaching of process improvement in colleges and universities range from provision of suitable case studies to the inclusion of process improvement within the accreditation of courses. The opportunities associated with the new higher apprenticeships could provide potential practitioners with process improvement skills for the future. Changes in the requirements by professional bodies for syllabus content for accredited courses, aligned with enhanced SFIAplus, could increase awareness of process improvement. The syllabus could be aligned with professional courses, such as by the ECQA course, so students could obtain the professional qualification as well as their degree. Taking the long term approach of ten years plus, the relevance of quality and process improvement could be introduced at the appropriate stages into the new schools computing curriculum, started in 2014 in the UK, to raise awareness of the need for process improvement to the future workforce.

## 1. Introduction

---

*Copyright © by the paper's authors.*

Proceedings of the International Workshop on Software Process Education, Training and Professionalism, Gothenburg, Sweden

20015-06-15 published at <http://ceur-ws.org>

The EC report on "New Modes of Learning and Teaching in Higher Education" identified that changes in technology provide an "enormous potential for widening access to Higher Education and increasing the diversity of the student population" (EC report, 2014, p.10, paragraph 3). It reported, from the UNESCO investigation, that the current estimated number of 100 million students worldwide, in Higher Education, is expected to increase to over 250 million by 2025 (EC report, 2014, p.14, paragraph 3). Many of these could be from outside the EU. They might be physically attending courses, or virtually, using e-learning techniques. These students might be already in full-time employment, returners after a career break, or undertaking lifelong learning following retirement.

It is recognised that quality and process improvement is desirable to produce and maintain high quality systems. Unfortunately there are barriers to those wishing to acquire the necessary skills, particularly for process improvement, whether student or professional. However, with the increased use of new ideas including developments in technology, there are now opportunities that could be made available to professionals, to students and their lecturers

## 2 Barriers to Students

The benefit of appropriate processes to achieve quality and process improvement is more visible with projects involving teams. The major projects for postgraduates and final year undergraduate courses in the UK are normally individual projects. The group projects, usually involving a maximum of six students, often achieve small outputs and are possibly in the first or second year of the undergraduate course. The students, with this limited experience, do not realise the practical benefits of quality, process improvement or even of documentation.

Most syllabuses are already very full on these courses, with constant pressure to introduce additional topics. Dedicated units on quality and process improvement are not usual. These topics are more likely to be included as part of a series of other units, including design and programming. Some students are more interested in the latter, and feel issues such as process improvement are not relevant or of interest to them.

The lecturers and teachers in universities and colleges often have had no practical experience, or even adequate training, in process improvement. The cost of relevant courses is often seen to be too high for academic budgets. There is limited access to material, especially case studies and case histories, which can often make a topic more interesting and understandable for the students. The cost of standards, even with academic discounts, is viewed by academic libraries, with limited resources, as too high. The websites of the standards organisations, are designed for practitioners rather than being suitable for academics or their students, making the concept of process improvement less attractive to them.

There is pressure in many universities on the type of research that would result in obtaining a high research rating leading to larger allocations of money from the Government to those universities. Many lecturers are on short-term contracts, depending on producing these highly rated publications and obtaining research contracts. These are not often related to promoting quality and process improvement, particularly in SMEs. Similarly, a lecturer, on a full-time contract, often has little time for spending with SMEs to encourage process improvement. This can be addressed by Government funding to "buy" some of the lecturer's teaching hours to work with SMEs. Publications relating to improving process improvement of SMEs are not usually highly rated in the competitive academic research community. Similarly the development of case studies, based on process improvement in SMEs, useful to assist in the teaching and learning of students, would not often be viewed as a high research priority. This attitude could discourage young lecturers, needing to consider their future careers, from following these extremely useful areas of investigation.

These lecturers or students, particularly PhD students, that investigate the effectiveness of process improvement, are encouraged to publish in journals if possible or at conferences that are mainly attended by academics. There is often active pressure not to write articles for trade papers or magazines that would be read by SMEs. This attitude results in very poor dissemination of the outcomes of the research into the wider community, and in particular, to SMEs. (Georgiadou et al, 2014)

The trend in recent years away from the conventional day release to full-time study has reduced the contact between university lecturers and local companies. To ensure that the syllabuses for these university courses address issues of concern to employers, and conversely, to promote their current or future employees with a relevant understanding and knowledge of topics, such as quality and process improvement, there needs to be an effective dialogue between the universities and the employers.

Some universities are designing very short, self-contained units, within their degree courses. These can be undertaken as a form of "short course" for industry with the university credits allocated to these "short courses". These could assist in increasing the links between academia and industry, and address industry's need to provide continuous professional development and lifelong learning (EC report, page 10, paragraph 5).

### **3 Barriers to the Professionals**

There are limited numbers of professionals with adequate experience and knowledge of process improvement, to be able to influence the majority of organisations. In many cases, there is little opportunity of gaining practical experience, especially if they are employed by SMEs (Small to Medium-sized Enterprises). As the number of people in SMEs that are employed directly in quality and process improvement roles is very limited, there is little opportunity to gain initial experience for those wishing to move into these areas and limited opportunities to "learn on the job".

Individuals could address these problems by attending courses, but this requires both the available time and money, which would not always be supported by their employer. The cost of access to standards can also seem to be a problem to them. The timing and location of these courses are not always compatible with their working schedule. This is particularly a problem for those working for organisations, including outsourcing companies, situated outside Europe.

SMEs and individual practitioners, particularly those involved with small web applications and the production of Apps, are often concerned more with the fast development rather than process improvement. For the development of Apps, there are no internationally accepted standards. The concept of global enforcement of such standards might be resented by some members of the Open Source community. Some organisations, such as Apple and Google, have quality guidelines, but those producing Apps have many other alternative potential "marketing locations" for their Apps. Although there are standards for quality and process improvement in this fast changing global world of software and hardware, these standards need to be constantly "refreshed" and cannot be enforced, especially in the communities of individuals and SMEs.

### **4 Opportunities for Professionals**

The use of courses on aspects of quality and process improvement that can be taken by blended learning approach, where there is a combination of a remote study, video-conferencing and attendance, can provide an opportunity to

gain required knowledge and skills. Possibility the attendance is arranged on occasional weekends or in blocks, so allowing attendees to travel long distances.

The author has been involved with such a Master's course for Six Sigma, where students flew in every two months from other parts of the UK and Europe (Protheroe et al, 2008). At the start of each of the Six Sigma units, the students were given the full learning material and the individual assignment, which in all cases was work related. The students, having studied the material for the first six weeks, then attended a weekend session, situated halfway through the unit. This involved a mixture of group workshops and individual discussions, similar to that of a modified "flipped classroom", allowing each student to progress at their own speed and direction (Almpanis et al, 2010). The students then continued to work alone, but with video and audio conferencing support, for the further six weeks, when they submitted their assignment (Almpanis et al, 2011). The students were also able to achieve the Black Belt for Six Sigma.

The author has also been responsible for the one, two and three day courses run by Tom Gilb Hon FBCS on different aspects of quality, held in London and other locations, organised through the BCS Quality Specialist Group which provided free training for BCS members, especially those that were currently under employed, as consultants or professionals. Training courses, leading to qualifications such as the ECQA SPI (Software, Systems and Service improvement), could increase the skills in the area of process improvement (ECQA, ND).

The identification of a suitable MOOCs (Massive Open Online Courses) covering part of the relevant skills, could be used to increase the knowledge of the professionals. Many of these MOOCs are free, or at a low cost (Dewar et al, 2014). Details of these MOOCs could be made available, say on relevant websites, such as those of SPICE and the professional bodies such as BCS Quality Specialist Group. Assessment of the relevant skills could be made at the Foundation Level, by online multiple choice questions, which could be organised by training organisations or professional bodies. These could be similar to those of Prince Foundation or the BCS Agile Foundation and other certificates (Agile, ND). It might be possible to link to the online assessment qualifications to the European Credit Transfer Scheme (ECTS) system.

The use of webinars, which are often free, could be used to increase the awareness of process improvement and impart some of the relevant skills. Examples of these are run at no cost by the BCS GreenIT Specialist Group. The presenters of the webinar can be located in different countries, as can the participants and who are also able to access the webinar after

the event. Presenters or active participation at these webinars could be recognised for the individual by the collection of Open Badges. These normally involve no or little cost to produce, and can be available for easy, quick and free distribution regardless of country via the Internet.

The professional bodies could be encouraged to organise webinars and also physical meetings, by providing speakers with process improvement experience. These could be recorded and made freely available possibly by YouTube, to provide a useful resource for practitioners to update their skills and for opportunities for trainers and teachers to assist with the up-skilling of those currently in process improvement roles or aspiring to those roles, by utilising these online approaches.

## **5. Opportunities for Students and their Teachers**

The lack of relevant experience of teachers and lecturers, which would enable them to inspire their students about quality and process improvement, is a major problem. This could be addressed by issues discussed in Section 4, such as the use of blended learning courses, MOOCs and webinars.

Professionals and relevant organisations could be asked to assist with the production of suitable case studies, case histories and short YouTube videos lasting possibly a maximum of five or ten minutes. These resources could easily be included in the relevant classes. Students could be motivated by the use of Open Badges. As they gained the relevant process improvement skills, they could be awarded the appropriate e-badge, which are now used by various organisations including some universities and schools as a means of motivation and as an on-line record of CPD (Continuous Professional Development).

Recorded lecture systems such as Panopto can be used to automatically capture the lecturer's explanations, attached to each Power Point slides for use later, possibly remotely. The author currently uses Panopto in short segments with PowerPoint and the use of interactive boards (Griffin and Ross, 2015). These segments are designed for final year students in particular those that have language difficulties or have missed sessions. It allows the students to go directly for further explanations of a particular slide. In addition, the lecturers are provided with a record of which students accessed the system, when it was used and more importantly for which elements of the recording the students found it desirable to re-hear the full commentary. Online capture could be used as part of a MOOC or to develop a "flipped" classroom, as described in Section 4.

The various appropriate Specialist Groups of the professional bodies, including the BCS Quality Specialist

Group and the BCS e-learning Specialist Group, could hold events, both physical and by webinars to increase knowledge of process improvement. The appropriate groups could organise competitions, aimed mainly at students to raise awareness of process improvement.

## **6. Governments & Professional Bodies**

As there is always pressure to include new topics on courses, the professional bodies, such as the BCS, could specify that process improvement should be included in any degree course to be accredited by that body. The governments, through their financial power, could play a major role in encouraging the professional bodies and the universities and colleges to give a higher priority to relevant courses and in particular to quality and process improvement.

The Government and professional bodies influence can also be applied to schools, to control the curriculum. An example of this is the UK computing syllabus, started in September 2014 in the first year of primary schools. These children, as they progress through their schooling, year by year, will follow a new computing curriculum, gradually increasing in depth and breadth, potentially until they reach the age of sixteen, to try to address in the future, the shortage of IT professionals. Interest in this approach has been shown in a number of countries including Denmark, Holland and Japan. By aiming to influence this new curriculum to include quality and process improvement, especially for those pupils in the latter school years, this would influence the potential workforce of the future. The active support by Government and professional bodies to include quality and process improvement in colleges and universities in their units, should be of benefit to future professionals and their employers.

By encouraging these units in these courses to be aligned with the relevant professional syllabus, students could be given the opportunity, in addition to attaining their degrees, to achieve with professional qualifications such as those of the ECQA. This concept has been used successfully over many years to improve students' employability. Networking students can achieve Cisco qualifications while undertaking their computing degrees (Udall and Ross, 2012a). The author implemented a similar arrangement, by aligning the syllabus of the BCS Structured Systems Analysis and Design qualifications with the appropriate second year unit at Southampton Solent University. Students completed the university's unit assessments and then, on completion of that unit, could take the BCS examination, so gaining both academic and professional qualifications (Uhomoihi and Ross, 2013 ). The author also ran intensive two week courses for professionals for this BCS SSADM qualification.

Employers could be encouraged to specify in job advertisements, qualifications which have a strong commitment to quality and process improvement, as they already do within Six Sigma, ITIL and Prince2. These could raise the profile of potential employees to the importance of process improvement. The professional bodies could offer, at no cost, to re-publicise these job advertisements on their websites providing they promote process improvement, professional standards or professional membership in the job descriptions.

Influence could be applied by government and professional bodies on the content and organisation of the new higher apprenticeships. These have recently been started in the UK, where a student, instead of attending a full-time university degree course, would be employed by an organisation while at the same time, would study part-time over a period of three or four years for a university degree or part of a university degree. There are special degree courses being designed by some universities for particular employers that would provide a large number of high-level apprentices in a particular discipline. In these cases many of the university degree units would align with the requirements of that industry or organisation.

Other universities, that are expecting the students on apprenticeships to come from a number of SMEs, are organising degree courses on a day release basis. These might possibly have some units run in conjunction with their full-time degree courses. Another structure that has been implemented is for higher apprenticeship employees to study by distance learning on relevant Open University degree units. These apprentices would have time allowed each week for their university studies and have their fees, as with the other models, paid by their employers. These students should complete half of a normal degree course during their three-year apprenticeship.

The SFIPlus industry structure model could be modified to enhance the roles associated with quality and process improvement (SFIPlus, ND). These roles, for the various computer related professions, identify the necessary skills, possible qualifications and possible activities. These are proposed for different levels, with the career progression from starting work at say eighteen years of age to possibly becoming a senior manager of a major organisation. By encouraging process improvement to become a specified role, this would raise the profile as well as clarify the knowledge and experience required at different levels. Within existing roles of SFIPlus, quality and process improvement could be specifically included, as they are relevant to all roles. As this SFIPlus model is used by many organisations, as well as individuals, to plan career progression, it would bring the need for appreciation and implementation of quality and

process improvement into the various levels and roles, regardless of the sector.

By aligning the degree courses with the modified SFIPlus which could include more emphasis on quality and process improvement, the skills of students could be more easily identified by potential employers (Udall and Ross, 2012b). This could improve the relationship between universities and colleges with their local organisations. To provide external checking of the level of knowledge of these areas, the professional bodies could audit this, in addition to providing a more general audit of their potentially accredited courses. Various multiple choice online qualifications could be designed, possibly administered by the professional organisations, such as the BCS, to assure the knowledge on quality and process improvement aligns with the relevant different levels of SFIPlus. These could be taken by both students and professionals.

## 7. Conclusions

To assist the lecturers to inspire their students, in addition to helping with suitable material, opportunities could be provided for lecturers and teachers to gain real life experience by shadowing process improvement professionals, possibly with Certification Bodies, subject to their clients' agreement, and in organisations with quality and process improvement sections. This would enable the lecturers to introduce some real world, even though limited, experience to their discussions with students.

Competitions could be organised, such as part the BCS Quality Specialist Group and e-learning Specialist Group, possibly related to promoting awareness of process improvement, but with the prizes being opportunities of work-experience for the winners to gain real life quality and process improvement knowledge first hand. The relevant organisations would need to be involved in the development, marketing and judging of such competitions, whether aimed at students, lecturers or open to professionals. The author is currently involved in such competitions, aimed at pupils of about school leaving age, and another competition aimed at their teachers, which has been designed in conjunction with the computing department of Hampshire County Council and the main prizes included relevant work experience.

By influencing the syllabus for these courses, and other degree courses, to include quality and process improvement, the future professionals, on entering the various Industries, could act as ambassadors for process improvement for the future.

## References

- [1] Agile ND, BCS Agile Foundation Professional Qualification, <http://certifications.bcs.org/category/17577> (accessed 19/5/2015)
- [2] Almpanis T, E Miller, M Ross, D Price, R James, 2011, Evaluation the Use of Web Conferencing Software to Enhance Flexible Curriculum Delivery, Proc IICE (Ireland International Conference in Education) 2011, Dublin, 2011
- [3] Almpanis T, E Miller, M Ross, D Price, R James, 2010, Virtual Classrooms for Flexible Curriculum Delivery on MSc Six Sigma Course, Proc INSPIRE 2010, London, ISBN 978-0-9557300-8-8
- [4] Dewar E, J Uhomobhi, M Ross, D Hutty, 2014 MOOCs development and implementation: The challenges and prospects for higher education in emerging countries. Proc INSPIRE 2014, Southampton, ISBN 978-0-9926958-2-8
- [5] ECQA, ND, [http://www.ecqa.org/fileadmin/documents/professional\\_leaflets/ECQA-spi-manager-flyer.pdf](http://www.ecqa.org/fileadmin/documents/professional_leaflets/ECQA-spi-manager-flyer.pdf) (accessed 19/5/2015)
- [6] EC report, 2014, Report to the European Commission on New Modes of Learning and Teaching in Higher Education, ISBN 978-92-79-39789-9, [http://ec.europa.eu/education/library/reports/modernisation-universities\\_en.pdf](http://ec.europa.eu/education/library/reports/modernisation-universities_en.pdf), (accessed 10/5/2015)
- [7] Georgiadou E, K Siakas, and M Ross, 2014 Innovation in Project Sustainability: The Need for Early Planned Dissemination and Exploitation, Proc 6th World Congress of Software Quality, London, 2014
- [8] Griffin B, M Ross, 2015, Speak and be Heard Later: Use of Audio-Visual Support at Southampton Solent University, Proc INSPIRE 2015, ISBN 978-0-9926958-7-3
- [9] Protheroe H, T Carrier, E Miller, J Rees, M Ross, 2008, Blended Learning for Six Sigma, Proc SQM 2008, Belfast, ISBN 978-1-906124-05-2
- [10] SFIPlus, ND, SFIPlus Industry Structural Model, <http://www.bcs.org/category/17784>, (accessed 19/5/2015)
- [11] Udall M, M Ross, 2012a, Assisting Employability for Undergraduates, Proc INSPIRE 2012, Tampere, Finland, ISBN 978-951-44-8901
- [12] Udall M, M Ross, 2012b, SFIPlus in the Curriculum, SFIA in Education and Workplace Learning

conference, Milton Keynes, published BCS e-wic,  
Open University, Milton Keynes, 2012

- [13] Uhomoibhi J, M Ross, 2013 Globalisation and e-Learning: Integrating University and Professional Qualifications for Employability and Lifelong Learning, ICEL 2013 (International Conference on e-learning), Cape Peninsula University of Technology, South Africa, 2013