



ARIALE

Public Report Manufacturing SMEs Requirements with Respect to Training of Automation & Robotisation

ARIALE Project

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Introduction

Improving the competitiveness of the company at the present time is impossible without the utilisation of modern technologies of Automation & Robotics (A & R). Introduction of new technologies should be completed by improving staff knowledge in this area. The ARIALE project main goal is to provide comprehensive training in the field of A & R addressed to employees of production SMEs. The adoption of modern e-learning solutions allows participants to establish an individual mode of learning tailored to individual needs and time resources. The scope of training materials will be appropriately broad and cover most of the issues related to the A & R systems in SMEs. Only well-trained staff featuring the latest technological developments in the field of A & R will increase the company's competitiveness not only in the local, national but also international market.

With the advent of the Internet and online learning methodologies and technologies, providers of education and training are creating learning materials to fulfil the demand. The Internet and digital technologies combined with appropriate learning strategies help to create open, dynamic and flexible learning environments with implications for countless applications with respect to education and training. Academic institutions, corporations, and government agencies worldwide are increasingly using the Internet and digital technologies to deliver instruction and training.

What does it take to create a flexible and distributed learning environment for professional learners? Well, a learning environment should be meaningful to all stakeholders, including learners, instructors, support services staff, and the organization. It is meaningful to learners when it is easily accessible, well designed, learner-centered, affordable, efficient and flexible, and has a facilitated learning environment.

When learners display a high level of participation and success in meeting a course's goals and objectives, learning becomes meaningful for instructors. In turn, when learners enjoy all available support services provided in the course without any interruptions, it makes support services staff happy as they strive to provide easy-to-use, reliable services. Finally, a learning system is meaningful to organizations when it has a sound return on investment (ROI), a moderate to high level of learner satisfaction with both the quality of instruction and all support services, and a low dropout rate.

The purpose of this Report is to walk SMEs through the various factors important to adopting open, flexible and distributed learning environments. It contains many practical items that it is possible to use as review criteria that learners should expect. Items in the checklist encompass the critical dimensions of an e-learning environment, including pedagogical, technological, interface design, evaluation, management, resource support, ethical, and institutional.

Beneficiaries

Who can benefit from this Report? A wide range of professionals can use this document to understand benefits and issues:

- Instructors can use the suggestions in this Report to develop courses for SMEs such as distance education, e-learning, blended learning, online education, Web-based instruction, distributed learning, educational technology, instructional technology, corporate training, etc.
- Instructors, teachers, trainers, training managers, distance education specialists, e-learning specialists, virtual education specialists, e-learning project managers, instructional designers, corporate education specialists, human resources specialists, media specialists, webmasters, writers/editors and technical support staff can use this Report to plan, design, evaluate, and implement e-learning and blended learning modules, courses, and programs for SMEs.
- Virtual/corporate training designers can use this Report to plan, design, evaluate, and implement corporate/virtual courses.
- Consultants, human resources managers, higher education administrators, department of education staff, ministry of education staff, virtual and corporate university administrators can use this Report to develop strategic plans for designing, evaluating and implementing e-learning initiatives.
- Providers of e-learning (consulting companies, universities, training organizations and other institutions) can use this Report to understand the level of services that SMEs learners expect in e-learning.
- Accrediting agencies can use this Report to review whether e-learning providers provide high-quality instruction and good support services that SMEs learners must have. Department of education and ministry of education staff can use this document to develop criteria for new grant initiatives for e-learning related projects.

Needs Analysis and Assessment

SMEs (small and medium-sized enterprises) represent 99% of all businesses in Europe and account in average for more than 60% of the employment and turnover figures (*Source: European Small Business Survey, 2012*). However only 24% of SMEs provide vocational education and training compared to 80% of large enterprises (employing over 250 people). SMEs play a key role in generating employment and creating economic wealth, but skill deficiencies in SMEs are adversely affecting their ability to reach their growth potential. By their very nature, SMEs are small, constrained by time and budget and reluctant to engage in learning/training programmes.

Therefore the purpose of research projects such as ARIALE is to investigate how SMEs can be engaged in appropriate learning interventions to address this major challenge in the automation and robotics fields.

Initial studies on SMEs can be traced only as far back as the 1960s. These organizations were largely ignored for a long time, until the emergence of several reports, which focused on highlighting the significant contribution of SMEs for the European economic development.

Since then, research in small business has grown steadily, examining different perspectives concerning to SMEs and their inside environments.

A common theme in this research points to its fragmentation and its failure to provide conclusive evidence about Automation & Robotics development in SMEs and learning needs for their penetration. Another theme emerging points to different deficiencies at the different contextual levels (technological, organizational including managerial, environmental, and individual) and to the lateness of the SMEs in adopting Automation & Robotics.

What could be first of all synthesized from this assessment is that Automation & Robotics are characterized by multi-faceted perspectives and represents fields too large and complex to be encapsulated within one study, one discipline, or one methodology of adoption for SMEs.

Still, what makes SMEs decide to adopt effectively automation and robotics technologies is not conclusive and remains the subject of considerable debate among researchers.

There is a consensus among researchers and consultants that is possible to develop an effective training system with the appropriate amount of knowledge. How significant is the actual use of traditional courses and e-learning technologies in SMEs? This leads naturally to the question of what makes SMEs adopt or reject e-learning?

In addition, how deep is the actual penetration of e-learning in SMEs business environment?

The Questionnaire for Requirements Gathering and Needs Analysis

ARIALE partners have elaborated and distributed among project target groups a detailed questionnaire for requirements gathering and needs analysis regarding the way to plan and improve skills and professional knowledge for SMEs.

A total of 103 questionnaires were filled by the target groups: SMEs managers, employees, trainers and consultants involved in automation and manufacturing jobs. The answers were distributed among the partner countries as follows: 36 from Bulgaria, 25 from Italy and 42 from Poland. The answers collected at the end of survey analysis allowed achieving a good level of knowledge about SMEs needs in the automation and robotics training field.

The results of the survey illustrate how professional associations and consultants may contribute to the use of e-learning technologies for SMEs. It also shows that – besides significant cost savings – there are further advantages that make the use of e-learning technologies attractive. In fact online learning can provide several good opportunities to SMEs in overcoming part of their technological, environmental, organizational, and managerial inadequacies.

Savings of travel or hotel costs are an obvious advantage of e-learning compared to face-to-face seminars. There are, however, also a number of other benefits, which are less easy to express in numbers but that have been also frequently reported by the target groups' feedback.

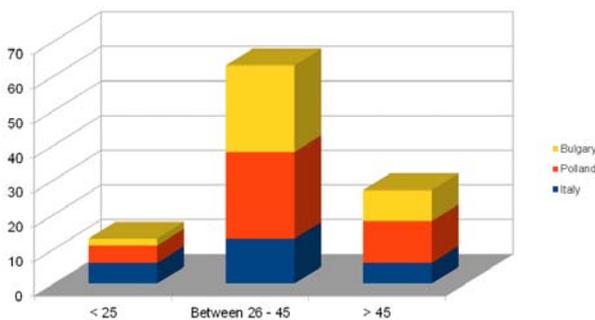
- **Time independence.** Learning activities can be carried out in the evening or during the weekend. Thus, managers and employees are not inhibited in their daily work routine.
- **Focus.** In their daily work, managers and employees are used to focusing on the essentials. This working style is better supported by e-learning than by face-to-face seminars. Participants can concentrate on the specific Automation learning goals, in which they are interested.
- **Learning at one's own pace.** Participants of e-learning courses can take the time they need to assimilate learning material. By contrast, during seminars participants are often reluctant to ask several times about the same problem, even if they have not yet understood it.
- **Advanced learning culture in SMEs.** The application of e-learning as part of the learning opportunities in a SME company leads to developing new learning culture. Compared to face-to-face seminars, e-learning allows for a prompt realisation of the knowledge acquired. Consultants therefore interact more often and exchange information more frequently than was the case when attending face-to-face seminars.

Lessons Learned and Learning Principles

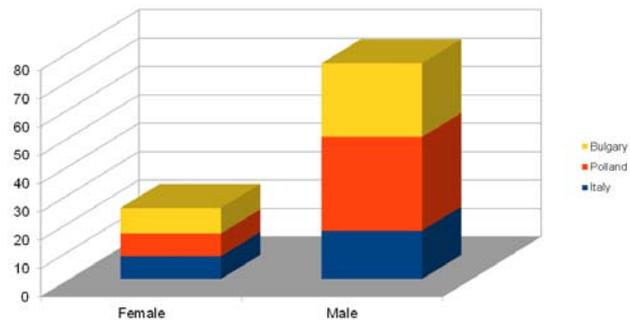
The survey included a total of 103 people in Bulgaria, Italy and Poland. Below is a summary of the results of the analysis.

Profile of the respondents

The majority of the respondents to the survey in all partner countries were within the age group 26 – 45 years, which was not surprising as all of the respondents are employed at SMEs or are trainers/teachers. In terms of gender the naturally for this economic sector the majority of the respondents in all partner countries are male.

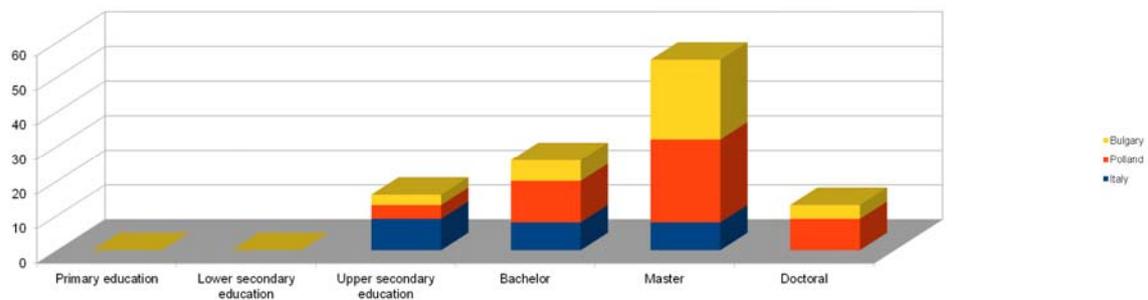


Age distribution of interviewed persons



Gender distribution of interviewed persons

There were no respondents below Upper secondary level of education. The most predominant group were respondents with a master degree. However, bachelor's and PhD degrees were also not rare.

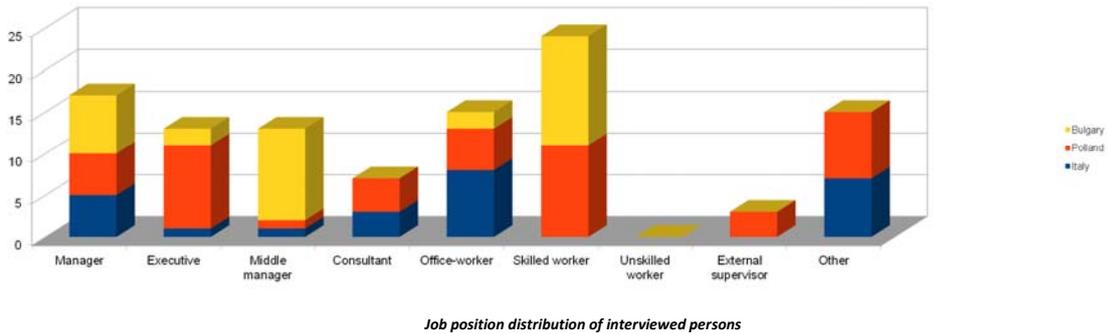


Educational distribution of interviewed persons based on the International Standard Classification of Education framework

The job positions of the interviewed varied a lot among the different countries. However, in the aggregated results there was balanced distribution between all levels within the organization:

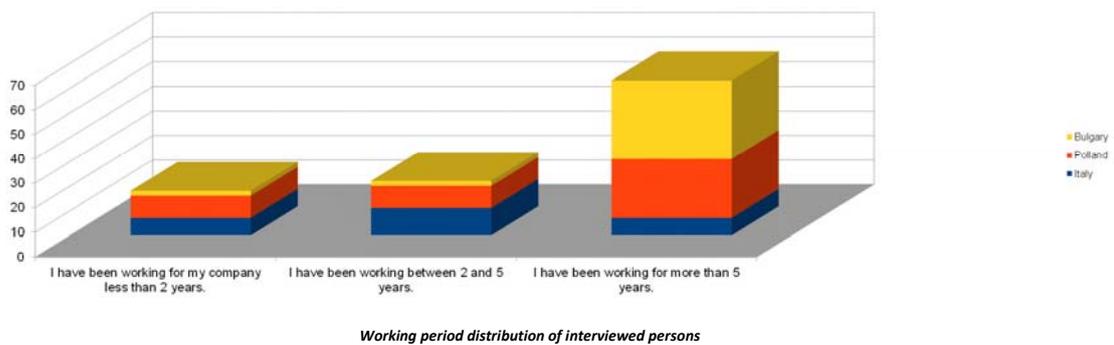
- Manager (17)
- Executive (13)
- Middle manager (13)
- Consultant (7)
- Office-worker (15)
- Skilled worker (24)
- Unskilled worker (0)

- External supervisor (3)
- Other (15)

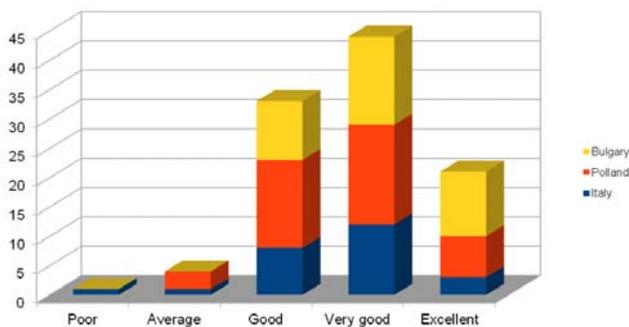


No unskilled workers were interviewed, which could be explained with the narrow specialization of the manufacturing SMEs as well as the sophisticated topic of the survey.

The largest group of the respondents (63) declared that they have been working for more than 5 years – which means very experienced people have answered to the questions regarding the course.



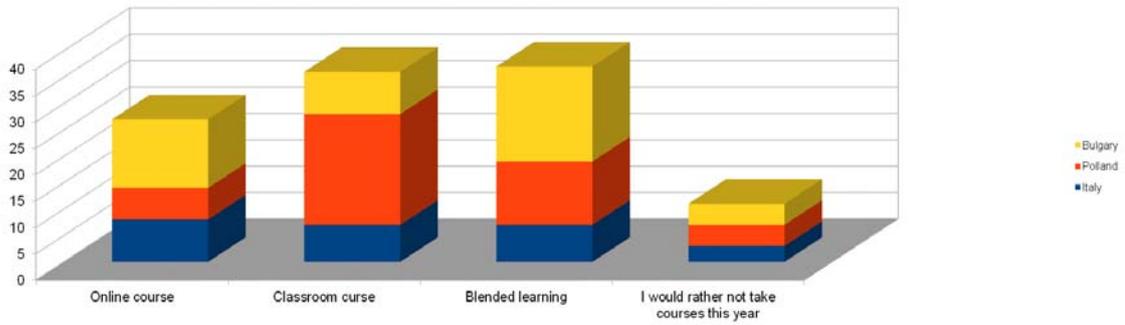
As for the computer skills, almost all respondents stated that they are Good, Very Good or Excellent.



Therefore, it can be considered that insufficient computer skills is a very improbable barrier for taking the ARIALE training course.

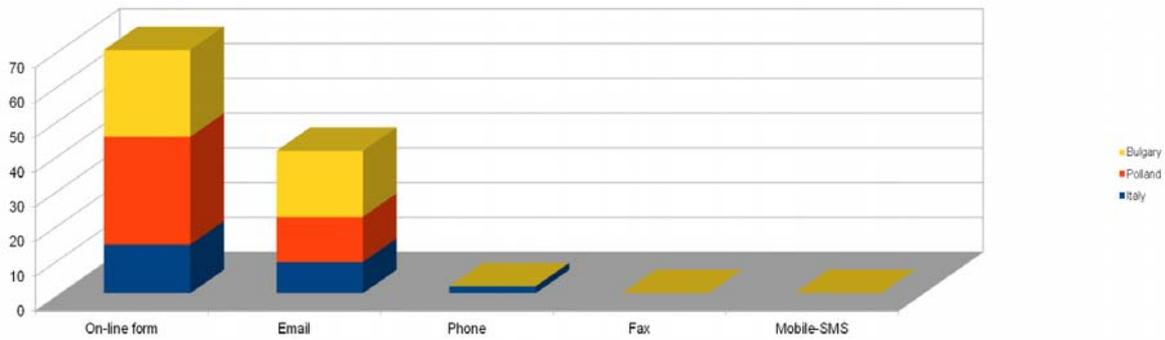
Course preferences

24% of the respondents have stated that they if they had the chance to choose a course to take they would pick up online course. The Traditional classroom course leads the statistics with 33% and just 1% less (32%) would choose Blended learning. The close percentages show a positive trend that more and more people are taking online courses and see the benefits from such kind of training.



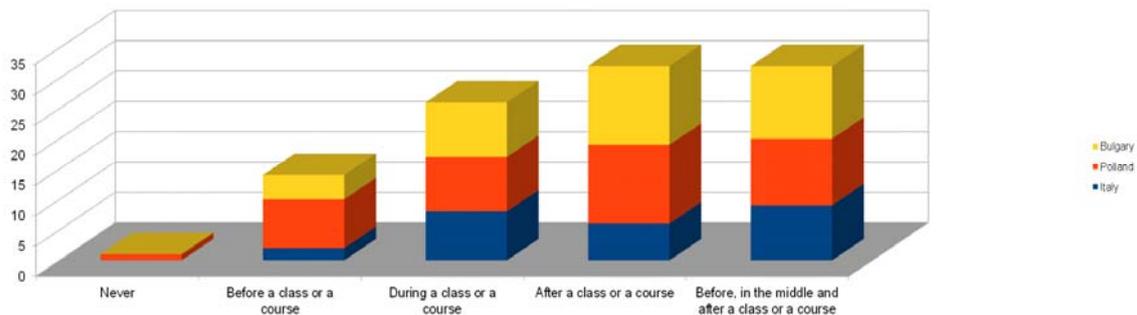
Course preferences of interviewed persons

With regard to the possible methods for course subscription, a convincing majority of 62% have voted for online registration form, while the second best choice selected by 32% was via e-mail. Therefore, papers and phones should be limited in the registration process.



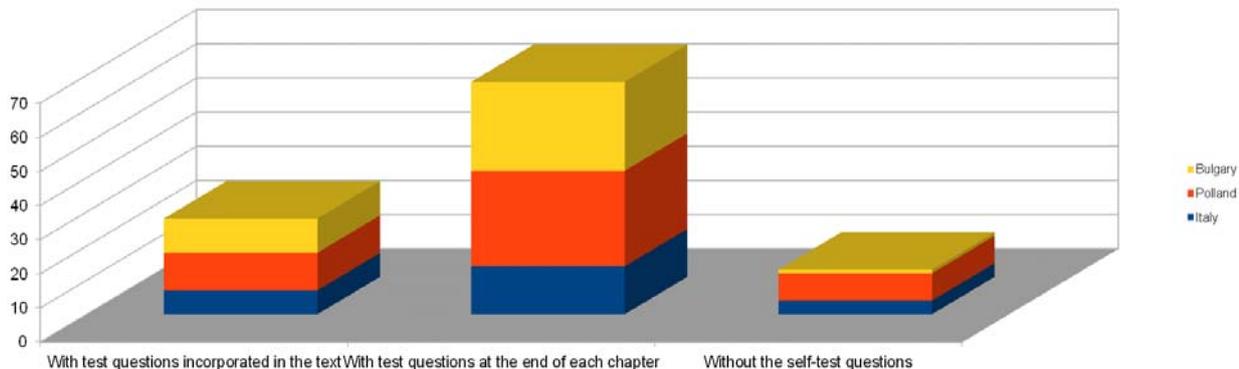
Registration (to a course) preferred according to persons interviewed

The most preferred examination time for 32% of the respondents were after the class / course and before, in the middle and after the class/course. The 25% pointed that they prefer to be examined during the class/course.



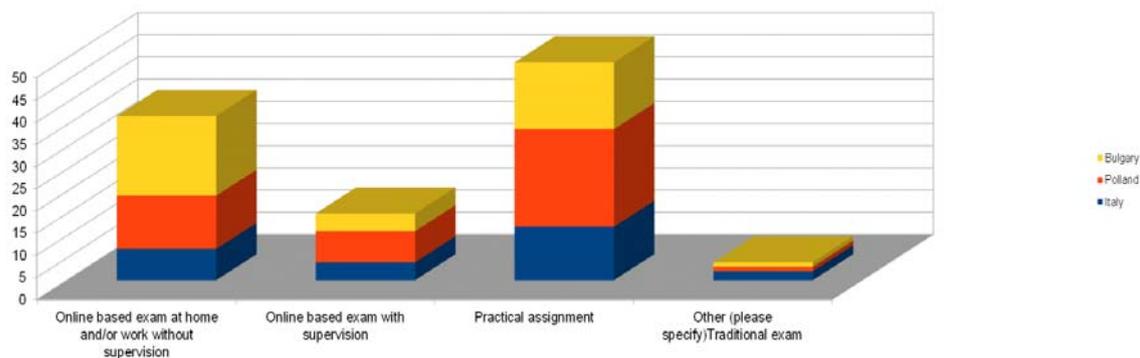
Preferred method to evaluate competences according to persons interviewed

All respondents except 1 have chosen some form of examination, so the mobilizing effect of the examination process should not be underestimated in the ARIALE course. In addition, 68 respondents want to have test questions at the end of each chapter.



Kind of preferred test questions according to persons interviewed

The most desired form of exam is via practical assignment (49 respondents), followed by Online based exam at home and/or work without supervision (37).

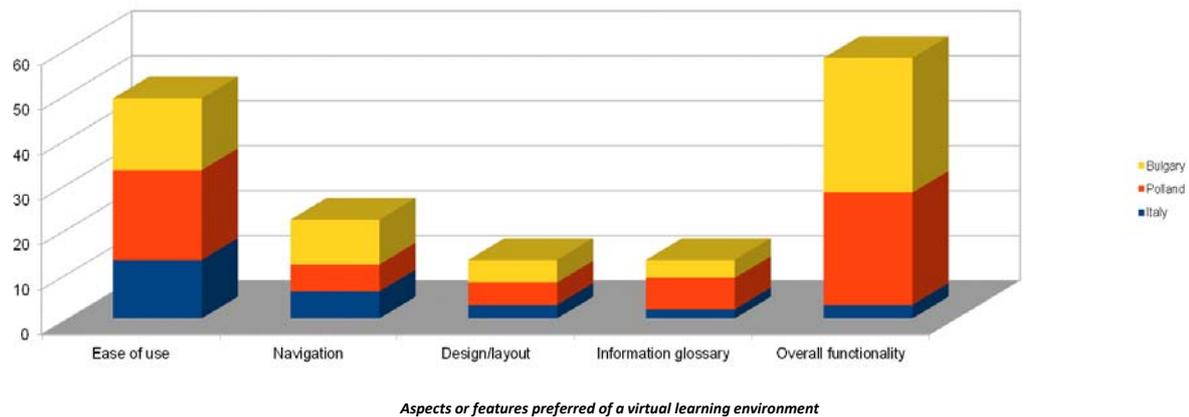


Kind of preferred assessment according to persons interviewed

In order to answer to these requirements the ARIALE course may give a choice to the learners at the end of the training whether to prepare some practical project or take an online exam.

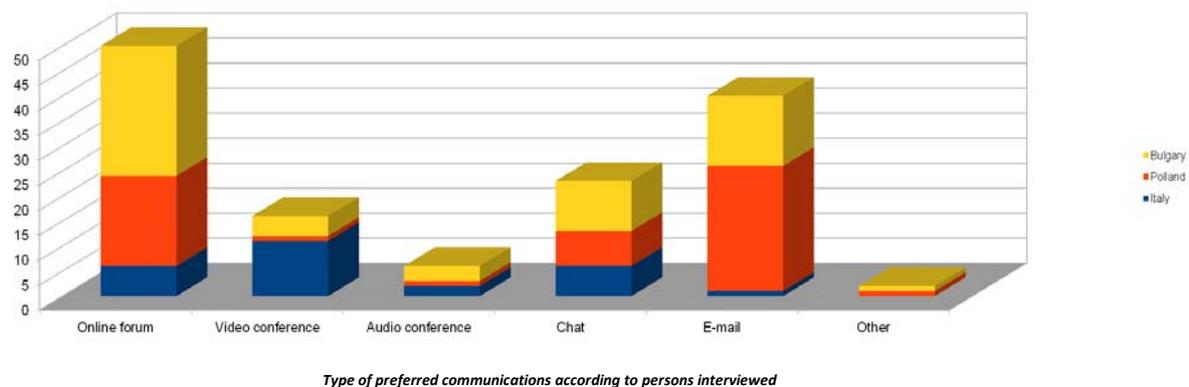
Technical aspects of the virtual learning environment

All aspects of the virtual learning environment were considered important by the respondents, leading are the Overall functionality (37%) and Ease of use (32%). Navigation is seen as important by 14%, while equal number of people perceive Design/layout and Information glossary as significant.



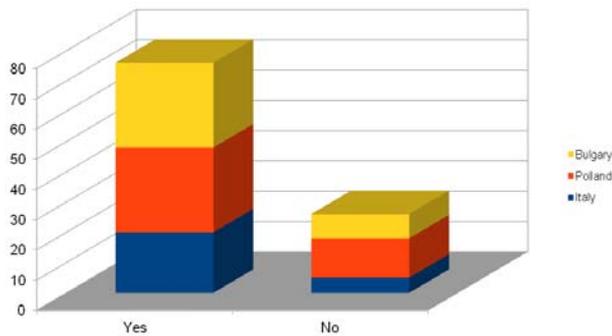
Therefore, in the development of the ARIALE course special attention should be paid to the overall functionality of the platform. The communication channels to be used with the other fellow-learners arranged from more preferred to less preferred are as follows:

- Online forum – 50 respondents
- E-mail - 40 respondents
- Chat - 23 respondents
- Video conference - 16 respondents
- Audio conference - 6 respondents

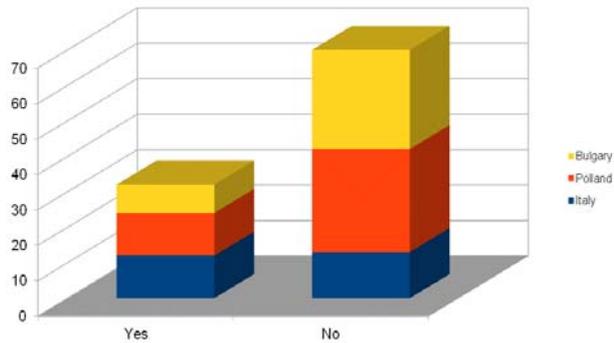


Attitude towards online trainings

75% of the respondents have taken a classroom course in the last 3 years. However, only 31% have taken an online course. 62% of the respondents (mainly in Bulgaria and Poland) believe that an online course could be as effective for a professional training as a classroom course. Almost equal percentages of respondents think that an online course will allow covering of a larger variety of topics that are not covered in a regular classroom training/course.

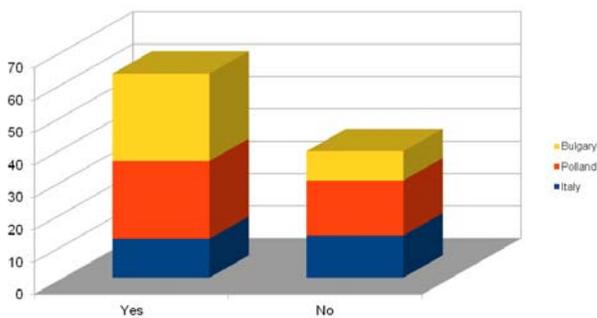


Number of persons interviewed that have taken or not a training course in a classroom

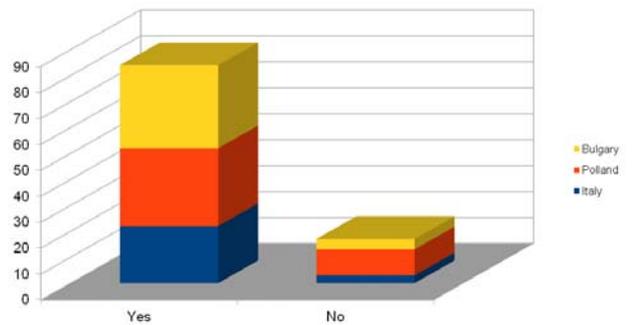


Number of persons interviewed that have taken or not an online training course

As expected 83% of the respondents, need a short introduction to the course in the beginning acquainting them with the goals of the course. Analogically, 86% want to be acquainted with the course's framework in the beginning to be better acquainted with the duration, requirements, etc.

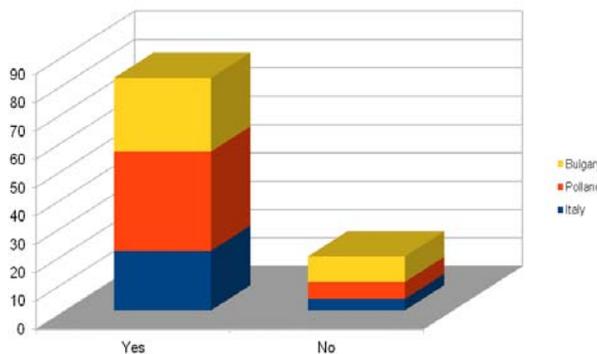


Number of people interviewed who think or not that an online training can be used as effectively as classroom training as far as professionals are concerned.

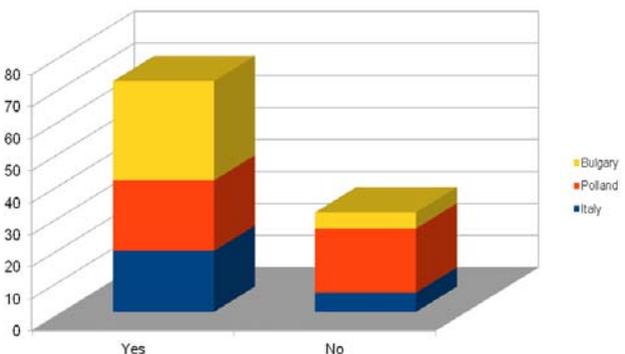


Number of people interviewed that need or not a short introduction to the course in the beginning acquainting them with its goals.

81% of the respondents prefer to have simplified interface and an easy workload of the e-tasks. In addition, 70% of the respondents consider that it should be a compulsory precondition that the test questions are correct before to continue studying.



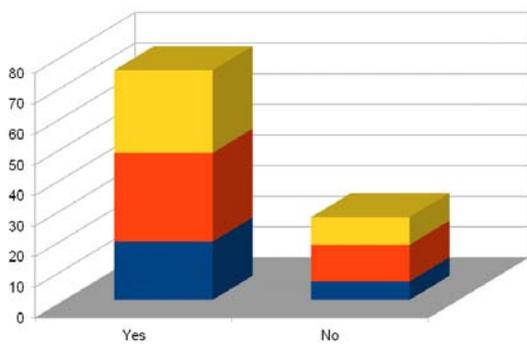
Number of persons interviewed who prefer a simplified interface and an easy workload of e-tasks.



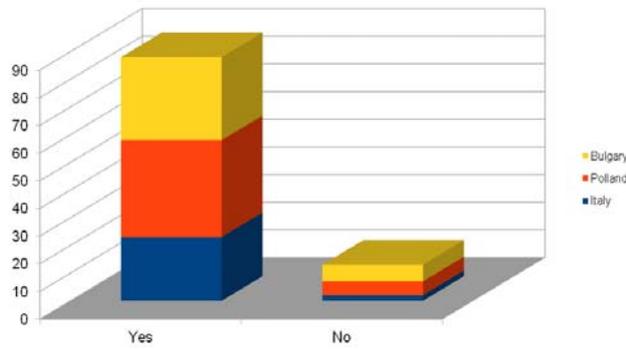
Number of persons interviewed who think or not that test questions are compulsory and that answers have to be corrected before to continue studying.

A particularly high number - 74% of the respondents stated that in their previous training experiences the content of the materials explained the knowledge and concepts well. In addition, a high number of respondents think that e-collaboration and teamwork activities can improve the learning results. E-tasks

and online assignments are the most preferred approach for the respondents (54%). Also not surprisingly 90% of the respondents think that a short presentation about the training contents by the teacher or instructor can positively affect participant understanding ability.

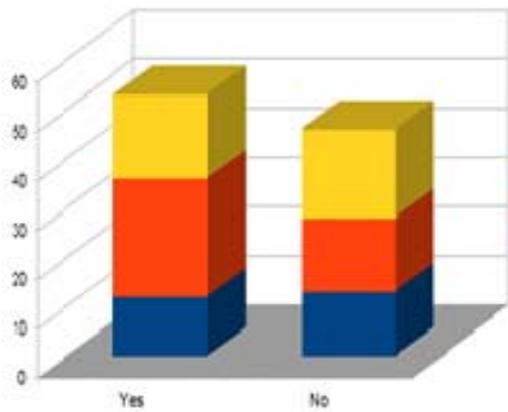


Number of persons interviewed who think or not that in their previous training experiences the content of the materials explained the knowledge and concepts in a good way.

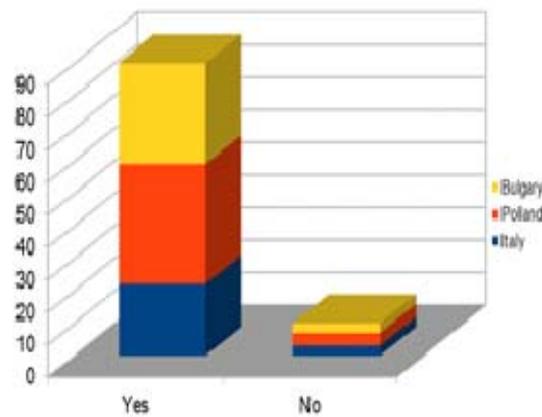


Number of persons interviewed who think that improving e-collaboration and teamwork activities can improve the learning results.

Analysis of the questionnaires resulted in 70% of the respondents stating that the previous courses in which they took part had met at least some of their objectives, and only 58% stating that they would be able to apply their learning in their personal and professional life within 12 months.

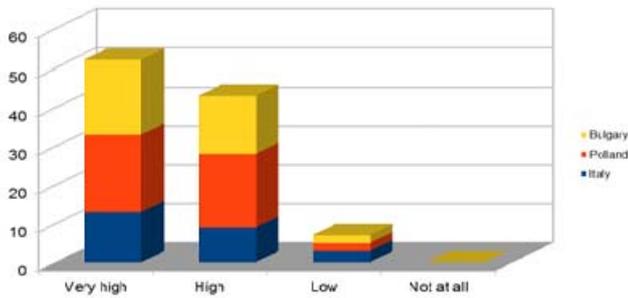


Number of people interviewed that prefer or not to do e-tasks and compile online assignments.

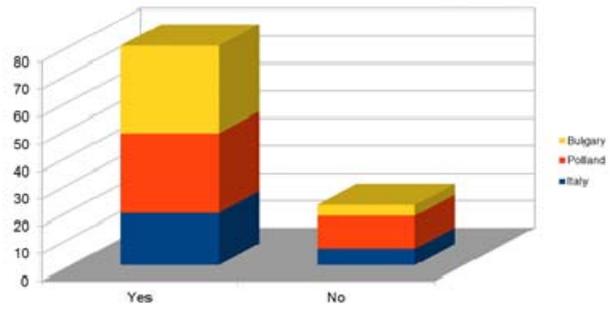


Number of people who think or not that a teacher short presentation about the training contents can positively affect participant understanding ability.

There were 92% of participants who agreed that it is useful to share with others and 66% felt that they could become more effective managers. It was interesting to note that whilst there was a poor response to questions about the on-line collaboration area, 85% of participants found the help of the tutors/facilitators very useful.



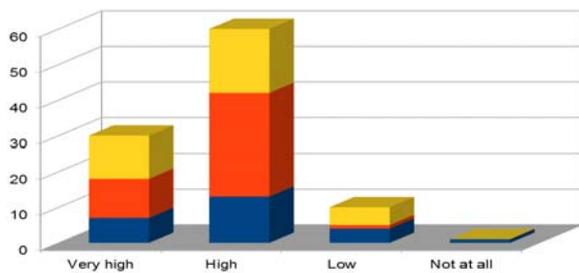
The importance of instructor's role to help people interviewed to learn



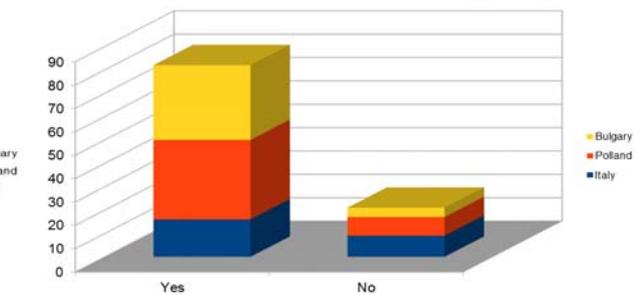
Number of people interviewed that would like to be in contact with other training participants through a virtual classroom.

The 78% of the respondents want to be in contact with other training participants through a virtual classroom.

For many of the respondents the availability of the teacher or instructor to provide help when needed (by email, phone, etc.) is considered very important (89%).



The importance of teacher availability to provide help according to people interviewed



Number of people interviewed that would like an off-line course on a CD-Rom

A substantial number of the respondents (80%) confirmed that they would like to course to be available off-line on a CD-ROM as well as online. This aspect should be taken into consideration by the ARIALE team.

Usefulness of the proposed course content

ICT based means for automation and innovation is considered "Very useful" by 42% and "Useful" by 38%. Therefore, it could be concluded that the choice of this topic is justified.

Sensors in industrial automation – the opinions for this topic vary from "Average" (30%) to "Very useful" (25%). The majority 32% find the topic useful. The 24% of the respondents consider the topic "Not quite useful" or "Not useful at all" which is a substantial number.

Actuators in industrial automation – the respondents' rates again cover the diapason from "Average" (21%) to "Useful" (34%) and "Very useful" (25%). However, if we sum up the number of people who have answered "Not quite useful" and "Not useful at all" we have 21% in total, which is significant percentage and should be considered.

Application of PLC in industrial automation was evaluated by 29% as "Very useful", 25% as "Useful", 26% as "Average" and "Not quite useful" and "Not useful at all" – together make 21%.

Industrial networks and interfaces in industrial automation systems was assessed as “Very useful” by 23%. The majority have voted for “Useful” (37%). 18% considered the topic averagely useful, while 22% stated that the topic is “Not quite useful” or “Not useful at all”.

Industrial robots in automation systems – the majority of respondents think that learning materials on this topic will be “Very useful” (32%), “Useful” (27%) and Average (17%). A total of 24% believe that information on this topic won’t be quite useful or useful at all.

Factors for a successful classroom course

The factors named by the participant were very diverse, however they could be grouped in the following categories:

Participants:

- Close levels of preliminary preparation of all participants.
- Discipline on the side of the participants.
- Motivated participants.
- Intelligent participants.
- Small group of participants.
- Possibility to interact among participants.
- Opportunity for making new contacts.

Lecturer:

- The good lector.
- Good preparation of the lector – in practice and in theory. Follow the right logic of the training material, motivate the trainees.
- Motivation of the lecturer.
- Skilled lecturer able to present the training material in an interesting way.
- The attitude and charisma of the lecturer and if he succeeds to give participants the impression that what they learn is important and will be practically applicable for them and they can use it in their work.
- The lecturer has to possess some good rhetoric skills, to be able to attract the attention of the listeners, to speak inspiringly and interestingly.
- Trainer has skills of knowledge sharing.

Atmosphere:

- Comfortable working atmosphere.
- Quiet and nice atmosphere from the participants.

- The number of trainees in the classroom should be considered regarding the available resources and size of the room, individual attention should be paid to each of the participants.
- Focus and concentration, there should be no distractions in any form.
- Good relations between teachers and trainees.
- Possibility to get answer for raising questions.
- Possibility of direct talk with trainer.
- Interaction among instructor and participants.
- Possibility of opinion and experience exchange.

Learning materials:

- Availability of samples.
- Good quality of material and technological basis.
- Good presentation of the training material.
- Ensuring conditions for practical assignments.
- Structure of the course.
- Maximum practical orientation of the course.
- Multimedia, video materials, (clips), practical materials.
- Balancing the level of the training material with the moment level of the trainees.
- Well-structured presentation materials.
- Training accuracy.
- Practical examples and very good communication.

Facilities:

- The hall has to be equipped with modern equipment and technology.
- All kind of education should be covered – exercises, presentations and other.
- The physical environment.

Factors for a successful online course

- Clear video clips.
- Clear tasks.
- Actual and practically useful topic for the trainees.
- Access to materials related to the topic of the course.
- With good functionality.
- Easy to use interface.
- Comprehensiveness of the content of the training course.
- Self-check test questions for checking the learned material.

- Opportunity to provide feedback and communicate with the mentor/trainer if assistance is needed or there are questions.
- Good lector.
- Focus and concentration, not to deal with any additional or side activities.
- Intelligent participants.
- The topic and the depth of the course.
- Motivation of the participants.
- Structure of the course.
- Adequacy of the training materials.
- Availability of links to websites demonstrating the material in the course.
- The usefulness of the information, its systematic, understandable and impressive presentation, attracting the attention of the participants.
- Clearly formulated topics and tasks and after that availability of the materials 24/7.
- Opportunity for constant contact with the trainer.
- The course has to be conducted with a real lecturer but in virtual environment, in real time in order to follow the results of the training, as well as online training with video materials.
- Motivation, the programme (curricula) and the ease of training.
- The good compilation of the materials.
- Interest from the trainees.
- Diversity of topics.
- Giving examples after each topic.
- Clear vision about the whole course from the very beginning.
- Use more images and visualization to make it easier to memorize the content of the course.
- Comfort of place and time.
- Unrestricted term and time of day of course utilization.
- Accessible in any and convenient time.
- Flexibility and possibility to learn from home.

Identified barriers to participation in online courses

Most of the participants in the survey have not taken online courses and therefore could not share first hands experience. However, the opinions of the respondents who answered to this question tended to converge around several common barriers:

- Lack of personal contact with the trainer.
- Lack of objectivity of the assessment.
- When studying in a class there is opportunity to compete with others, which can be a motivating factor.

- It is easier to distract your attention during an online course, less attention during online courses.
- The course is not always easy to access and available all the time.
- I have not found so far well prepared internet course.
- Some areas are not suitable to create the e-learning courses.
- Lack of possibility for discussion.
- Lack of motivation to intensified activity.
- They are not effective.
- The learner has to have very strong internal motivation to take the course as well as systematic work is necessary.

Some of the respondents were very fond of online courses as they encourage self-learning and ensure opportunity to learn at any time. Also online courses allow covering more diverse topics, which are not covered in the traditional classroom training and shortens the time for preparation. The training is done in time convenient for each of the participants, which also makes it a preferred choice.

Expectations for an online course

Most of the respondents did not have any expectations for the course, as they have never participated in such training.

The expectations expressed however were very common: flexible time and place for conduction for the course; well-structured materials on interesting and useful topics.

Simulations, good practices and exercises were also expected from the course. Participants requested that the information presented will be practical and specific and not general.

What respondents wanted as a result of the course was to improve their qualification and to widen their worldview. Maximum interactivity and availability of links to other sites was also recommended.

There should be no excessive audio and visual effects, and still the information has to be detailed enough, if necessary there should be graphs (pictures) and video clips.

Another respondent shared that they expect the course to be practically oriented, to present different case studies and to encourage the application of the learned in the production process, not to be only theoretical.

The course has to be conducted with a real lecturer but in virtual environment, in real time in order to follow the results of the training, as well as online training with video materials.

Here are some more characteristics of the online course as expected from the ARIALE project target group:

- More video materials and practical case studies.
- Wide scope of the presentation materials on the topic of the course.
- Involve the user with techniques for fast learning.

- Low levels of difficulty for achieving the targets.
- Good trainer/instructor, training accuracy in help to do job better.
- Easy to use but substantially demanding.
- Effectiveness.
- Clear interface.
- To gain proper skill/knowledge.
- Professionalism.
- Objectiveness, concreteness, should transfer most important most useful information.
- Possibility to get answer for specific questions and problems.
- Maximum useful, practical knowledge.
- Professional and fast.

Kind of practical tasks to be included in training activities

All of the mentioned: self-projects elaboration, simulations, team exercises, success stories, case studies solving, etc., were pointed as good tools for practical tasks. Especially for the Programming, software engineering and hardware engineering own projects were recommended. In the beginning of the course share realized good practices. In the end of the course, there could be also projects prepared the participants on their own.

Simulations, opportunity for discussions with the other participants as well as with the lecturer, exchange of opinions, practices were also mentioned.

Effectiveness of the out-of-class learning

It was stated that this kind of activities can be very effective but of course, it depends on the learner. Assignments and practices are obligatory; self-improvement through additional tasks is a necessity for anyone who wants to get deeper into a given discipline.

When real cases related to the topic of the training are solved then the learning is much more effective. Relevant reading materials related to the learning activity (thematic), as well as practices for easier assimilation (understanding) of the material are also considered useful for improving the effectiveness of the training. Practical tasks are key and additional number of them would increase course quality. Additional work is a key issue in learning, by realization additional task individually. Practical tasks are seen by one of the respondents as a helpful way to verify gained knowledge.

Recommendations on improving an online course

There were various recommendations regarding the form and presentation of the online course. Most prevailing opinion was that the lessons should be no longer than 45 minutes.

One of the respondents suggested that all the lessons are presented as video clips and are accompanied by a pdf file explaining the material presented in the clip. The duration of the clips should be again no longer than 45 minutes.

The distribution of the learning material should be considered along with the time allotment for the course – over flooding with information should be avoided.

Participants should have the opportunity to put into practice what they learn. There should be practical tasks envisaged after each module as well as conditions where the participants can perform these tasks.

Learners should be given the opportunity to choose for themselves which modules to study.

Not to put emphasis on the importance of the modules, the modules to be equal in their presentation. A common suggestion was that the course should have a short theoretical part and significant practical part.

There were particular recommendations for the time allotment and duration of the course as follows:

- 30h/15 weeks.
- 45h/15 weeks.
- the course should not be more often than 2 times a week and not longer than two months and it should be in the winter season.
- the course should not be longer than 1 year, divided to e.g. 4 modules with exam after each.
- not longer than 2 days.
- the full course to be max. 8h - 1,5 h per module.

Suggested self-evaluation forms before, in the middle and after training course

Multiple choice tests and short open questions were the most preferred forms of examination suggested by the respondents in the open-end questions of the survey. Simply tests without open-end questions were seen as an easier way to cheat, while open-end questions would reduce this risk.

An interesting observation was that the questions before the course give the trainer idea about the knowledge level of the participants. While the questions at the end of the course give idea about the level of the trainer, how prepared he was and whether he/she managed to transmit his knowledge to the audience.

Another observation was that short questions are a good idea during the course but it should be carefully used to not discourage participants. Some of the respondents expressed doubts in the self-assessment as a tool and that results from tests could be not very reliable. However this is the only approach for learners to tests themselves without feedback from the trainer/instructor. One of the respondents recommended that there should be problems and tests after each chapter/module. At the end of the course one general test is recommended so as to check the overall understanding of the material.

Additional subject to be included

- Robots, robot-hands, mobile, types of kinematics, gas solutions.

- Human resource management, psychology of change, change management.
- Advantages (benefits) from automation.
- Improving productiveness; preparation of middle management level personnel.
- Working principles, programming and application of microcontrollers.
- Application of controllers in industry.

The following principles informed the design of the ARIALE LMS (Learning Management System) at the beginning of the project. These were elaborated in view of the findings acquired after the national surveys processing:

- The focus has to be on learning and learner-managed environments.
- Learning is better supported in collaborative settings and dialogue between experts plays a major part in the collaborative learning process.
- Social interaction allows for co-construction of knowledge, which promotes engagement of learners in work based and problem-based learning.
- The role of the facilitator/Tutor is essential for collaborative e-learning.
- Critical reflexivity is an important part of the learning process for evaluating and examining both the learning process itself and the resultant actions taken.
- Learning has to be situated and context dependent.

The quality of an e-learning course is enhanced by:

- *Learner-centred content*: E-learning curricula should be relevant and specific to learners' needs, roles and responsibilities in professional life. Skills, knowledge and information should be provided to this end.
- *Granularity*: E-learning content should be segmented to facilitate assimilation of new knowledge and to allow flexible scheduling of time for learning.
- *Engaging content*: Instructional methods and techniques should be used creatively to develop an engaging and motivating learning experience.
- *Interactivity*: Frequent learner interaction is needed to sustain attention and promote learning.
- *Personalization*: Self-paced courses should be customizable to reflect learners' interests and needs; in instructor - led courses, tutors and facilitators should be able to follow the learners' progress and performance individually.

Considerations and ARIALE Programme Requirements

From the analysis of the ARIALE questionnaires on end users requirements, many considerations emerged:

- The target group involvement in competence development and learning contents improvements can have a very positive effect on the individual SME's competitiveness and performance.
- Formal methods of teaching and learning are not necessarily the most appropriate way of engaging, motivating and transferring knowledge to SMEs workforce. So formal training is not the best way of learning for SMEs. Instead, non-formal and informal learning can constitute the most important way of acquiring and developing the skills and competencies required at work.
- Training activities have to be focused on the specific needs of the SMEs for example giving the possibilities to assemble the learning contents available in the platform. An active learning approach focuses on solving real problems and the employees' needs.
- The SMEs' heads frequently own a negative attitude to change and learning. In many cases, time devoted to learning activities is considered as lost time. When employees are involved in the learning process dealing with issues of relevance to their careers they become motivated learners. To get effective motivation the learner should be put in the centre of learning.
- SMEs are driven primarily by profit and they are focused especially on bottom line. The role of promotion is very essential. No matter how good the training and support material, it has to be carefully promoted from the head and delivered to be effective. It must go to considerable lengths to highlight the commercial benefits of business improvement (non-commercial benefits can be promoted as secondary benefits once the main commercial message has been thought).
- Learning for many SMEs' heads has seen unfortunately as a cost, and they do not always consider it as an investment for the future. The curricula should have a measurable impact within the organisation and should be affordable and value for money.
- SMEs use a short-term approach; they only set up a training action plan on Automation or Robotics only when they face meet problems. Approaches to learning, training and development in small firms needs to take account of the shorter planning time frames they use by relating learning opportunities and benefits to these shorter periods.
- Some of the advantages of e-learning directly address the needs of SME's: flexibility, cost benefits, location is not a barrier, freedom to work at own pace, less disruption to work schedules.
- An informal environment should be built to aid networking. The network should provide a forum for exploring ideas with peers, and give support to individuals. Network learning broadens access and participation of SMEs in real-life learning environments. Network technology offers the opportunity to

facilitate, strengthen and connect SMEs in order to build and enhance networks of business at the regional, national, or international level.

Other target groups' comments highlighted **successful aspects** to follow in LMS development such as:

- Enjoyable and useful live face-to-face sessions can encourage virtual collaboration.
- Some contents have to be focused on management issues.
- Tools for personal (one-to-one) discussions after a learning activity.
- Structured tools and easy templates can be very helpful for inexperienced online participants.
- Expert participants can become platform facilitators especially during the virtual learning phases.
- Easiness to contact facilitators, tutors and group members by tools as email, audio and video calls, etc.
- Direct contact with course instructor.
- In some cases, face-to-face/traditional learning sessions seem preferred, maybe due to age of participants (felt virtual learning may be more easily adopted by younger people).
- Collaborative aspects of the platform features are confirmed as essential.
- Learning from best practices looks as very useful.
- Access to other external resources (such as e-libraries) look valuable for every participants.
- For many interviewees interpersonal development and practical training are more important than academic learning. Practically oriented, to present different case studies and to encourage the application of the learned in the production process, not to be only theoretical.
- Simulations, good practices and exercises.
- Accessibility to training content 24h, accessible but also interesting interface, tests/quizzes e.g. after each lesson and course.

Target groups' comments highlighted besides **not so successful aspects** that need to be verified for LMS development such as:

- Previous experiences with LMS or similar platforms in many cases showed that video/animations were often unusable and not intuitive.
- Not well-structured presentation of materials or graphs.
- Lack of collaboration following face-to-face sessions.
- Wanted more structured multimedia contents in the curricula.
- Difficult to schedule time for remote learning and give up if it does not work easily or quickly.
- Clearer structure at the beginning and more tasks with clear deadlines.
- Problems with motivation and lack of direct contact with other people.

Conclusions and Implications

The overall conclusion of the ARIALE survey on SMEs is that it is possible to involve successfully them by using an engagement strategy that communicates needs and addressing their current automation problems. The combination of face-to-face and virtual action learning (blended learning) can work well, and help to encourage the SMEs to join online courses. The need for a clear structure of the curricula was underestimated and in the future, more attention should be given to informing potential participants on the structure, tasks and the expectations of their involvement.

There was a need of tutors and/or facilitators to be in communication almost on a daily basis and use a flexible style to motivate the participants. There were times when a 'light touch' of facilitation was sufficient and also times when the participants looked for clear directions and guidance.

Some other recommendations are the following:

- Clips no longer of 45 minutes.
- Attached to each video clip there should be pdf document with the material trained in the clip.
- To take into consideration the quantity of information, which is provided by the course along with the time allotted for the course.
- Everyone to be able to do by himself some of the demonstrated exercises, if there will be such.
- Not to put emphasis on the importance of the modules, the modules should be equal in their presentation. Everyone will choose for himself the module, which he wants to study.
- It should take into account the leisure time of participants, the course should not be more often than 2 times a week and not longer than two months and it should be in the winter season.
- Multiple choice tests adoption and not open questions.

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