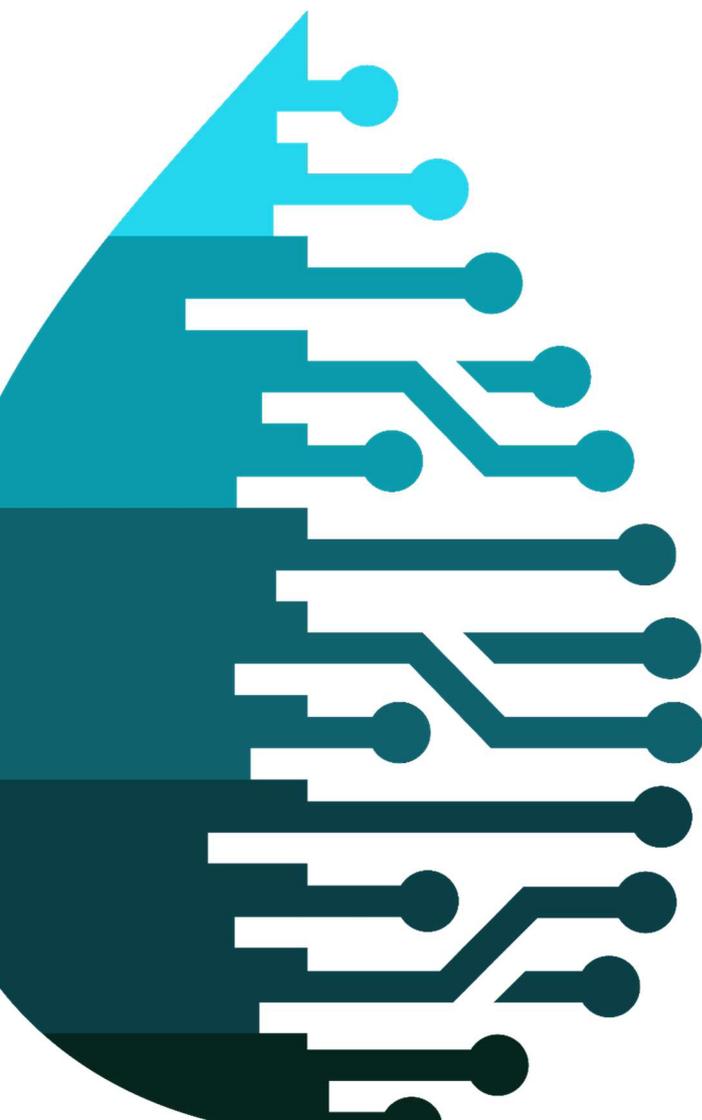




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# BLENDED LEARNING IN VOCATIONAL FORESTRY EDUCATION

Wp 2 Analyses and Assessment  
2.1. Report on the assessment of digital needs, challenges and barriers



29/06/2023

*ERASMUS+ Project*  
2022-1-AT01-KA220-VET-000089296  
FOREE – Boosting Digital Skills and Competencies  
in Forest Education



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**FOREE**  
Digital Skills for Forest Education

**Report lead: Forestry Education Center North Rhine-Westphalia**

**In cooperation with: Participating staff of Forestry Education Centers in Europe**

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## Abstract

The FOREE report on the status of e-learning, or blended learning, in European forestry education presents results based on contributions from staff working in forestry education. In total, 89 teachers and principals from 37 forestry education centers in 9 countries participated in the online survey, and 71 participants from 24 institutions took part in the six Focus Groups organized by FOREE partners.

Traditionally, job and education profiles in forestry are practical and nature-oriented and rather adverse towards digital means and media. However, increasing digitalization changes work requirements in forestry as well as in other sectors, and the pandemic has further boosted the use of various digital teaching technologies in forestry education. An awareness for the integration of e-learning has been created, with various levels of experience or expectation among forestry education institutions.

The main barriers for e-learning identified include, next to organizational challenges and an increase of workload, the lack of digital competencies in teaching staff and the related concern about technical or didactical challenges. Suitable trainings are rarely available and teaching staff mainly applies learning-by-doing to enhance their competences.

However, combining digital and practical teaching is seen as an advantage, especially during preparation or after training phases. It is confirmed by most contributors that trainees' performances are improved and that multi-media approaches help them to deepen, keep and refresh their knowledge and skills. The application of virtual or augmented reality trainings is also supported, especially for safety-relevant topics.

The mapping of the results of Focus Groups and survey results shows that the forestry education community has a wealth of information and experiences with digital teaching that can be made useful to all through structured exchange. Focus Groups have, next to a detailed picture of the current status, manifested the explicit wish to engage in an exchange of experiences and best practice examples. This can be addressed by the planned FOREE Digital Toolbox and MOOC.



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# 1. Introduction

## 1.1. Background

Forestry is an important economic factor in the EU, not in terms of value added (0,17% of total EU GDP in 2020) or workforce, but forests do not only cover 39% of the land area and secure the supply of the irreplaceable product wood ([Eurostat](#)), they have multiple functions whose economic value is more and more recognized ([Taye et al., 2021](#)). Sustainable forest management allows to remove a part of the annual increment while ensuring forest ecosystems, biodiversity, water retention, climate change mitigation (CO<sub>2</sub> consumption) and recreation areas for the citizens.

The term „sustainable“ was first used in forestry 300 years ago (at least in the German language) and marked a revolutionary insight into the balance of consumption and reimbursement. The recognition of other ecological and societal forest functions as „forest services“ however marks a new trend and raises societal expectations of forestry. In addition, forestry is facing severe challenges as the condition of the European forests is deteriorating due to climate change, drought, and related infestations as e.g., bark beetle or the increasing danger of forest fires ([Forest Europe, 2020](#)).

Work in the forest is getting more demanding and complex. This is not only true for professionals working in forestry but for owners as well, of whom 60% are private, often small-scale forest owners ([EFI](#)). With high societal expectations, there is nevertheless a lack of interest in forestry and consequently an ageing workforce ([Schroff & Bernasconi, 2015](#)). Forestry education for adult learners and young professionals both must strive to attract learners and to adapt to the many challenges, including rapidly changing working environments due to mechanization and digitalization.

The Regional Assessment of Forest Education in Europe ([Rekola et al., 2020](#)) states that forestry education is often „insufficient, deteriorating or outdated“ leading to insufficient preparation of students and trainees „to meet the changing demands of the workplace“. The assessment is based on a survey which was conducted worldwide in 2020 and is focused on education subjects and topics than on teaching methodology, with a very small assessment of digital teaching approaches.

Since the beginning of 2020, teaching, and learning have changed significantly under the pressure of the COVID pandemic. Education and training institutions all over the world had to adapt rapidly to new dimensions in education. In April 2020, the Forbes magazine headlines „From now on, blended learning will be the benchmark“ ([Dans, E., 2020](#)). The current changes are expected to be permanent and a fast and creative adaptation of tools, syllabuses and teaching methodologies is seen as essential to maintain the quality of teaching. This is true for all education systems, from primary school to vocational training and university. But vocational training has a special role and must face the challenge to integrate practical and project-oriented learning into blended digital teaching concepts.

Digitalization in forestry and forest in the domain of education has become a topic well before the pandemic and its distancing rules. In 2015, the Federal Office for the Environment (FOEN)



updated their overview of the most important forestry training programs in Europe and North America and point out that “E-learning is getting more and more important, this also in forestry education, especially in the basics” ([Schroff & Bernasconi, 2015](#)).

Vocational education and training, in contrast to tertiary education, has a strong focus on teaching practical skills. This involves a physical demonstration by the teacher, tangible objects, and important signals from the surrounding area which may be a sign of danger (e.g., awareness of falling branches when cutting a tree). Practical teaching and learning is the core task in vocational education, theoretical lessons deliver the conceptual background to enable optimized decisions and actions: „Training measures can only be considered effective if the transfer of the learned contents to practical situations is continuously successful“ ([Tonhäuser & Büker, 2016](#)). This characteristic feature of vocational and further education and training is understood to foster teacher-centred pedagogy ([Brennan et al., 2001](#)), in contrast to the student-centred approach demanded for online teaching ([Archambault et al., 2022](#)).

During the pandemic, forestry education institutions had to strengthen their resilience by implementing distance teaching. What started as a necessity, has now become an experiment with the goal to explore new teaching approaches.

The report presents the outcomes of a survey and six Focus Groups with teachers and managements of European vocational forestry education institutions. The aim was to assess (i) the current status of experiences with digital teaching media, (ii) perceived barriers of motivations, (iii) competence development on individual and organizational level and (iv) cooperation options. This task in the FOREE workpackage 2 prepares the “Development of Blended Learning Courses (ToT and MOOC)” in workpackage 3. Results of the 6 Focus Groups are additionally presented in more detail in separate reports.



## 1.2. Objectives and structure of the survey

The survey was distributed in local languages among forestry education institutions (vocational and further education). Partners used their national networks, the distribution on European level (in English) was supported by the ROSEWOOD4.0 network, by the INNOVAWOOD network and the European Forestry Institute (EFI). After several rounds of reminders, responses were collected from 89 individuals (trainers, as well as management including principals, department heads, and e-learning managers).

All inputs are stored at the FBZ by the responsible team and are not accessible. Addresses or contact data are not included in this report.

The set-up of the questionnaire was based on a discussion of the expected analyses results during the kick-off meeting. Survey questions were drafted in English by FBZ, then approved/edited and translated by partners. Closed questions were used to obtain detailed results on specific expectations for/ experiences with blended learning approaches. Each closed question was accompanied by open fields to allow additional comments which have been translated and are included in this report. The questionnaire was divided into two pathways depending on the role given by the respondent. For teachers/trainers, 15 questions were foreseen, while for management persons additional questions on organizational issues and cooperation were included (23 questions in total). All questions were worded carefully to include both target groups, with and without experience with digital teaching (e.g., by asking for both, experience, and expectation).

Questions were structured as follows:

1. General Information  
Name of the institution; type(s) of education; country; age group; job description
2. Experiences with e-learning  
At present/planned; motivation; barriers; types of digital teaching media and methodologies; topic areas; connection with practical training.
3. Competence development
4. Cooperation

## 2. Survey results

### 2.1. Background of responses: countries, education institutions and work role, age groups

A total of **89 questionnaires** were completed representing individuals from **9 European countries** and **37 forestry education institutions**, and, in two cases, freelancing teachers. Among these, 16 contributions come from management (principals, department heads, or persons with special responsibilities for e-learning), representing 14 forestry education institutes in six different countries. Three respondents classify as regional officials in charge of forestry training and 70 as teacher/trainer. The largest group of participants belongs to the age group 30-fifty (47), 36 beyond 50, and a few (6) are younger than thirty.

Of the total responses, greater contributions were obtained in the four partner countries, there are only few responses per country from other European countries (see Figure 1). Responses have been analysed on question level, assessing individual answers without considering national or institutional background.



Figure 1 Distribution per country (individual responses)

In most cases (21), both, vocational and further education are offered, followed by 14 education institutes which are specialized on vocational education and three offering adult/ further education only. As the focus of the survey distribution was on vocational education, consequently only one of the responding institutions offers tertiary-level education.

Some participants named areas of further education, namely training for the European Chainsaw Certificate (ECC), insurance, fire department, forestry machine operator and forestry technician master courses, workplace safety trainer. In addition, information and dialogue with citizens and NGOs, as well as organizing events around "forest" and "forest work" were mentioned as educational activities.

### 2.2. Experience with e-learning in forestry education, motivation, and barriers

The reported **experience with e-learning** is surprisingly broad: Only 10% do not have any experience, 79% use online teaching to a certain extent and 11% extensively. Of the 10% without any own experience, the majority are interested to employ digital teaching approaches soon.



The use of **digital teaching is motivated** (Figure 2) by a diverse range of arguments. The recent challenge of how to keep up education and training activities during COVID has left its mark: most of the respondents (58%) confirmed the wish to increase their resilience with regard to the recent experience of the pandemic. But other, more proactive motivations, as increasing attractiveness and efficiency of forestry education, or a need to address future digitalized working profiles received similarly positive answers (above 50%). Surprisingly, e-learning *as a means to foster cooperation with other forestry education centers*, to draw on the possibilities provided by digital teaching approaches to **share or co-produce digital contents**, was confirmed by 55% as a motive in its own.

As expected, the motive to save cost and time with e-learning is less pronounced. The Focus Groups have shown that many forestry education institutions have only recently started or are currently at the beginning of the process to integrate digital teaching, a phase with rather high cost and work efforts. Since the introduction of digital teaching technologies was enforced by the emergency of the pandemic, efforts (investment and time) were initially accepted and supported by all actors concerned. In the meantime, the pressure to use digital teaching is relieved and a reflection process has set in. To assess this statement, it should be kept in mind that the majority of the participants report own experiences with e-learning, they can therefore be expected to refer to own perceptions. The fact that 43 % confirm the motive to save cost and/or time at this time, could therefore reflect a perceived added value, an experience that the initial effort has paid of (or will pay off soon) in a considerable number of cases.

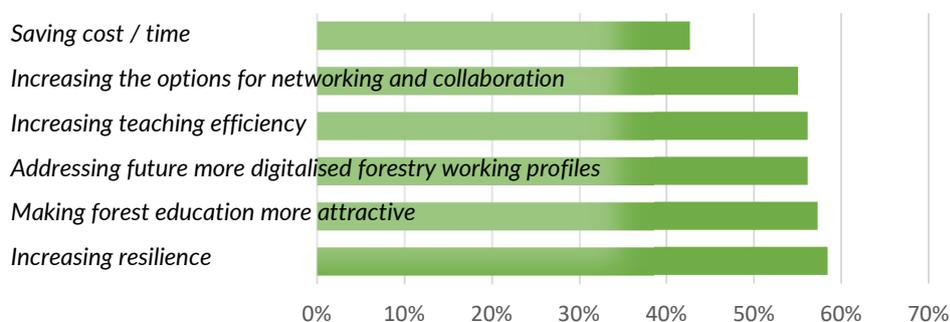


Figure 2 Main motivation to use digital teaching, multiple answers possible

The spectrum of possible motives offered in the multiple-choice question was widely complemented by participants (the following open answers have been grouped, if they are unchanged, they are shown in brackets, together with the original language):

- “Enjoying innovation” (*Freude an Innovationen*).
- “Bringing together geographically distant classrooms” (*Riunire aule geograficamente distanti*).
- “Reaching those who could not be reached in attendance (distance, cost, time)” (*Raggiungere chi non sarebbe possibile raggiungere in presenza (distanza, costi, tempo)*).
- “In the area of repetitive basic knowledge students/participants are encouraged to be more engaged in self-study. When it comes to demanding technical topics, the goal is to better convey content (retention rate) and make it more interactive” (*Im Bereich*

*repetitives Basiswissen sollen die Schüler/Teilnehmer mehr in die Pflicht zum Selbststudium genommen werden. Wenn es um fachlich anspruchsvollere Themen geht, ist das Ziel Inhalte besser zu vermitteln (Behaltensquote) und interaktiver zu gestalten).*

- “The possibility to individualize learning as well as to give the student more responsibility for completing the e-course independently. Distance learning is a good opportunity to catch up on missed subjects” (*Võimalus individualiseerida õppetööd samuti anda õpilasele suuremat vastutust iseseisva e-kursuse läbimise nõol. Kaugõppe puhul on hea võimalus puudunud teemasid järele õppida).*
- Simplified application procedures, environmental management, attractive further education program; digitalization of work in forestry is an especially important topic.

The perceived **main barriers for e-learning (Figure 3)** in forestry education are concentrated around the lack of digital competences among teaching staff, their concern about technical, didactical and organizational challenges of digital teaching and the expected additional workload.



Figure 3 Main barriers for e-learning, multiple answers possible

Insufficient infrastructure or financial means and a lack of learners' compliance related to inadequate media competences or disinterest is perceived as a barrier by nearly one third of the participants. Less important is a general fear of job loss and changing working conditions. Another barrier (separate question to management) can be the missing support from higher authorities which was reported by 10 institutions from Germany, Austria, Croatia, Spain, and Italy. Many participants used the opportunity to specify or complement the list of barriers (selection):

- “For beginners it is most difficult to find out which of the broad portfolio of technical options is needed to convey the content. Or how content must be rebuilt to be able to use certain functions effectively” (*Am schwierigsten ist es, als Laie herauszufinden was brauche ich aus dem breiten Portfolio technischer Möglichkeiten, um meine Inhalte zu vermitteln. Bzw., wie muss ich meine Inhalte umbauen, um bestimmte Funktionen effektiv nutzen zu können).*
- “Lack of time for intensive study and familiarization with the subject” (*Mangel an Zeit für eine intensive Beschäftigung und Einarbeitung in das Thema).*



- “High personnel and time expenditure required in the initial phase exceeds available capacities” (*Der in der Initialphase erforderliche hohe personelle und zeitliche Aufwand übersteigt die verfügbaren Kapazitäten*).
- “Time required for set-up is underestimated” (*Zeitlicher Aufwand für den Aufbau wird schnell unterschätzt*).
- Lack of network coverage (esp. GSM) and bandwidth, lacking support from IT department
- “Depending on the topic/content. Activities defined as dangerous work can only be trained with practical training. (e.g. manual felling, rope crane)” (*In Abhängigkeit des Themas/Inhalts. Als gefährliche Arbeiten definierte Tätigkeiten lassen sich nur mit einer praxisnaher Ausbildung ausbilden. (z.B. Holzerei, Seilkran)*).
- “In forestry there is a need for training in the forest” (*In ambito forestale occorre fare formazione in bosco*).
- “Need for practical activities in the field so that the teacher is respected by the learners” (*Necessità di attività pratica in campo, anche affinché il docente sia rispettato dai discenti*).
- “E-learning can only be a part of forestry education as learning in the field largely requires experiential real-life practice” (*E-õpe saab olla metsanduses vaid osaõppena sest valdkonna õpe vajab suures osas kogemuslikku reaalset praktikat*).

An overview on the use of/interest in **digital teaching media and methodologies** (Figure 4) among participants in leading positions (management) shows that online repositories and video conference systems for online teaching are most common. Simulators are already well established in the training of harvesting machine operators and used in more than half of the cases (this figure probably being higher if answers could be shown as a portion of institutions that are offering machine operator training).

Tools to implement interactive courses for self-paced online learning (LMS and authoring tools) are used by nearly half of the responding institutions and nearly the same numbers are interested in these technologies.

Social media are applied in nearly half of the cases, and those who are not active in this area are not interested in introducing their use. In addition (open field), interactive livestreaming of practical lessons directly from the forest has been named (test use during pandemic), as well as using simulators together with virtual reality applications.

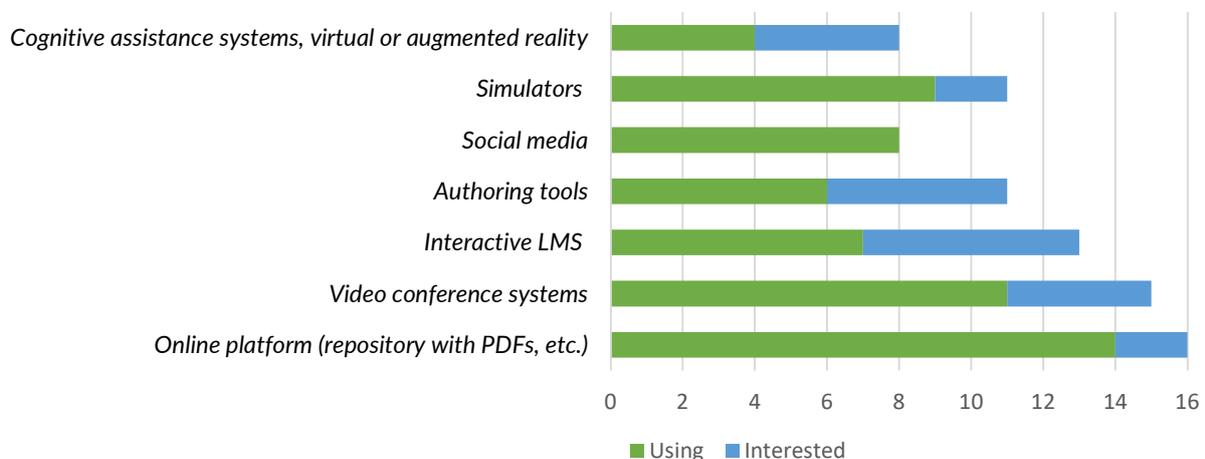


Figure 4 Types of digital teaching media and technologies, multiple answers possible

The LMS (Figure 5) is actively used (by more than one third) for evaluation activities, to hold live video classes and communicate with trainees, to provide video or audio content and online courses, as well as quizzes and (self-)tests. Progress monitoring functions are applied by only 15 individuals but the interest in this function is relatively high. Mobile access to the LMS is regarded as an important feature.

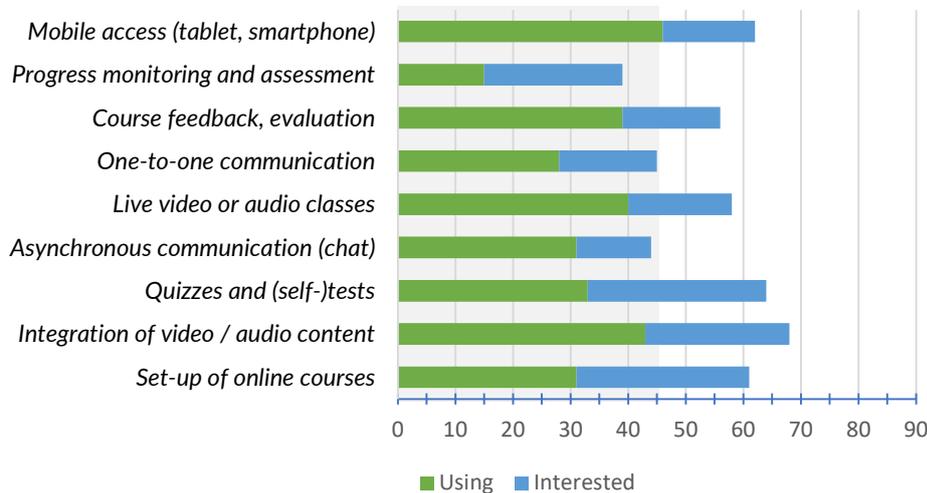


Figure 5 LMS functions already used or interesting, multiple answers possible

Other tools and functions have been named, as for example:

- Overview of the use of e-learning content via educational statistics, access figures
- Tutorials on YouTube and Instagram
- Microsoft Teams as a collaborative LMS, iSpring Learn

Another participant reports that the introduced LMS is used only scarcely and irregularly. Smaller ("half-finished") learning modules have been created but are hardly used in training (e.g., species knowledge, husbandry, professional theory competition, modules to accompany machine operator courses).

In vocational forestry education, the **practical trainings** (Figure 6) are at the very focus of teaching efforts and expertise. Is it possible to enhance practical learning by digital teaching elements and how can they be connected? By most participants, digital teaching is seen as useful for the preparation of practical or manual training in the forest.

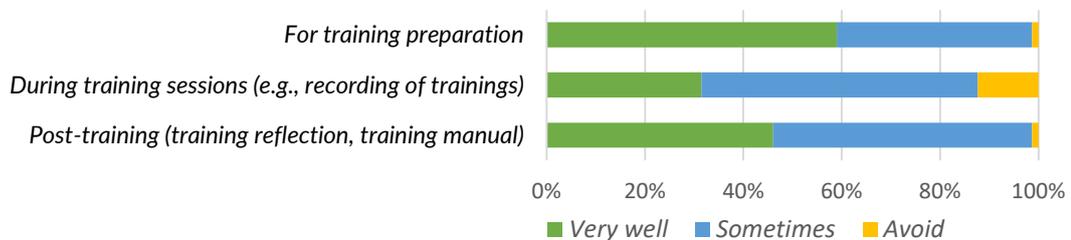


Figure 6 How can digital teaching be connected with practical/manual forest training?

In the post-training phase, digital media are still regarded as useful, e.g., to provide manuals or other digital content, and to undergo a reflection process. There is less experience with or interest in using digital means to enhance practical trainings on-site, during the training phase.

Vocational forestry education covers a broad range of topics, some of which have a higher theory component. Participants were asked **which topics they see as suitable for a digital/ blended learning** approach (Figure 7). As multiple choices were possible, answers are fairly evenly distributed. The more theoretical subjects as legal and economic aspects, followed by forest management, ecology, and logistics, are preferred (14-17%). Mechanized timber harvest and forest pedagogy need the immersive experience in the forest and are seen as less suitable (11-12%). Hunting as well as manual timber harvest receive a low approval (7-8%) for digital teaching, the latter depending heavily on practical training to avoid the significant connected danger and hazards.

- Forest management
- Mechanized timber harvest
- Manual timber harvest
- Ecology
- Legal/ economic aspects in forest & wood management
- Forest pedagogy
- Logistics
- Hunting

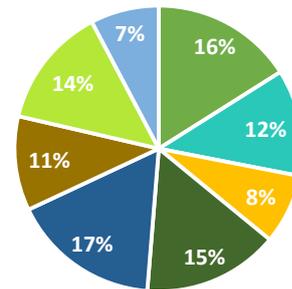


Figure 7 Suitable topics for blended learning in forestry education, multiple answers possible

Expected or observed effects of **digital media integration on teaching performance** are presented in Figure 8:

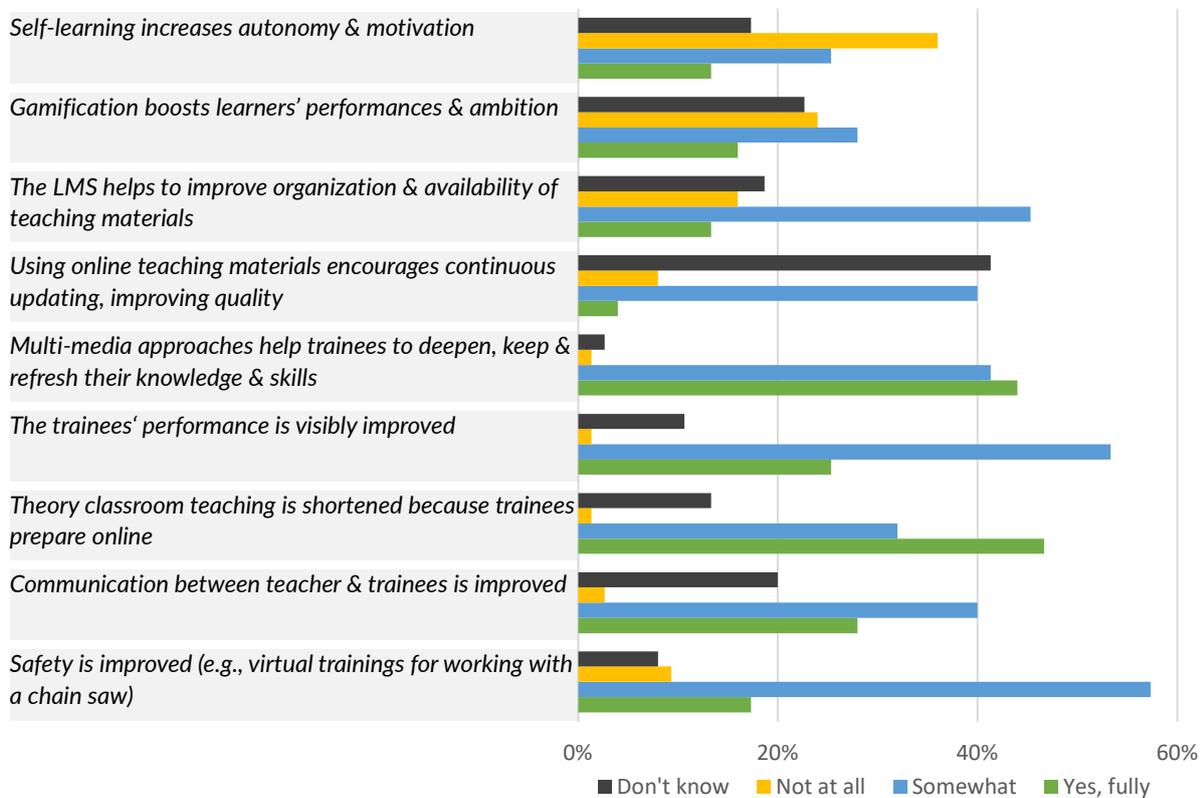


Figure 8 Effects of digital media integration on teaching performance, multiple answers possible



Most participants agree completely (44%) or somewhat (41%) with the statement that multi-media approaches help trainees to deepen, keep and refresh their knowledge and skills. Similar approval rates relate to the shortening of classroom teaching by online preparation.

The use of an LMS is expected to improve organization and availability of teaching materials (45% agree somewhat, 13% fully) but with a relatively high share of insecurity (19% “Don’t know”) and disagreement (16%).

The option to improve safety for dangerous practical trainings (as working with a chain saw) by e.g., using virtual reality (VR) trainings is not recognized by some (17% non- or disagreement) but 74% confirm it (somewhat or fully). This is interesting as VR trainings are mostly used to prepare practical training, helping to create awareness and train efficiently for dangerous or challenging (as e.g., organizing a rescue chain incl. a helicopter) activities. On the other hand, practical education is often perceived as incompatible with digital teaching approaches, the conflict probably being due to the level of specialization embedded in the choice of answers.

Gamification approaches illicit mixed responses, with an even distribution between disagreement and full consent.

The highest share of dis- and non-agreeing answers (53%) is surprisingly related to the statement that self-learning increases autonomy & motivation. This may relate to the perceived differences in acceptance and ability between target groups for the trainings that have been reported during Focus Groups. Obviously, the acceptance, motivation and digital competence depend not so much on the age of trainees, but on the educational background. Students, or participants with completed studies or similar education levels can be reached more easily with online or blended learning offers.

Nearly 70% believe that “Communication between teacher & trainees is improved” (somewhat or fully). This result is interesting, as Focus Groups have shown that there are reservations among teachers towards chat functions etc., which they deem incalculable in terms of time expenditure and the pressure of constant availability. These concerns are probably visible in the relatively high share of “Don’t know” answers (20%), so the distribution of answers may reflect the level of experience with this specific feature among participants.

Among the possible effects of digital media integration, one of the most important is the question of whether the performance of the trainees is visibly improved. This is confirmed (somewhat or fully) by nearly 80% of the participants. As the survey was distributed in parallel to the conduction of the Focus Groups, there was no opportunity yet to further specify this very encouraging statement (e.g., how this improvement was characterized or measured).

Other effects were described in detail by the participants and are listed below:

- „Acceptance and aversion. Very heterogeneous audience with different previous knowledge and motivations“ (*Akzeptanz und Aversion. Sehr heterogenes Publikum mit unterschiedlichen Vorkenntnissen und Motivationen*).
- „I see great advantages in dealing with the topic in advance. So, everybody can acquire knowledge individually according to his own learning speed“ (*Ich sehe große Vorteile im vorherigen Beschäftigen mit dem Thema. So kann jeder individuell nach eigenem Lerntempo Wissen aneignen*).



- „Use of expert knowledge through external experts (information questions lectures)“ (Nutzung von Expertenwissen durch Zuschaltung von externen Experten (Infos, Fragen, Vorträge)).
- Homeschooling possible, more diversified (Homeschooling möglich, abwechslungsreicher).
- „Higher distraction, much screen work and following eye problems“ (Höhere Ablenkung, viel Bildschirmarbeit, folgend Augenprobleme).
- „Personal responsibility is increased, partial blocking of evaluations“ (Eigenverantwortlichkeit wird erhöht, teilweise Blockadehaltung bei Evaluierungen).
- „Lessons must be designed and prepared digitally much more elaborately and intensively“ (Der Unterricht muss digital deutlich aufwendiger und intensiver gestaltet und vorbereitet werden).
- „Teachers felt a very positive impact on their working styles when they were using E-Learning as part of face-to-face instruction. In the same manner, students are becoming motivated to learn independently and study their courses with greater responsibility. It also enhances collaboration. “
- „Learner’s endurance during a task/lesson are shortened severely when using certain digital tools. For example, digital seminars where learners’ attention span are nowhere near IRL seminars. The same situation can be observed when watching a video. Calls to action are needed to regain learners’ attention. “
- „I avoid technical solutions as they tend to take more time from the practical education.“
- „Improve teaching skills made more difficult by the digital tool“ (Migliorare le capacità didattiche rese più difficili dallo strumento digitale).
- „Assuming and not conceding that the average forestry worker is able to use the necessary tools for digital training it should be considered that he or she normally has difficulty in attending even hands-on classes (working in the forest with the teacher) and is therefore very unlikely to be sympathetic toward digital teaching and to be able to transfer the minimum knowledge from the teacher“ (Ammesso e non concesso che l'operatore forestale medio riesca a utilizzare gli strumenti necessari alla formazione digitale, va considerato che ha normalmente difficoltà nel seguire lezioni in presenza anche pratiche (lavoro in bosco col docente) ed è quindi molto difficile che sia bendisposto verso la didattica digitale e che il docente riesca a trasferire le conoscenze minime).
- „It is important to alternate digital pedagogy and practical work with digital learning because everything may seem simple and clear on the digital screen but in practical work nothing works. The balance is very personal“ (Oluline on digipedagoogika ja praktilise töö vaheldumine digiõppega sest digis võib kõik lihtne ja selge tunduda aga praktilises töös ei õnnestu midagi. Tasakaal on väga personaalne).

Other barriers that have been named concern the possible restrictions through IT departments or the implementation of different learning management systems, especially in case of forestry education centers that belong to state forestry administrations. Additionally, the observance of data protection laws is mentioned as a difficult and time-consuming process.

### 2.3. Competence development

Four questions addressed the importance of specific digital competences, ways to develop them among the teaching staff, and the availability of programs to support competence building.

Digital teaching technologies are only one aspect, digitalization in the working environment is getting more and more important in the wood and forest industry and is rapidly changing job profiles and qualifications. This requires new, often digital skills from learners and teachers as well. Other emerging topics relate to climate change, water management, or sustainable forest management and demand a constant **adaption of curricula and teaching content**. Forestry education institutions use a broad range of measures and activities to adapt their teaching content to the technology shift and stay up to date (Figure 9).

- Regular training with equipment providers
- Regular exchange with other forestry education institutions
- Participation in joint research or other publicly funded projects
- Regular exchange with employers and their associations
- Further qualification of staff
- Specialization of staff (specialists/ generalists)
- Visiting forestry fairs and conferences

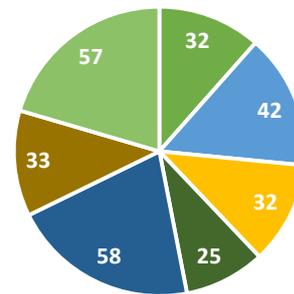


Figure 9 Adaptation of teaching content to changing working environments, multiple answer possible

Other means to adapt and update teaching content are mentioned, as a personal initiative to enhance content and teaching style driven by own interests and internet research, or the collaboration on joint projects as e.g., tests for new processes, machines, and equipment.

In education teams, **competence development** (Figure 10) is an individual, but also an organizational challenge. The pyramid of measures employed to build digital teaching competences (Figure 10) shows a broad basis with “learning by doing”, followed by the training of *technical* media competences with staff members. Only 42% report that didactic media competences are trained specifically. Other measures are employing staff with specific competences, to outsource the development of digital media or (rarely) to buy ready-made digital training materials.

Systems for user feedback and quality management are used to reflect and improve quality and know-how.

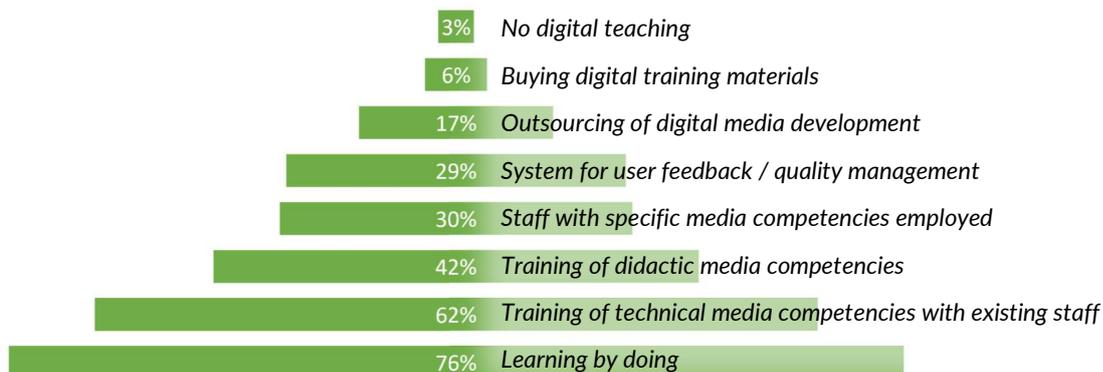


Figure 10 Adaptation of media competences in forestry education teams, multiple answers possible

Additional contributions stress the importance of internal discussions and exchange of experience. In one case, a publicly funded project on "Creation of digital teaching materials" was mentioned. But there are also frustrating experiences: "As a specialist teacher I was thrown in at the deep end - support from superiors was limited", or "A temporary project position was created for LMS introduction. Results included rewriting of teaching materials (from a pool of PowerPoint presentations), creation of videos and small learning modules. After (premature) transfer of the project manager to another office, activities in the LMS were not continued by instructors. Since then, only occasional updates and enhancements have been made based on learning by doing."

The next two questions were addressed to **management** (16 contributions of 14 institutions). From a management perspective, not only basic technical knowledge in using digital tools is recognized as important among the **digital skills required for staff** (Figure 11), but the awareness for other competences is also pronounced. Media integration is acknowledged as an important strategic aspect by 12 (of 16) participants: knowing *where* to use digital teaching methodologies and how to integrate them.

11 management participants confirm the statement that digital teaching needs a specific didactic approach requiring special competences and understanding from teaching staff.

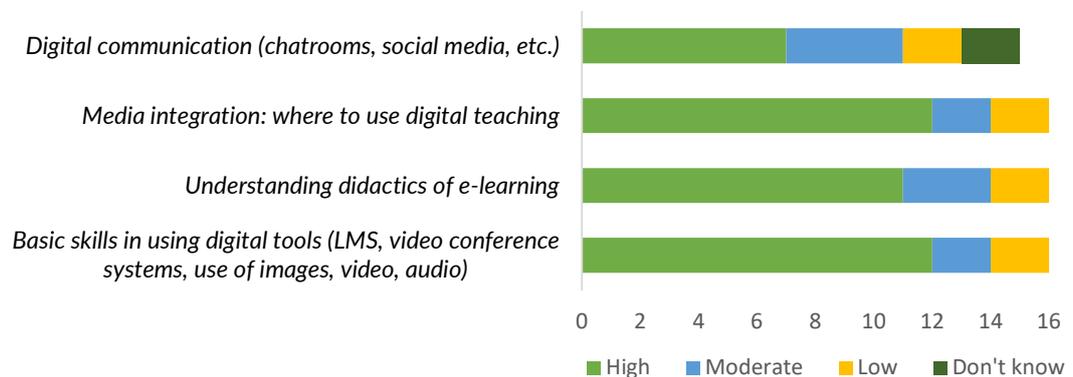


Figure 11 Importance of digital skills for new and existing teaching staff, multiple answers possible (question to management)

Again, digital communication using chatrooms or social media is met with less approval, and the share of insecurity ("Don't know" answers) is higher than for the other skills. It is noticeable that the seven institutions who fully agree with the importance of digital communication skills have intensive experience with e-learning.

The importance of developing new skills among the teaching staff is mostly acknowledged by management participants. Still, these skills and competences are obviously developed through "learning by doing" in most cases (see Figure 10).

According to more than half of the managements, **suitable programs to improve digital teaching skills in forestry education** (Figure 12) are scarcely available or cover only some aspects. Only two respondents see a sufficient coverage of all aspects of digital teaching by available training courses. It should be taken as a call to action that one third have not yet addressed the

topic or no information. There is obviously a need for a proactive information campaign for the FOREE train-the-trainer program and digital toolbox as the target group is aware of the need for competence development but not connected with relevant and reliable information.

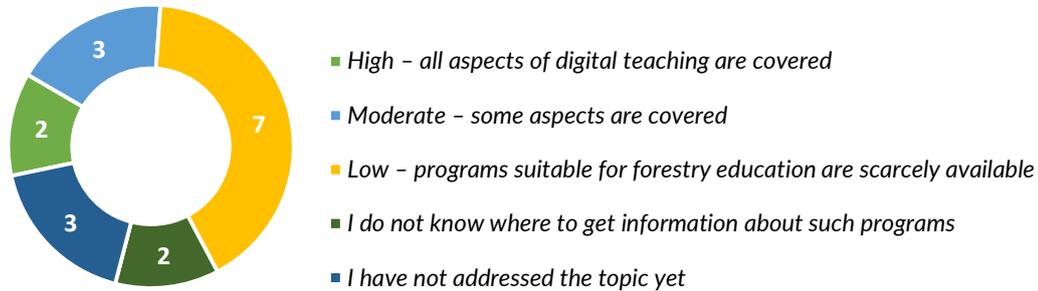


Figure 12 Availability of programs to improve digital teaching skills in forestry education (question to management)

## 2.4. E-learning and cooperation

As shown before (Figure 2), the option to cooperate with other forestry education institutions is perceived as one of the factors *motivating* the introduction of digital teaching and digital media integration. The possibility to cooperate is therefore on the one hand an important asset and on the other hand seen as a means to improve efficiency and availability of e-learning, e.g., by sharing an LMS, or by co-production and sharing of digital content or even full online courses. 13 managements report they are already cooperating or are interested, and no one sees cooperation as impossible. Others specify cooperation options through joint funded projects or interactive livestreaming events or sharing an e-learning module.

One participant reports that initial interest in co-production and sharing was impeded and a shared LMS failed due to the state administration IT restrictions, respectively to service providers.

Potential **barriers to cooperation** (Figure 13) were assessed separately. Data security issues, lack of support by higher authorities and issues related to a joint business model or intellectual property protection were rated as highly or moderately important by more than half of the responding managements.

Regional differences in teaching contents are not seen as a significant barrier (half of the ratings attribute low, and only one high importance).

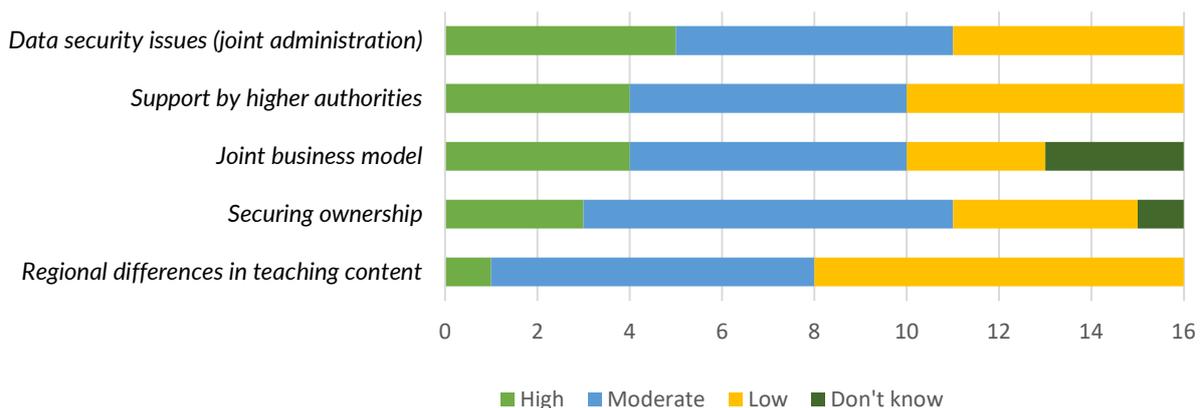


Figure 13 Potential barriers to cooperation, multiple answers possible (question to management)



Aiming at further concretization of cooperation options, managements were asked to provide examples for specific teaching contents that would be suitable for the joint creation of an online course. The following suggestions or existing examples were given:

- Mechanized timber harvesting
- 2-hour impulse presentations on specific topics
- Plant protection expertise
- All contents of the inter-company training and the training to become a forestry technician as described in the training regulation (Germany).
- Rope crane course in use as part of high school training (3rd QE)
- QGIS (free open-source geographic information system) course
- Already agreed between the forestry education center North Rhine-Westphalia and the Social Insurance for Agriculture, Forestry and Horticulture (SVLFG): share contents of the online chainsaw training course
- Based on the training ordinance for foresters, numerous occupational theoretical training contents are being formed, e.g., planting procedures, timber harvesting procedures, basics of forestry machine use, etc. It is also conceivable to create a nationally standardized online course to supplement the advanced training for master forestry technicians or to supplement the advanced training for certified forestry machine operators.
- Forestry basics (i.e., basic course) as the need for orientation is common to all practical silviculture, forest planting, etc.

In the next chapter, the results of the Focus Groups that have been presented separately in 6 individual reports are mapped. Both activities, distribution of the survey and conducting Focus Groups) were carried out in parallel.



### 3. Mapping of the Focus Groups

Six Focus Groups were conducted in total, two on transnational and four on national level, each with a duration of 90 minutes. In total, 71 participants from 24 institutions participated (some institutions were represented by different persons in more than one Focus Group).

Name	Date	Participants f/m	Institutions
Focus Group Italy	16.3.2023	1/17 (18)	5
Focus Group Estonia	8.5.2023	3/4 (7)	1
Focus Group Germany	11.5.2023	2/6 (8)	2
Focus Group Austria	12. & 22.5.; 2.6.2023	0/8 (8)	4
Transnational FG Trainers	5.5.2023	1/16 (17)	12
Transnational FG Principals	12.3.2023	7/6 (13)	8

Table 1 Overview of the FOREE Focus Groups

The participants' contributions describe barriers, complaints, fears, problems but also positive experiences and problem-solving approaches, providing recommendations. Often, statements are directly conflicting. The most frequent or relevant feedbacks are contrasted below. It is already apparent how fostering a systematic exchange between forestry education institutions as planned with the FOREE Digital Toolbox can help to address reported issues (translated and summarized, not verbatim).

#### Resources, efficiency, technology

Perceived barrier / problem	How to solve it / other experiences
<p>Time consuming new activities for teachers:</p> <ul style="list-style-type: none"> <li>• Learning new digital skills</li> <li>• Developing new teaching strategies</li> <li>• Set-up of digital teaching content</li> <li>• Management of the digital learning environment (e.g., check activities and progress, set tasks, evaluate, update content and links)</li> </ul> <p>Communication with groups or individuals in digital learning environment</p>	<p>Invested working time must be recognized (often invisible) &amp; assessed realistically.</p> <p>An innovation strategy is needed to plan the implementation step by step.</p> <p>Learning by doing and training (both, e-didactics, and handling technology) must go hand in hand.</p> <p>Systematic exchange with other forestry education institutes on experiences including tangible examples can help to get started.</p> <p>Employ specialized staff for digital media (technology / didactics)</p>
<p>Cost for software and services (LMS, professional video production, etc.)</p>	<p>Sharing digital contents, even planning joint production can help to save resources.</p>
<p>Selection of suitable digital technologies, tender process, in some cases compatibility problems (state IT infrastructures, existing LMS, etc.)</p>	<p>Exchange (e.g., recommendations for suitable soft- and hardware, tender examples, solving infrastructure adaption).</p>
<p>Data protection and gender issues</p>	<p>Define and share guideline.</p>
<p>Availability of devices (trainees)</p>	<p>„Bring your own device“ is usually preferred. Substitution by school only in a few cases.</p>



Language barrier impedes sharing of content (e.g., video tutorials)

Using AI to improve automatic translations.

No demand for online seminars among target group.

Outreach is increased, new target groups reached, saving travel cost and time.  
Attractiveness for employed participants is increased due to better compatibility with work.  
Careful evaluation of target groups and markets.

## Acceptance, motivation, teaching methodologies

### *Perceived barrier / problem*

### *How to solve it / other experiences*

Practical training is the core task of forestry education and needs real objects, real environment, and personal / bodily interaction. Teachers fear that their role and job satisfaction are in danger.

Practice is a strength of forestry educational institutions and can be complemented with a strong hybrid, digital education offer.  
Blended learning with digital preparation phase can enhance efficiency of practical training and saves time for practical work.  
Digital teaching can complement conditions / tasks that are not available in the practice area.  
Some trainings related to dangerous/ rescue situations can be efficiently supported by virtual reality training.

Personal interaction, relationship-building and transferring emotions is difficult online (e.g., seminars for urban forest owners who have to be motivated to take care of their forests).

Blended learning, after initial face-to-face contact, engaging participants online is easier.  
Create awareness among teachers for convincing and authentic self-presentation (e-didactics).

Too much preparation before practical training may weaken the respect the teacher and his/her demonstration.

Digital teaching should not „copy“ usual classroom/ practical teachings, didactic strategy should connect online part with practical lesson.

Teachers are not motivated to adopt new teaching methodologies and are not convinced that the result will be worth the efforts.

Innovation can increase job satisfaction is invested efforts are acknowledged. Individual decision for new teaching methodologies.  
A LMS helps to implement a clear central organization, to (re)combine and sort teaching content.  
Digital material can be repeatedly viewed and listened to, reducing mistakes.  
Digitalization is increasing in forestry work; digital teaching helps to address that fact.  
A clear pedagogic/ didactic strategy must be developed with management and teaching staff.  
Student-centred teaching changes the teachers' role which can also be a relief.

Acceptance among trainees is mixed and depends on the educational background (on average, higher with tertiary education).

More evaluation needed to identify reasons and further development of acceptance after COVID.  
The digital media mix should consider different learning types.  
Self-determined learning (at your own pace, time, and space) must be accompanied by the trainer (interaction within the learning platform).



Feedback from participants shows that young, agile delivery is particularly appreciated for theoretical content.

Modernize multimedia; learning videos, tutorials & games, small learning blocks, multiple choice or picture puzzles, gamification, and call-to-action make learning more attractive, dynamic and appealing (not a repository).

## Competence and organization development

<i>Perceived barrier / problem</i>	<i>How to solve it / other experiences</i>
Experts with excellent practical skills are often not the same who have digital skills. In general, low level of basic digital skills among teachers. Guide and (online) courses to learn digital skills are missing.	Teambuilding process, teachers with more motivation and experience can act as multipliers. Internal specialization, employ specialists. Digital Toolbox will provide examples, stimulate ideas, provide information. The train-the-trainer course will help to develop basic skills.
Bad results due to lack of experience / competence, e.g., LMS ends as „PDF-haven“,	Competences should be developed step by step, e.g., from a case study. A team strategy should set clear goals.
Frustration with learning by doing due to time spent with interfaces that are not intuitive.	Better options for finding suitable technologies with exchange platform (Digital Toolbox).
Problem with regulation (insurance law, work law, pre-scribed teaching hours, absence from workplace in dual education system in Germany, Austria & Switzerland.	Problems may be similar, exchange on this topic can be included in the Digital Toolbox to avoid redundancies.
Inferior quality of digital contents.	A school strategy, together with team competence building & exchange on best practices as benchmark can help to avoid frustration due to insufficient quality.

On the next page, a short mapping of positive and negative aspects is presented. In addition, the contributions as included in the Focus Group Reports are listed in full detail in the Annex to provide a standalone document.



	Role / Satisfaction / Motivation	Efficiency / Quality	Outreach / Resilience	Measurability / Control
Resources	<p>Invisible „digital working time“</p> <p>School strategy needed</p> <p>Internal specialization</p> <p>Share competences/ examples within and among teams</p>	<p>Additional staff needed</p> <p>Time and cost for e-learning</p> <p>Broader range of external experts and competences</p>	<p>No demand for online courses</p> <p>Save travel time &amp; cost</p> <p>Reach new target groups</p> <p>Enable teaching under adverse conditions</p>	<p>Online time of learners not recognized by employers</p> <p>Efficiency of e-learning against time and cost</p> <p>Digital evaluation much faster</p> <p>Interference with labour/insurance law?</p>
Technology	<p>Frustrating non-intuitive interfaces</p>	<p>Limited LMS functions obstruct didactic options</p> <p>Virtual Reality improves safety-relevant trainings</p> <p>Lack of LMS interoperability</p>	<p>Limited connectivity (bandwidth/)</p> <p>Availability of devices among learners</p>	<p>Copyright and IPR-related issues</p> <p>Data protection, gender conformity</p>
Methodology / Strategy	<p>Gamification (simulators) and interactivity motivates learners</p> <p>Touch, see, hear: object-related learning missing</p> <p>Innovate teaching approach &amp; redefine own role</p> <p>Respect for teacher as demonstrator of practical skills at risk</p>	<p>Option for repetition relieves trainer, intensifies practice</p> <p>Tests after unit completion to reach silent learners</p> <p>Correct errors in real-time (filming false working postures)</p> <p>LMS helps to combine, sort &amp; explore contents</p>	<p>Adapt teaching to digitalization in forestry</p> <p>Media provide conditions not available in practice area</p> <p>Demonstrate expertise on public platforms (YouTube)</p>	<p>Digital preparation with entrance exam brings participants on same level</p>
Competences	<p>Diminished job satisfaction through loss of personal contact</p> <p>Difficult relationship building</p> <p>Lack of basic competences/ examples prevents didactic idea development</p>	<p>Lack of suitable trainings for forestry teachers</p> <p>Integrate digital content from different sources, share competences and contents</p>	<p>Mixed digital competence of learners, depending on educational background</p>	

Table 2 Mapping of the Focus Group outcomes



## 4. Recommendations

Forestry education institutes are interested in the integration of digital teaching methodologies to increase resilience and outreach, to innovate teaching approaches and increase attraction, and to be ready for digitalization in the forest industry. The awareness for e-learning in forestry education has grown since the pandemic: In some places, a pioneering spirit is apparent, while in others interest and frustration with the difficult to estimate efforts balance each other. Often, strategies, competences and planning are insufficient due to a lack of experiences and examples, it seems difficult to even assess priorities.

The most important identified gaps match well with the objectives of FOREE, and what is more, the community is interested to participate in the project's activities. Concrete need for an instrument like the Digital Toolbox has been suggested, a need for an exchange platform on experiences, information, recommendations, and examples.

The main critical issues to be addressed by both, the Digital Toolbox and the Train-the-Trainer program as identified by the survey and the Focus Groups are listed below:

**What:** Enable basic understanding and provide examples to build competences related to the following digital technologies and functions (interest / use ca.1/1 or higher):

- Cognitive assistance systems, virtual or augmented reality
- Video tutorials (scripting, processing, animation)
- Authoring tools
- Artificial intelligence
- Interactive LMS, most interesting functions
  - Set-up of interactive online courses including video/ audio content
  - Quizzes and (self-)tests
  - Live video or audio classes
  - Course feedback, evaluation
  - Progress monitoring and assessment
  - Mobile access

**How:** Strategic competences needed for successful implementation

- Media integration: Where to use digital teaching, which technology and when.
- Blended learning: How to connect digital teaching to practical lessons in a way that supports the trainer, intensifies teaching, and avoids conflict with trainer role.
- E-didactics: Understand characteristics of different modes of online learning and didactic basis to deliver clear, motivating, and interactive content and related guidance strategies.
- Communication: When and how to communicate with individuals and groups, general goals, stumbling stones and prerequisites (technologies).
- Time management: How to assess and to plan own and student's efforts.
- Evaluation: Learning success, resource efficiency of blended learning.
- Recommendations for: Data protection, gender issues, infrastructure & compatibility.
- Motivation: How to motivate the team to engage for digital teaching (effort-benefit).



**Who:** Collaboration perspectives within and between teams

- Teambuilding process: How to distribute of competences and responsibilities – necessary basic skills for every teacher, degree of specialization, multipliers within the team, outsourcing.
- Cooperation among forestry education institutions and individuals
  - exchange platform providing content for sharing (bourse; option to provide or swap)
  - share examples, not so much full online courses, but elements as e.g., tasks, small games (memory), group work, visuals, video tutorials etc.
  - suggest emerging topics (e.g., related to water management, climate change, reforestation after hazards, fire prevention etc.) and find partners for joint creation with distributed tasks according to special strengths and competences.
  - exchange staff to capitalize on special competences and experiences (all aspects, also organizational) ...“we are not competitors“



## 5. Annex

Contributions from the Focus Groups are integrated below to provide a complete documentation in this document (see also the 6 Focus Group Reports).

### 1. Positive aspects of digital technology integration in the forestry training sector

*Germany (green), Austria (blue), Italy (red), Estonia (purple), Trainers, transnational (black)*

#### Resources

- Seminars for professionals have a large catchment area with considerable travel distances. Online classes are useful here, especially for preparation: E.g., participation in the face-to-face class or seminar only after passing the entrance test.
- Digital preparation: brings all course participants to the same level, avoids longer theory lessons in the practical part and makes it more attractive, shortens the attendance time - thus facilitating participation for working people. For short seminars of about 2 hours, avoiding travel is still appreciated even after Corona.
- Time- and location-independent possibility to learn with the LMS, also via cell phone.
- In inter-company training, attendance phases could be reduced by including e-learning; for this purpose, the course and learning strategy would have to be adapted.
- Resilience: During Corona, the online offering was highly appreciated.
- *Transferring theory and testing theory in digital learning will free up more time for practical exercises.*
- Travel and accommodation expenses are reduced (saving time, money, and CO<sub>2</sub>).
- Integrate existing video tutorials (YouTube) into the learning platform; selection ensures quality and is a valuable asset in its own. Produce only video content which is not available or specific to the region.

#### Acceptance, motivation, teaching methodologies

- Innovate the own teaching approach, redefine the teacher role: Each teacher can identify subjects/teaching areas that are suitable for implementation of self-study with digital media. But it must be kept in mind that basic knowledge is required to even consider this.
- Away from frontal lectures: videos and images add variety if online media are precisely tailored to the educational purpose and are suitable.
- All learning types can be considered, i.e., the auditory, the visual, or the communicative learning type. The challenge is to use targeted digital didactics and methodology.
- Encouraging independent, active learning.
- Control of learning success in the LMS, knowledge queries to check after completion of a unit. The advantage is that this also reaches silent learners and better activates all participants. Self-tests are easy to implement in the learning platform and have been positively evaluated (by users of ECC courses).
- Learning management system (here Moodle as LMS): chance to combine and sort learning content. Different formats, teaching methods are very suitable for some content, less for others, the right mix increases teaching quality.



- MS-Teams is used as standard communication tool and has become the information hub, all documents are centrally and easily available for teachers and students; after 5 years of schooling, information on all subjects is available for Matura preparation, there is no "losing" of documents possible anymore; printing is no longer necessary. Moodle and Edindividual are also in use, e.g., for tests (offer flexible possibilities for creation and evaluation).
- Central, clear organization of learning content, contacts, and communication via the learning platform.
- Include group work, quizzes or flashcards, memory with scores in lessons, produce examples, and share experiences with colleagues.
- VideoTutorials in class: explained and accompanied by the trainer - a didactic advantage compared to a limitation to pictures and presentations. Tools such as the „shooting cinema“ provide a certain degree of safety, in the specific case for handling the weapon in preparation for practical shooting exercises, the tool is also well used by students (accompanied by teachers) in their free time.
- Decision support tools, e.g., for rope crane routing are extremely interesting for trainees. Identification apps for plants are well accepted and support the lessons because they are easy to use. In general, mobile phone apps are much better accepted than "traditional" instruments and devices; calculated results of apps (specifically ballistics app) are independently checked and questioned by students.
- Individual teachers create their own video tutorials (e.g., mathematics) at a professional level.
- It must be a supplement and not a replacement for the practical course.
- It can help to report more objectively, and correct errors made in real time by the trainees in the field (i.e., checking wrong postures during activities on field).
- It can buffer dead moments or bad weather days when you cannot go out on the field.
- It can support real-time training in the field because: they help to show situations that cannot be reproduced in the field for safety reasons (what not to do and related consequences of mistakes).
- It helps to repeat or better explain some details of the explanation/demonstration of the technique applied in the field (i.e., cableway design and planning, GIS analysis).
- Helpful in explaining and demonstrating less practical parts of the course (i.e., zipline design and planning).
- It helps to show examples, conditions, situations that are not present in the practice area (i.e., windthrown, forest types and composition, stand structures, etc.).
- It helps to show actions that are not possible during the field course for practical reasons (i.e., diverse types of cuts cannot all be practically demonstrated).
- It can help to fix the contents at the end of the course or at the end of each explanation.
- The contents can be divided into files according to the topics and therefore easily explored.
- It is important to calibrate the integration of digital technologies according to the level of the course and the contents (i.e., in the basic forest cut course, there will be perhaps less digitization because more practical experience is needed)
- Attractiveness: digital content provides points of contact as an additional, individual learning opportunity for deepening knowledge of content. Exciting content can be worked on in group work in face-to-face classes if theory units have been outsourced online.
- Many trainees appreciate the alternative to classroom instruction and are very receptive to digital learning. Content must be web-based and available with mobile phones.
- Video tutorials allow students to work out important topics before they repeat them in practice (chainsaw, cutting down trees). VideoTutorials also strengthen interaction in the classroom.



- Practice is a strength of forestry educational institutions can be complemented with a strong hybrid, digital education offer. Creating small learning blocks, multiple choice, or picture puzzles like memory (text and picture), gamification, and call-to-action (immediate call to action), then a learning platform will be successful, not a repository.
- Through inquiry, independent grouping, or appointment booking, you get participants moving until self-directed learning is achieved - at their own pace and repetition.
- The pedagogical background is important: how do people learn and how do I use that, i.e., how do I digitally address the different learning types correctly.
- Learning videos, learning tutorials and games make learning more attractive, dynamic, and appealing. Feedback from participants shows that young, agile delivery is particularly appreciated for theoretical content.
- Learning platforms are not open to the internet, therefore copyright barriers are somewhat less relevant. Existing video tutorials can be integrated, only what is not available or region-specific has to be produced.
- Improved ability to co-create/share learning content on digital platforms.
- The learning platforms will be different, but many will have similar tools and the creation of learning modules will have some similarity: this lends itself well to training content for a train-the-trainer course.
- Share best practices, what is being done at other training sites? To make clear to trainers what possibilities one has and to stimulate ideas.
- The forestry community is quite small - there is no need for everyone to develop by themselves, we can move faster together.
- Textbooks on forestry that students can access digitally are a very good tool.
- Increased efficiency: outsourcing of repetitive explanations in VideoTutorials as preparation for working with the real machine relieves the trainer. Evaluation of evaluations and initial knowledge queries digitally facilitated (also because not handwritten).
- Correction efforts are significantly reduced, paper is saved.
- Virtual reality: processes, safety-relevant behaviours can be trained digitally very well with it, is not appreciated enough in the forestry industry, also the costs are overestimated.
- Publicity: YouTube reaches many participants, training institutions must be represented with expertise and serious content
- The use of artificial intelligence in the planning and building of the class reduces the burden on the teacher.
- Digital material (video or audio) can be repeatedly viewed and listened to; it can reduce the mistakes that students make.
- Digital learning enables the learner to stock up on a personal learning path. This will free up time for teachers for learners who are not suitable for digital learning.
- In forest machine learning, simulators are very useful. The learner trains his/her skills digitally, receives feedback digitally and instantly and can do so individually. Harvesters are too expensive to let an untrained student work on it right away.
- Simulations such as harvester simulators or hunting apps are perceived by students as games and are well accepted (gaming character).
- Drones, map monitoring environments, forest measurement and evaluation - this is all already digital and will free up people's time and energy for other important topics.



### Competence and organization development

- Training on didactics (regarding technical options) to get suggestions on how to integrate (less complex) digital elements such as memory, knowledge queries, etc. into existing lessons. The goal of the training must be to create a realistic understanding of the existing technical possibilities. In this context, examples from other training institutions (as to be provided in the FOREE Digital Toolbox) are considered helpful.
- Don't simply digitize face-to-face teaching - moving content, video clips, audio files, and interactivity, set tasks digitally. Digital teaching elements can be integrated in a goal-oriented manner, first defining content that is suitable for independent learning.
- Instruction on how to produce own VideoTutorials was offered in cooperation with the Public Relations Department in the forestry technicians' master class (e.g., cleaning of the carburetor on the chainsaw). Similar trainings should be offered to interested teachers.
- Among colleagues, an interested core group of "multipliers" could build up advanced knowledge in course design (without administrator function) and pass it on in the team as needed. Motto: mutual help, team spirit, learning from others, each subject coordinator or teacher defining his/her own area for online teaching.
- Teachers must be convinced that the integration of digital teaching elements and units will bring tangible benefits to their lesson design and teaching success. Everyone must make the decision individually for their subject area.
- The pedagogical/didactic strategy has to be further clarified. One argument could be to move away from frontal instruction toward more self-organized learning in a sandwich format by integrating digital media and tasks to better address different learning types. This could give each trainee a chance to learn better, more individually.
- Competence development activities for teachers could help them to develop own ideas for the targeted use of digital learning elements, which in turn boosts motivation. Training and learning by doing must go hand in hand.
- The working time invested in digital teaching must be realistically estimated.
- Organizations can find within their human resources the individuals suitable for developing their digital branch (internal specialization).
- There is a need to renew/modernize/update the multimedia materials developed up to now.
- Media saved in devices can help overcome network connection problems.
- Digitization can be useful if you start from a case study or in any case if you introduce it in small steps.

### 2. Negative aspects of digital technology integration in the forestry training sector

#### Resources

- Additional time required by teachers invested in e-learning appears difficult to estimate and "invisible" compared to face-to-face teaching (digital supervision, checks on knowledge level, follow-up and activation, communication via chat in the LMS).
- Preparation of interactive digital learning content is time-consuming, PDF upload is done quickly, but not effective for learning success.
- How can the working time invested in e-learning be saved elsewhere?
- A lack of time for innovation, as well as a lack of examples and competences (technical and didactic) creates fears and a defensive attitude on the teachers' side. This is where the FOREE Train-the-Trainer program can have a positive effect.



- Time resources: administration and preparation work in learning platforms consumes too much working time with activities unrelated to the subject. More complex tools have to be tested and practiced before use, preparation of e.g., videos (by teachers as well as students) requires a lot of time.
- Great effort (cost, time, learning effort for didactics and technology), especially at the beginning.
- The time burden for working in the learning platform is high and often underestimated.
- Elaborate application process for LMS, especially regarding data protection.
- Link collections need to be updated continuously, apps and programs become obsolete very quickly, if they are not constantly updated, it will be boring for the students.
- An overview on digital teaching tools is necessary to save time.
- The curriculum has to be fulfilled; tools have to be integrated in the timetables.
- **Difficulty in preparing/creating/distributing multimedia material, as it requires many resources (in terms of time) and skills.**
- Creating high quality, attractive learning materials with high didactic value, gaming elements, etc., means very high time consumption. Other didactic innovations also fail due to time requirements.
- Personnel resources: imparting practical forestry knowledge requires high competencies in working techniques, this is rarely combined with high competencies to create digital content. Additional staff is needed.
- In day-to-day operations, no hybrid teaching due to lack of staff resources Problem with hybrid teaching (additional person to manage online audience).
- Communication (one-to-one and with groups) must be ensured on the learning platform which means extra effort and availability for teachers.
- Cost: even elaborate preparation of digital instructional media does not increase attendance.
- Little economic potential: digital content is available on the Internet for very little money, little willingness to pay for it.
- Little demand for online events: Especially in the forest industry, there are people who don't like computers. If there is no other way, even the oldest person makes an effort to be there with his phone, but there is no active demand. According to Corona, great longing among participants to get together.
- Recognition: recognition of digital preparation time as working time (problem for both course participants and subject teachers), approval from superiors.
- Technical hurdles: Cell phone network coverage of participants, often costly IT service required online or on the phone with participants.
- Most of the useful digital environments in forestry are paid for in Estonia and require a license.
- Designing and testing digital learning material is too time-consuming, the teacher does not have enough time to prepare.

#### **Acceptance, motivation, teaching methodologies**

- **Motivation:** Real practitioners want to touch things, see things directly, that motivates them.
- Acceptance by trainers and trainees mixed depending on previous education, classical practitioners do not like to sit in front of the computer.
- Motivation and efficiency: Trainers ask first why do I need this? There is a vicious circle between competence and Motivation. It is a strategic effort to encourage acceptance with instructors by creating incentives and communicating concrete benefits.



- Often the learning platform becomes a PDF haven as it is a natural reaction to feed first. Then the acceptance will be low and teachers and learners both be disappointed.
- Personal emotions: In the course setting, you can better respond to participants and feel how they feel. In seminars for new (hopeful) forest owners, it is important to vividly convey to them the benefits of dealing with their own forest as a workplace.
- Build relationships: With digital mediation across screens, the transmission is less good than in a classroom. Participants' reactions are hard to discern online.
- Acceptance: divided among instructors, some are tech-savvy, others not. The added value of digital teaching must be clearly recognizable, otherwise the work seems unnecessarily bloated. However, balance in the team is possible with good strategy development and communication.
- Job satisfaction: subject teachers value personal sociable contact with participants.
- Motivation and prerequisites in the various target groups are very different (young trainees vs. professionals doing further education seminars) and must be taken into account individually.
- Self-study and personal exchange in the learning process must be optimally combined, otherwise there is a risk that acceptance, motivation and discipline of learners will suffer.
- Until now it has not been considered a necessity to integrate digital technologies.
- Within the same group of users there are different levels of interest in the course, so it is difficult to capture their attention and create contents that are adequate to such a diversified audience. Usually, the levelling takes place in the practical phase in the forest, while in the classroom it is already difficult to homogenize the audience.
- Risk that if too many multimedia materials are provided, especially to be viewed before the course, the participants arrive too prepared and therefore the role of the trainer is lost (contrary to the flipped approach).
- Risk that if too many multimedia materials are provided, especially to be viewed before the course, the participants lose interest during the practical activity because they have already "seen"/experienced the contents (contrary to the flipped approach).
- Digital skills are also often lacking on the users' side: it is not a matter of age but of population category and background.
- The obstacle lies mainly at the beginning, when it is necessary to approach a "new" methodology such as the digital one.
- Inertia to change habitual use of certain tools, i.e., mobile only for social, since there is a lack of knowledge on how to use them in alternative ways than the everyday domestic use.
- Showing videos/multimedia elements might take away the trainer's credibility, who appears not serious because it raises doubts that he is not showing in person or in practice the activities/operations that he is teaching because he does not really know how to implement the theme, appearing, therefore, unprofessional.
- Risk that digital material becomes fossilized only on theory or that the course becomes too theoretical when one of the achievements of the sector has been to make the courses more practical.
- Risk that the videos do not reach the training goal and pass the right message if not done well, as they risk becoming ridiculous/not very representative/not credible-serious/boring.
- Tools must not lead to the situation that students have to work out the content almost entirely on their own and that the lessons only serve as an assessment ("student-centered work" as the new trend - teachers only as guides and experts for questions); the input of the teachers is necessary.
- Workload and results: How can teaching efficiency be assessed, effort and benefit should be measured. For this purpose, a very open exchange with other forestry educational institutions can also be helpful.



- No substitute for practical instruction: teaching of skills dominates training, learning on the object is required. Video content is often overloaded and not interesting, especially for students); for exercises, e.g., with devices, and practical work, online tools are a good support, but they do not replace the lessons.
- Tools need to be practical and mature - an app for cutting down a tree with glasses and an artificial saw didn't work (too inaccurate, not yet mature).
- Tools should not be used all the time, but as a change (e.g., Kahut to check knowledge or as a component of presentations; both by the teachers and the students).
- Risk of using tools that are unsafe/suitable for the work environment involving certain dangers/risks (i.e., phone/tablet could lead to distraction when high attention is required during forestry operations and training).
- How to ensure that the learner has passed the theory and can be admitted to practical work.
- For course participants, digitization means additional demands on top of the subject-specific demands, especially when processing exams.
- Data privacy, gender conformity: if recorded and thus lessons are fully documented, there may be complications.
- Technical issues with state firewall, in-house IT, learning platform compatibility, etc.
- The structure of the learning management system should be more intuitive, self-explanatory. Additional assistance is needed for colleagues who are not computer-savvy.
- Risk that the created material will be disclosed without authorization (copyright and intellectual property rights-related issues).
- Trainees are released from work in the apprenticeship training company during block instruction, their presence is obligatory. How can online teaching be controlled? The situation would have to be clarified in terms of labor law and insurance law.
- Experience shows that the teaching time required is less in online lessons, as there is less communication. How is the number of hours prescribed for the training objective met? This problem does not arise when digital media are used to accompany classroom teaching.
- Additional effort when guest lecturers must be involved (seminars).
- If a teacher has a negative attitude towards the use of digital tools, he or she will avoid digital learning.
- Language barrier - applications and digital environments are in English.
- Videos: Videos must be checked critically in advance, content must be suitable (e.g. American films are often not suitable for Austrian conditions); availability of the topic is sometimes difficult for special content (e.g. blasting); publication of self-made videos is problematic due to the necessary compliance with safety aspects, small details and errors are quickly overlooked, repeated checking is necessary; very many good videos and other tools are not available in German - language barrier as a knock-out criterion; targeted use necessary (watching films as "recreation")
- Risk of needing a connection to the data network which is not always available in the field (when material is not available offline).

### Competence development

- There is no guide to learn how to use and implement certain digital tools.
- There is no suitable preparation of the personnel of the various organizations to create quality digital materials and contents because there is a lack of digital competence in the forest training sector and at the moment it is discouraging to even start to produce them.



- Competencies: additional know-how, not of a technical nature, in dealing with different media is a challenge for training institutions.
- Lack of support for innovation in educational practice by higher-level agencies.
- Competence development for teaching staff often neglected, thus jeopardizing acceptance and quality, which in turn has a negative effect on the trainees' cooperation. „Procurement of hardware is fast; training of employees takes time.
- Digital materials are not available in forestry vocational education and adult forestry education, on which the teacher can take a suitable course.
- The digital skills of learners are limited to the use of social media or digital literacy is nonexistent.
- *Wishes for digital skills.*
  - *Video processing and animation to create educational materials.*
  - *Using Artificial Intelligence*
  - *Digi didactics in general*
  - *Time management to create digital learning materials.*
  - *How and why to change your attitude towards digital learning*

### 3. Management

perspective

One of the Focus Groups was conducted with principals of forestry education institutions in four European countries and focused on the management perspective. The results as compiled in a separate report are also included here to provide a standalone document.

#### 1. Digital teaching integration

*Digitalization is getting increasingly important in the wood and forest value chain. Where do you see a suitable integration of digital teaching methodologies into practical forestry education? What are the main bottlenecks (dimensions: cost / infrastructure/ motivation and competences teacher/learner) ? Which factors support a transformation towards a flexible blended forestry education? What may be low hanging fruits - suitable areas or subjects to start with?*

- Practical learning is predominant in forestry education, 60-70 percent of the education takes place outside, in the forest.
- Our teachers are practical trainers, they don't have digital pedagogic competences and to increase them we need time. And we need an interface in front and for the teacher that is self-explanatory.
- In practical training, digital teaching is especially useful in the preparatory phase.
- During the pandemic, practical training was replaced by streamed lessons directly from the forest to the trainees on their PC at home, using the gateway of the mobile network in the forest which was technically challenging.
- For the vocational training of theory or general subjects, digital means are useful.
- We come from a more traditional way of teaching where we focus on transferring skills and competences, but we want to go more to coaching education. Learners must first go through a process of learning to plan, decide, and control their own results.
- Digitalization introduces new vocational contents like photo optical measurement, using apps, tools and decision-making systems, and new professional profiles like lidar specialist in forestry. New ways of knowledge transfer must be adapted to these new digital topics. In addition to practical training, we should apply learning management systems, simulation tools and augmented reality.



- Content and didactics are both important. Producing digital content does not mean to simply upload a pdf. Tests, films, questions, quizzes must be produced in a way that activates learners and must be combined for blended learning following a well-adapted didactic strategy.
- For the integration of digital learning into day-to-day learning, the first question should be: Do we have a strategy in place? It not only depends on the teacher but also on the school hierarchy, on next executives, and on administrative aspects.
- What should we source out because it takes too much effort and time to learn by ourselves, what is necessary for our own staff to learn?
- Training digitally reduces traffic time and allows the flexibility to work in your company and learn in one day, make trainings more attractive for employed learners.
- Repetitive education is requested in forestry education, costing a lot of time and therefore money. With digital education in place (for suitable topics), resources can be saved for both, learners, and education providers.
- Limiting factors to integrated blended learning are low bandwidth, lack of understanding of self-based learning by customers, lack of time to produce the content, integrate new didactic methods and tools from soft- to hardware, lack of motivation, and competences of both, teachers, and trainees.

## 2. Building digital teaching competences

*How do you rate/see the trainers' /teachers' motivation to apply digital teaching methodologies? What are the most important skills and competencies that staff and school management should build up (digital teaching didactics/ student-centred approach)? How can competences be built on individual and organizational level (individual training for teachers, task distribution among teaching staff/ specialization, outsourcing)?*

- The very practical trainers and teachers like to give their trainings surrounded by trees, a little bit of sunshine, but no digital equipment.
- Vocational practical training means usually that the teacher is demonstrating. The impact of a digital training situation on listeners is far less than in a real-life situation, more and other skills are needed. One of the skills is to do less talking but putting trainees to work. The best teachers are failing in that area, are missing that competence.
- Digital teaching is not first a question of technical competence, the approach of the teachers to digital teaching should be a pedagogical one.
- Trainers and teachers must learn new didactic competences and methods. Customers must build digital competences and must learn self-learning.
- The educational level of the target group is important for the way we can use digital education. Most customers are not good at theoretical learning.
- Devices are not a problem; customers use their own devices.
- Some teachers are very open and already skilled with digital applications while others are afraid of it. If advantages can be clearly demonstrated, technicians are easily convinced (e.g., finding lost chain saws in the forest with app on phones). Their motivation should be raised step by step.
- With e-learning and digital tools the teachers must fail first to be able to succeed. Teachers do not allow themselves to fail so they don't try anything digital.
- One option is to outsource content production to professionals who transfer the educational subject to digital content.
- A concept needs to be developed together with all staff members, not everybody needs to make tutorials for everything.
- At our center, digital teaching was centralized, and digital coaching put in place, someone with excellent digital competences combined with a person with didactic competences. That combination worked very well.



- New competences are needed concerning emerging subjects as the forest ecosystem, or climate change, and new methods to transfer these competences. In the future, coaching education, and the competence to communicate with our clients and with society will be increasingly important. How can we build an education and learning partnership with our customers? Digitalization should support a different method, attitude, and role system, more like coaching or a learning partnership.
- In museums, digitalization is an option to reach non-visitors. It is also a question of attitude; we must accept that our audience has own competences. It is a new way of participation and inclusion in the best way of its meaning.
- In practical training, only one solution is correct: you are successful when you repeat what I demonstrate to you. This teacher role is not up to date anymore. We need to act more like a teaching coach for our customers and value their own attitudes and experiences. Blended learning and tutorials can be a good support for that.
- In pilot courses we have trained educated, high-level customers who knew much about forest management. We tried using a coaching style teaching and it was not successful because the private forest owners wanted us to tell them what to do.
- In forestry we have three disruptive forces, first the chainsaw, then the harvester and now digitalization. The teaching staff is afraid that practical teaching will change with e-learning, that teachers are not needed anymore. What is their role and the job in the future, and how can teaching be done in an attractive way – the motivation to learn is high but a strategy is needed.
- A gamification example is the Virtual Factory: students start to swipe the floors, then get promoted to worker, planning the production floors, then to manager and to boss. Feedback encourages to learn more. The involved tasks are demanding, even for experienced teachers and much appreciated by learners.

### 3. Cooperation options

*Creating and managing digital content in forest education is new and an effort that should not be underestimated. Could you imagine cooperating, to join forces with another forestry education institute in your region/ country or even on European level? Shared effort means shared ownership – could that be an option for you? Is it possible to identify teaching subjects with a common ground across borders which could be suitable for joint creation of digital teaching materials?*

- 10 years ago, filmed content entered our vocational trainings, now we are at the dawn of the artificial intelligence age, and adding AI to our educational systems is a very time and money consuming business. The only way to cope is cooperating with one another, sharing training sessions and content, joint content production.
- Intellectual property should be discussed on international level. We're not contesting each other across countries so that shouldn't be a problem.
- We have had very good experience on international level in sharing, developing a Moodle application for the European chainsaw certificate with our colleagues from the Netherlands, participating in rosewood4.0 project and other European projects.
- National cooperation to share resources to outsource digital content development to professional companies would be good. The standard book „The Forced Worker“ is produced by forestry schools all over Germany. It could be a good project to do it digitally, including gamification approaches attract our young customers.
- Video tutorials produced by us are well used on YouTube, reaching small forest owners or people outside forestry. On request from other countries, we started to provide them in English. If „The Forest Worker“ is digitalized, such tutorials can be easily integrated.
- Many forestry education centers will have the same topics, not identical courses but similar contents and modules, so we could develop these modules together and share.



- It would be also good to share administration experiences: what other centers have bought, competent suppliers, or even examples for tenders.
- An initiative by several universities at European level to create a joint e-learning platform was stopped due to administrative and financial hurdles, maintenance, etc.
- We need a kind of think tank and best practices concerning emerging topics, for example water retention and climate change. We need to think about contents and goals for the future, to integrate science. Concerning emerging topics most of us are beginners and it is a chance to share our experiences in European forestry.
- One option is to identify topics where they education centers are competent and motivated and organize content production. Another option is an open-source construction where everybody puts in their knowledge or examples and it can be shared, not waiting to organize topics.
- Sharing means not just sharing contents but also cultural backgrounds. To offer a content to a public and make them participate means considering diverse cultural backgrounds, different ways of perceiving an object, so we can learn from each other not just the content itself but also the way to consider the content.



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