



09 Recommendations

Recommendations for stakeholders in other EU-countries and on the European level for dissemination, transfer and use



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Learning
e-Mobility
Plus

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1. Introduction

It is forecast that the impact of electric mobility as an economic factor will significantly intensify over the next years. The increasing number of electric cars in the EU will drive the development of electric car service networks, both in terms of diagnostic and repair services, as well as an expansion of charging stations for electric vehicles.

The emerging market of electric cars and hybrid cars will heighten the demand for skilled workers in this field. This requires school curricula be adapted as regards how the syllabus is taught in the automotive and electronic sectors.

Furthermore, in order to further anchor these technological innovations, good practices developed by countries need to be embraced. International cooperation makes it possible to exchange information concerning new solutions on how to best approach technological change.

Electric mobility plays little to no role within the sphere of vocational education and training. And when it does, the focus is generally on theoretical learning, seldom on practical applications. While the basic theory of electric motors is the major component of the curriculum for electricians, practical training in the workshop is often limited to workbenches equipped with standard motors for the purpose of practicing normal maintenance work procedures. Electric or hybrid motors are seldom available in this context.

Even at the university level, electric mobility is dealt with only marginally, even if several engineering science faculties have since initiated dedicated courses.

While numerous small and medium-sized enterprises (SMEs) are very innovative, they have difficulties in accessing vocational education & training options, as current processes still require long time for transferring new contents into teaching practice. What this means in the sphere of electric mobility is that the potential synergies in view of a “VET 4.0” have not yet been adequately exploited.

The project "Learning e-Mobility Plus" was aimed to illustrate the opportunities for cooperation of VET, research and science and enterprises - using the example of the future-oriented technology electric mobility. Moreover, the aim was also to establish mutual experience and knowledge transfer, to create innovative learning environments that are able to transfer technological requirements into practical applications and to facilitate cross-sectoral competencies (electro-automotive-IT) and to more closely link the VET sector with university, research and the business sector.

Based on experience gathered from the active and successful cooperation realised by the partners in the three participating countries Germany, Italy and Poland, joint conclusions and recommendations were formulated with a view to promoting the transfer of

innovative learning models, in addition to supporting the continued development of vocational education, not only in their own countries, but EU-wide as well.

2. Current situation

(Summary, for details see the national recommendations)

Situation in Italy

In the area of higher and university education no dedicated training exists in motor vehicle technology. Mechanical engineering has introduced novel courses on engine technology and vehicle systems. Degree courses have recently been initiated in automotive engineering (vehicle engineering science at Polytech University of Turin, transport engineering science at the University of Florence). In addition, the subject of mechatronics degree courses is being dealt with in Padua, Pavia and Modena. Students in engineering science receive more complex training in motor vehicles in the form of project work and company-based R&D activities.

With respect to skilled workers, cooperation between vocational school and industry remains quite limited for historical reasons. However, a significant improvement in quality is anticipated over the years to come, due to the reform for a dual system. To ensure the successful imparting of complex technologies, close linkage of theory and practice will be required in the specific learning models. Until recently, practical internships in industry were only one option among many in Italy, and by no means the norm. Since 2016, both types of practical curricula have been more closely linked to the needs of industry. Vocational training centres are currently introducing dual training schemes that decisively strengthen practical training in the industrial sector.

Situation in Germany

The training situation at universities and vocational education & training institutes is characterized by independent course content. Vocational and university education takes place more or less in parallel. There are increasing calls from policy-makers, vocational schools and students to improve permeability.

In the area of vocational education, in addition to automotive mechanics, electrical engineering - indeed the occupational profile in which mechatronics is already anchored - is assuming an increasingly important role and in turn causing a further decline in the significance of mechanical work on motor vehicles.

In vocational education, however, fears persist about embracing new technologies such as vehicle digitization and networking as part of motor mechanics training.

Situation in Poland

Hybrid cars do not constitute a significant part of the Polish automotive market yet, and electric cars to an even lesser extent. National priorities in respect of alternative sources of motor vehicle power comply with Union properties in Europe. A significant increase in electric vehicles in the Polish car market is anticipated. But 93% of the companies do not cooperate with universities and research institutions; 7 % of the companies participated in training on new spraying technology. Cooperative initiatives involving scientific and vocational education & training schemes are usually realized in the context of various pilot projects. Based on the project results one may conclude that each teacher does not discuss the question of electromobility during the lessons, although it should be covered according to obligatory curriculum.

The teachers covering the subject of electromobility usually take advantage of multimedia presentations as well as the models of chosen components. In the majority of cases, students are interested in this subject and perceive this knowledge quite useful, as the number of hybrid and electrical motor vehicles is increasing lately. The students believe that in the future they will deal with such vehicles working as car mechanics. Modifications developed in the context of school curricula for various professions in accordance with Polish law may be authorised for school use in general school training in these fields.

3. Conclusions

The following can be concluded from these joint project initiatives:

1. All EU states are actively implementing the "Innovation Europe 2020" strategy, although concrete implementation differs from country to country.
2. Making sure that skilled personnel have the competencies they need in the area of electric mobility/hybrid remains a challenge in all three countries - as in other EU countries (even if some countries have already shown progress in this regard)
3. The European exchange programme directly benefits all partners, i.e. participants can:
 - learn on-site how innovation and teaching practices are implemented in other countries
 - identify new partners who want to actively promote modernisation of vocational education
 - exchange learning materials
4. When choosing cooperation partners it is important to ensure that at least one of the consortium members possesses adequate experience and expertise in a concrete field of technology (such as in our case the electric mobility).
5. Action is needed to ensure the competencies of trainers/master craftsmen/specialist subject teachers in how they will teach these new technologies - training in the use of innovative learning environments and new teaching contents. Targeted training

opportunities for teaching staff/trainers in the area of electric mobility have not been widely available so far (offered by professional organizations, seminars at universities).

6. Cooperation between vocational training and academic education must be strengthened. The kind of close cooperation between vocational schools and universities - as practiced in our project - was unknown territory for many partners. In Poznan, where academic education and vocational training traditionally have very few points of contact, the corresponding cooperation formats first had to be established.
7. The involvement of industry is indispensable. Successful models of cooperation between vocational schools and firms must be rendered more visible and more widely publicised, in particular in countries such as Italy and Poland where, to date, no such dual vocational education schemes have been available. It is not easy to attract suitable smaller firms as partners, because SMEs lack the methods systems or management systems that facilitate innovation transfer.
8. For the active involvement of apprentices and students in joint working groups to succeed, dedicated support is required and the knowledge gap in the chosen subject must be kept to a minimum, i.e. an approach that addresses the different competencies of the apprentices and the students in a targeted manner.
9. The formation of a strategic EU partnership in the education sector requires support from policy-makers (national ministries of education, directorates and agencies of the EU Commission in the educational sector), in order to ensure successful cooperative efforts.
10. Surveys of industry, universities and vocational schools have shown that practical cooperative measures such as joint consultative boards or regular joint events are well suited to breaking down reservations and prejudice.

4. Recommendations

Electric mobility is one of the most future-oriented technologies within the entire EU.

Successful strategic cooperation for the purpose of anchoring new technologies in vocational education must be better marketed. The introduction of innovative learning models should not be allowed to fail due to the lack of funds in the various institutions.

The project has formulated the following recommendations for the three core stakeholder groups:

4.1 Education Authorities Level

General

- Support for regular cooperation between vocational schools and firms - e.g. in the form of cooperation agreements (SME counselling helps to identify which additional competencies are required)

- Support for joint projects between vocational schools and universities to implement pilot measures
- Beyond promoting cooperation between vocational schools and SMEs, to also support the notion of 'university-vocational school collaboration', e.g. by recognizing days spent in practical training
- Strengthen educational permeability: make university access easier for trainees, make it easier for students with academic problems to transfer to vocational training schemes
- Develop continuing education opportunities in electric mobility for teaching staff
- Adapt examination regulations: include examination questions on the topic of electric mobility in the exam procedure
- Comprehensive financing of innovations now required by technological advances. Also as regards educational equality, all trainees should have the possibility of learning new technologies that are already in strong demand in a growing industrial and commercial sector.
- Accelerate decision-making processes in school administrations. In doing so, good practices should be closely followed in the context of European projects/programmes, particularly given the diverse options available to vocational schools in terms of integrating innovative course content (despite different framework conditions in the EU)
- Promote the dissemination of results –regular publications, reports on successful projects via in-house publications, professional journals and presentations at professional events (in order to reach both policy and expert stakeholders)

In trade chambers and guilds

In this regard, the trade chambers and guilds should

- actively persuade member firms of the necessity of adopting contemporary training approaches (e.g. on the subject of electric mobility). Solution development shall be made in due respect to not overburden the SME's in terms of costs or time expenditure.
- include innovative course content (e.g. on hybrid/electric mobility) in the final examinations.

In vocational schools

School administrations should

- provide teaching staff with the tools they need to successfully carry out their work in new technologies,

- give more emphasis to interdisciplinary projects - e.g. between electronics and mechanics,
- promote company visits and internships, maintain permanent contacts with companies offering internships. These represent excellent learning opportunities. In this way, vocational school classes can experience the reality of how certain company-internal practices function in practical terms. Preference shall be given to those receiving firms that strongly focus on research and innovation and commit to new technologies.
- A working group combining teaching staff of various subject areas should maintain the contacts with collaborating SMEs and universities. Such cooperation models allow schools to open up to their local environment and to offer both trainees and teaching staff other perspectives and new viewpoints. The universities can also contribute further methods and cutting-edge know-how, which in turn broadens the competencies of the teaching staff.

4.2 Industry and Commerce Level

Sustainable firms should

- be more actively involved in professional associations and represent their interests therein. They need trained personnel that possess these new skills. It is in their interest to ensure that the imparting of knowledge/competencies in the area of new technologies becomes a mandatory component of their educational focus.

Professional associations should

- be more open to the issue of 'new skills' and more closely involved in the discussion process regarding sustainable future development of vocational education; they should also advocate more strongly for those firms that commit to new technologies (publicise at PR level etc.).
- organise sustainability prizes that promote sustainable business practices and innovative technologies in their fields (still not common practice in many countries).

4.3 Support and promotion level - lobby work

- Cooperative efforts in future-oriented technologies require robust support.
- In their national programmes, the member states should more strongly emphasise innovative technologies in their professional training and university education schemes.
- The coordination of national programs in support of new technologies needs to be improved (overly divergent structures hamper cooperation, particularly in those sectors that specifically require cross-border cooperation). National approaches should

– especially in the area of vocational education & training – be harmonised EU-wide. Local sustainability cannot be achieved in the area of new technologies without first establishing global sustainability programmes.

- Integration of the education issues in policy levels by promotion programs in other sectors (“Smart Cities” or for example in Germany “The Electromobility Showcase”); academic and vocational initial training and further qualification actions were integrated into Promotion of Electromobility by SME (Automotive sector; Transport, Logistic)
- Formation of national agencies for electromobility
- Changes in educational policy - the integration of innovative content and new forms of learning into framework curricula, training regulations and examinations cannot succeed without close collaboration with industry and commerce. Policy-makers and administrations must therefore exert stronger influence on their commercial partners to share the responsibility of implementing such political and technological changes– all with a view to achieving more sustainability.
- New approaches to cooperation between vocational schools, universities and firms, as well as EU-wide cooperation, require support from programmes such as ERASMUS Plus. The current project is an example of the kind of very successful cooperation that can be achieved with such a programme.
- In assessing and selecting funding projects, one important criterion should be that - among the partners - the greatest possible diversity in terms of the stakeholders themselves should be represented. This strengthens cooperation at the various levels and helps to surmount "institutional gaps".

4.4 Final recommendations to strengthen cooperation between vocational schools, universities and firms

The importance of the promotion of electromobility has now arrived at European level in important EU policy declarations in many EU countries. To ensure that the process can be countered with qualified specialists, the provision of innovative educational content must be ensured.

The following steps are required:

Vocational education - business sector

- Companies may support the schools through provision of equipment (models, parts, assemblies) in the field of new technologies (for instance electric power train);
- Vocational subjects teachers may be enabled to take part in professional trainings organized by companies, presentations of new models and technical solutions, for instance demonstrations on the school premises;

- Groups of outstanding students may be given the opportunity to take part in company trainings.

Vocational education - higher education

- HE and VET providers are called to jointly implement projects with the participation of students and trainees.
- HE and VET providers shall work on the correlation of vocational subjects' curricula; enabling larger participation of VET-trainees in demonstrations and presentations organized by universities and the joint use of the VET-school facilities for practical training with joint learner groups of VET-trainees and HE-students.

INTERNATIONAL COOPERATION

- It is necessary to amend/modify the current VET-curricula and to introduce new topics. This may be done through the set-up of joint work groups with experts from both VET-schools and universities of several countries, exchanging experiences, organizing seminars, elaborating on contents etc. Further, the cooperation with Technical Universities is essential in order to properly address new technological developments and to complement the didactic process.
- Financing new pilot projects or retaining old programs:
 - For scientific alliances
 - For VET strategic partnerships with innovative SMEs
 - Strengthening the permeability between VET & Higher Education (VET-Students & HE-Students in the same projects, e.g. in mobility projects)
- Mainstream the topic and support the collection of good data (Presentation of Good Practice in Round Tables, conferences, National actions platforms, e.g. Project Results and dissemination platforms of the EU)
- The different kinds of European Federations with their professional special interest group of vehicle or transport logistic companies across Europe should be supported and more promoted in order to improve and expand their range of operations
- Stimulation of the creation of good transport culture in all EU-cities
- Dedicate more EU-funding to invest in regional structures

All types of stakeholders affected by the technological changes and respective developments in business and education are invited to make use of experience of this project and the new model of teaching presented here.

“Learning e-Mobility Plus” is intended to spread the new contents and model of teaching not only in the three participating countries, but across the EU as a whole.

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