



Conclusions & Recommendations

for the successful integration
of digital innovations
in technical
vocational training



Co-funded by the
Erasmus+ Programme
of the European Union



Project Coordination

BGZ Berlin International
Cooperation Agency GmbH
www.bgz-berlin.de
www.car2lab.eu

Authors

Grazyna Wittgen
Prof. Dr-Ing. Michael Lindemann

Picture credit

Rear view of luxury car © Sergey Nivens - Fotolia.com

Design

Franziska Zahn, Qin Feng, Elisabeth Schwiertz,
Steven Gräwe, Martin Popp



Berlin, 2019

Content

- 1. Introduction 5**
- 2. Recommendations for decision-makers at regional, national and European level 7**
 - 2.1 Recommendations for education providers and developers..... 7
 - 2.2 Recommendations for the use of the telematics kit and the learning units developed in the project 8
 - 2.3 Recommendations for decision makers/level of governance..... 8
 - 2.4 What does this mean at the national and European level? 9
- Recommended literature and links..... 12**

1. Introduction

Securing the transfer of technology know-how

Vocational education and training is confronted with the growing demand for professionals with ICT skills. The challenge for the VET systems of the EU countries is to implement the rapidly developing new technologies in training. These technologies also lead to drastic changes in the automotive sector. An important trend is the combination of physical mobility with the possibilities of the Internet. EU education systems (vocational and higher education) need to find solutions quickly to cover the rapidly evolving new technologies in education and to impart digital competences for new technology fields in a practical way.

Today, for example, vehicle telematics is indispensable for securing modern, resource-saving national and transnational transport. For modern transport systems it brings synergy effects through the combination of several technologies: telecommunications, information technology and automobile technology. The "telematics market" is growing annually and the demand for innovative support tools is increasing rapidly.

The transport must meet the current environmental requirements and offer technological and administrative solutions. Telematics solutions not only facilitate the work of motor vehicle companies and forwarders, but also help to increase the overall efficiency of car traffic (streamlining administrative processes, avoidance of "empty runs", traffic jams etc.). Especially today, it becomes clear how important the introduction of modern technologies (also for environmental concerns) is in the automotive sector. The implementation of innovative projects for the current as well as the future labour market requires the co-operation of various trades and of different networks.

The need to rationalise transport and digital communication processes is directly linked to the growing need for skilled workers with new competences. The implementation of national development and the anchoring of technological innovations depend on knowledge of the developments in other countries and their examples of good practice. Efficient and sustainable work networks between educational institutions, universities, motor vehicle companies and politicians play a major role.

The aim of the "Car2Lab" project was to significantly strengthen the acquisition of job-related digital skills in training in the automotive sector in order to adequately prepare young professionals for the demands of a digital working environment.

With our project "Car2Lab" we have succeeded in bringing together a significant alliance of experts from four EU countries and to develop EU-wide transferable learning and teaching materials in the important field of automotive telematics. They enable the transfer of competences (ICT competences) for pioneering technologies (electric mobility, autonomous driving, etc.).

This includes the integration of industry 4.0 content into vocational and academic education. Through the active cooperation between vocational training institutions and universities, solutions for dealing with technological developments and their influence on the world of work and new occupations and job descriptions were explored.

The partnership successfully implemented the following:

- * Integration of industry 4.0 topics in the VET sector in previously mechanically oriented professions
- * Creation of an innovative, digital learning tool with simulated work processes and real-time data
- * Establishment of a permanent learning cooperation between vocational school, university/research and companies in the design of work-based learning for the automotive sector

The strategic "Car2Lab" project partnership has summarised its lessons learnt on framework conditions for the sustainable dissemination and use of our project results in the participating countries Germany, Denmark, Italy and Poland as well as on findings on promoting factors, which the partnership is happy to share with others.

At the same time, the partners have realised that despite different traditions and differences in the vocational training systems in Germany compared to Italy, Denmark and Poland, the need for action in the area of vocational education and training in all countries has many things in common. The strict separation of the recommendations explicitly by country is therefore not always the case.

This is not a scientific study, but lessons learnt through the close and direct exchange of experiences from daily work and the mutual familiarisation of methods and teaching materials as well as through the exchange of experiences with our supporting partners.

Our recommendations are based not only on the conclusions of our own lessons learnt but also on recommendations for action, scientific analyses etc. of the participating countries.

2. Recommendations for decision-makers at regional, national and European level

2.1 Recommendations for education providers and developers

The increasing technical specialisation and diversity of ranges of knowledge pose increasingly serious problems for all players in the education sector. Due to limited time and increased complexity, it is no longer possible to fully convey the required scope of knowledge of a professional sector. "Car2Lab" has revealed these problems in the case of vehicle telematics.

Already the selection of the subject area telematics is a specialisation that leaves out many other innovative areas of automotive technology. It is therefore important that the involved stakeholders (vocational schools, universities, companies, industry, associations, etc.) seek contact with each other and define the core fields of the training sector that arise in the course of new developments - and here in particular through digitalisation. It would be wrong to deal individually and in response to general trends with topics that are ultimately lacking in relevance.

Although the credo "freedom of teaching" may still apply, the teaching of content that is not necessarily needed in the labour market cannot then be the core task of the training institutions when it comes to knowledge that goes beyond basic knowledge. Once the topics have been defined or narrowed down, the learning objectives, the learning competences, the learning modules and the learning materials that are required must be defined. In "Car2Lab" it was proven successful to define the learning objectives together with the stakeholders (and here also with students and trainees) and to derive the learning units and learning materials simultaneously.

The development of learning materials primarily requires close cooperation between the producer of the learning materials and the teachers. At this point at the latest, the need for other infrastructure such as network access, network capacities, end devices such as tablets, smartphones, laptops and software, and the resulting costs become apparent. Consequently, the administration-specific departments of the training institutions and, if necessary, political stakeholders must be involved in this process.

In addition, from now on, administrative institutions should also be involved to clarify how the resulting learning modules can be integrated into the curriculum. It is also advisable from this point on to involve future teachers in the process. They should accompany the development of the learning materials and specify the required teaching modules. This process represents a kind of further training in order to give the trainers and teachers early access to the foreign subject areas.

The development of the teaching modules should be initiated based on the learning objectives, the learning materials and the required learning competences. After a pilot phase together with teachers and developers of teaching materials, it is essential that trainees/students are working with the new systems and learning modules during a longer test phase in order to get familiar with them. The feedback and the questions of the learners in combination with the learning objectives is the best basis for appropriate examination tasks and questions. In practice, two to three iterations with the stakeholders involved will be necessary in order to install such a learning module in a functioning manner.

2.2 Recommendations for the use of the telematics kit and the learning units developed in the project

Vehicle technicians will never be IT experts. Vehicle technicians, however, should recognise and understand the benefits of digitalisation through meaningful and challenging examples. Due to the high complexity of the topic, we recommend the following application possibilities:

1. in the vocational training centres (level: technical college)
2. in the apprenticeship to become an automotive mechanic with the focus on: systems engineering and high-voltage engineering
3. in addition, in other related professions on selected aspects (e.g. in the area of industry 4.0) on topics such as:
 - Networking of the automobile
 - Global positioning systems, such as GPS, etc.
 - Mobile networks GSM, GPRS, UMTS, LTE
 - Data processing computer centre ↔ Vehicle
 - Communication channels Car2Car, Car2X
 - Cost efficiency
 - Data protection and customer rights (see our learning units)

2.3 Recommendations for decision makers/level of governance

Politics can at best define boundary conditions for new teaching and learning content. The content orientation must come from the training institutes. Neither politics nor educational institutions and universities are able on their own to define with certainty which topics of digitalisation are important in education.

The described process is formally not new. An important finding, however, is the fact that the selection of new core competencies and topics for teaching requires the input of all stakeholders. Well networked institutions have an easier time participating in the definition process than less well networked ones.

As a consequence, the results are not made available for all stakeholders. On the one hand, this may of course also result from a lack of motivation of individual teachers, but most of the time the specification of teaching content is often not tailored to needs or not coordinated among the stakeholders.

2.4 What does this mean at the national and European level?

1. The Internet contains countless examples that describe, for example, the profile of a vehicle technician or vehicle mechatronics technician. If, however, you are looking for information about what skills and capacities are necessary depending on the specialisation, it is quite difficult finding them.

It would therefore be advantageous to initiate a forum and give all stakeholders a certain voice. A platform of this kind should exist virtually and should also include workshops and conferences in which the results are recorded and published for everyone.

With a large number of participants, a representative picture of required learning content for certain occupational groups and directions could be captured, which would be an enormous help for all those who are entrusted with the constant definition and teaching of curricular content in both higher education and vocational training.

2. Cooperation between vocational schools, companies and universities is essential for the acquisition of new technologies. Most vocational training centres face difficulties in bearing the costs of digitalisation and business support should therefore be considered. It is conceivable that vocational schools could then offer seminars to company employees in return.

Vocational training professionals and enterprises should actively cooperate at every stage of the didactic process, from planning the courses to assisting in the definition of key competences to evaluating the whole process.

Companies are often able to anticipate innovations and to recognise future labour market developments at an early stage. At "Car2Lab", the development of our highly innovative digital learning tool was only possible because a software company, a manufacturer of didactic tools and a university worked hand in hand and closely with the participating vocational training institutions as project partners.

3. Trainees and students do not always see the need for certain contents. However, even trainers and professors sometimes do not. Training systems, especially for digitalisation, should therefore convey and demonstrate the practical benefits.

National decision-makers should actively promote digitalisation in vocational education and training, above all in terms of strengthening human and financial resources, but also in the dissemination and transferability of tried and tested innovative models. This could also be done by supporting cooperation between vocational training and companies, e.g. in the form of tax cuts for companies that assist educational institutions in acquiring new skills and adapting new technologies.

In this context, good practice in Italy must also be mentioned: the Italian plan of the government "Piano Industria 4.0" and above all the so-called " Further Training 4.0" (Formazione 4.0). Formazione 4.0 enables small firms to obtain 50% reimbursement for training in innovative technologies. "Iper ammortamento", on the other hand, is a depreciation on the purchase of equipment and machinery used in the digitisation process.

In Denmark, the digitalisation strategy of the Danish government was followed by a Digital Growth Strategy (DGS) in January 2018. It includes both strengthening the digitalisation of small and medium-sized enterprises and developing digital skills.

4. The European Commission should continue to promote the exchange of good practice and strategic partnerships when designing new programmes. The ERASMUS+ Strategic Partnerships help to think outside the box and exploit synergies.

This type of project enables through the extended and "tested" cooperative networks:

- Sustainable use of results through geographical and horizontal transfer of good practice and innovation
The programme's databases should not be underestimated either (e.g. EPALE); they provide a good opportunity to gain an overview of the initiatives of other European actors in various thematic fields and, if necessary, to contact them.
- Increasing the attractiveness and quality of vocational education and training
- Reduction of development standard differences between the individual countries
- Securing skilled workers

In order to advance digitalisation, qualified professionals are needed in all EU countries. Therefore, educational programmes and cooperation alliances between different actors that benefit vocational education and training are indispensable.

CONCLUSION

The implementation of the rapidly developing new technologies in training and the resulting challenges for the vocational training systems of the EU countries requires the involvement of all stakeholders.

The need for action in vocational education and training relates primarily to:

1. Further training courses for teachers and in-company trainers
Educators cannot teach new skills if they themselves cannot confidently manage and use the new technologies. Educators must be given a considerable framework for efficient further training ($\geq 30\%$ of working time!!!)
Integration of new content into master classes and master preparation courses
2. The need for digitalisation is not always recognised!
3. Trainees and students must be made aware from the outset of what apprenticeship-specific and professional perspectives they can expect.
4. Adaptation of the new content to the examinations/frameworks in the field of dual and higher education: The content must be aligned with the market/ companies/ workshops.
5. Changes to the existing structures in the vocational schools/companies (equipment of the rooms, access to data, location-independent learning).
6. The rethinking at the workplace
This also implies a reorganisation of responsibilities, e.g. in car workshops. A mechanic does not have to be able to develop software, but must be prepared for handling the new technology.
7. Further education offers for decision makers
It should be noted here that the administrative support that needs to be provided is not always and everywhere available. In many cases, this fails because of a mixture of competitive thinking and the responsibility of individual actors. This concerns both the financing and the regulatory provisions (acquisition of modern technology, cooperation between school and software companies, free server access, learning platforms, data protection provisions in relation to the use of data for control systems).
8. Integration of digitalisation into the range of other funding instruments, e.g. offer of educational leave and award of educational vouchers.
9. New cooperation and permeability concepts
10. Regular evaluation of new technologies and pedagogical concepts

The "Car2lab" partnership has proven that the implementation of even complicated initiatives can succeed and that close cooperation between vocational training, universities and companies is a very important instrument that leads to success.

Recommended literature and links

- **Digitalisation: 35 countries in comparison-Germany Trade & Invest (GTAI)**

<https://www.gtai.de/GTAI/Navigation/DE/Meta/Ueber-uns/Was-wir-tun/Schwerpunkte/digitalisierung,t=digitalisierung-35-laender-im-vergleich,did=2230672.html>

- **Germany**

German Confederation of Skilled Crafts (Zentralverband des Deutschen Handwerks e.V./ Kompetenzzentrum Digitales Handwerk)

<https://handwerkdigital.de/angebote/5-schritte-zur-digitalisierung>

Articles published regularly in the BIBB journal BWP - Berufsbildung in Wissenschaft und Praxis (Vocational Education and Training in Science and Practice)

<https://www.bibb.de/veroeffentlichungen/de/publication>

- **Denmark**

Danish Agency for Digitalisation

<https://en.digst.dk>

<https://en.digst.dk/news/news-archive/2019/january/new-direction-for-reform-to-create-world-class-digital-services>

- **Italy**

Article: " Digitalisation and Industry 4.0:Italy invests in SMEs"

http://heilbronn.ihk.de/ximages/1477887_2019indust.pdf

- **Poland**

Reports of the Initiative Think Tank (association of companies for the promotion of digitalisation).

http://www.thinktankcyfrowy.pl/index_en.html

Information on the website of the Polish Ministry of Digitalisation

<https://www.gov.pl/web/digitalization>



Project partnership:

Germany



BGZ Berliner Gesellschaft für internationale Zusammenarbeit mbH
Pohlstraße 67
DE - 10785 Berlin
Telefon: +49 (30) 80 99 41 11
Telefax: +49 (30) 80 99 41 20
info@bgz-berlin.de
www.bgz-berlin.de
www.car2lab.eu



www.kfz-innung-berlin.de



www.htw-berlin.de



www.viom.de

Denmark



www.aarhustech.dk



www.teknologisk.dk

Italy



www.confartigianatovicenza.it



www.sangaetano.org

Poland



www.mechatronika.pl



www.samochodowka.edu.pl

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.