

REPORT

July 2015

Project: Design of Curriculum for Woodworking CNC Operators in Turkey

ERASMUS+ KEY ACTION 2 – STRATEGIC PARTNERSHIP PROJECTS

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1. German vocational education system

Vocational training in the Federal Republic of Germany is provided on the job and in vocational training schools. Based on what is referred to as the dual system, practical vocational training is given at work, backed up by theoretical training and general education provided in vocational training schools which are generally attended on one or two days a week. The characteristic feature of this system is that the provision of knowledge and skills is linked to acquiring the necessary job experience. This ensures that training will proceed under the same conditions that the trainee will encounter when practising his chosen occupation. Only on the job will a trainee be able to learn to cope with the constantly-changing demands of the job and to appreciate the variety of social relationships that exist in the work environment. In addition, learning by doing gives a sense of achievement and provides a special source of motivation for the trainee. It promotes independence and a sense of responsibility, which are indispensable qualities in a developed industrial country, because by tackling concrete tasks under real working conditions the trainee can show evidence of the knowledge and skills he has acquired and can himself experience the success of his efforts. This shows that training on the job is more than just a process of institutionalised and organised learning.

In Germany there are currently some 350 officially-recognised training occupations, constituting the basis for more than 20,000 adult occupations. They achieve good labour mobility, as the on-the-job training also imparts qualifications that may be put to general use and are not tied to occupational skills. The training regulations are a central element of the German vocational training system. Although they are incorporated in state law, trade and industry also play a decisive part in their formulation. In preparing these regulations, the responsible Federal minister is assisted by the Federal Institute of Vocational Training, which in turn is advised by committees of experts representing the different occupational groups and appointed at the suggestion of the leading trade, industry and union organisations. The importance of workplace training is reflected in the fact that the standards and rules for this kind of training were set up by the self-governing economic bodies, i.e. mainly by the Chambers. The Vocational Training Act regulates more than just the training of young persons after their period of compulsory school attendance. The concept of vocational training in Germany comprises initial training, further training and vocational retraining

2. Tasks of the Chambers

The principal tasks undertaken by the Chambers in vocational training are the following:

- **Looking after and supervising training matters**

One of the most important tasks of the Chambers is advising training employers on all problems connected with training, e. g. the training occupations to be considered, how training should be structured, the use of training aids, and educational, psychological and legal questions. The Chambers also give advice to trainees. Any employer wishing to engage trainees must fulfil certain conditions as regards his suitability for this task. The firm must be able to offer facilities, production programmes or services on the basis of which the prescribed knowledge and skills may be imparted. In addition, the training employer and any training officers must have specific personal, professional and teaching qualifications. The Chambers will ascertain before the start of training and also during the course of training whether these qualifications are held. This is done on the basis of a vocational training register kept by the Chambers, in which all vocational training contracts must be entered. The task of looking after and supervising training matters is assigned to the training counsellors on the staff of each Chamber.

- **Interim and final examinations**

Every trainee must sit an interim examination in the course of his period of training. The examination serves to ascertain the level the trainee has reached. The competent Chamber establishes boards of examiners to hold these examinations. Every trainee may sit a final

examination at the end of his period of training in order to show that he has acquired the necessary professional qualifications. To hold these examinations, the responsible Chamber will establish boards of examiners consisting of at least three members, being employers' and employees' representatives in equal numbers and at least one vocational school teacher. Rules to be observed in connection with final examinations are issued by the Vocational Training Committee of the Chamber, consisting of employers' and employees' representatives in equal numbers and vocational school teachers as consultant members. These rules set out the entry criteria, the form of the examination, the criteria for marking, the arrangements for issue of examination certificates, the consequences of breaches of the rules and the possibilities for repeating the examination. The skills to be examined are laid down in the training regulations. According to the occupation, they may provide for a test of practical and/or theoretical skills. The practical examination will call for samples of work and/or test work-pieces. The theoretical test is conducted as a written and/or oral examination.

After having passed the examination, the trainee will receive an examination certificate issued by the responsible Chamber. This certificate is not an authorisation. Its principal purpose is to show that the person concerned has acquired the qualifications necessary for a specific occupation. But it is also the basis for professional progress and career advancement. Passing the final examination is one of the conditions for admission to the Masters' examination and many other further training examinations, for demonstrating aptitude for training in a number of branches of trade, industry and commerce, and in many cases forms the basis for claiming collectively-agreed benefits in the workplace.

- **Further training**

The Chambers may hold examinations to test the knowledge, abilities and experience acquired as a result of further training. The Vocational Training Committees issue special regulations governing the subject matter, purpose, standards, procedure and conditions of entry for such examinations. The Chamber establishes boards of examiners to hold the examinations, subject to the same conditions as for the final examinations. To achieve an orderly and uniform system of further training, the Federal Minister for Education and Science may issue ordinances regulating the examinations. The Chambers collaborate in formulating such regulations through experts whom they appoint. However, the activities of the Chambers in the field of further training are not confined to holding examinations. They also provide further training measures. In this context a distinction can be made between training for advancement, the object of which is to enable the trainee to gain advancement in his job, i.e. to take on a better-qualified position in his firm, and training for adaptation, the object of which is to retain and extend occupational knowledge and skills and to adapt these to technical developments. These are generally short-term measures, while training for advancement will normally require the trainee to attend courses totalling 500 to 700 hours of instruction. As a rule only these courses are completed by sitting an examination held by the Chamber.

- **Vocational retraining**

The Chambers hold examinations for persons who have been retrained for a different occupation, setting up the required boards of examiners. Where these examinations are not held for recognised training occupations, the Vocational Training Committees must issue the necessary regulations concerning subject matter, purpose, standards, procedure and conditions of entry.

3. Basic info on CNC Operators

CNC Operators work in a variety of wood manufacturing organizations and perform CNC related tasks on a number of different machines of varying complexity. CNC machines encompass a broad range of machines such as milling machines, routers, moulders, lathes, drills, cutters, and grinders. CNC operators not only possess knowledge of the techniques required to work on the specific type of machine they are assigned to but must also possess computer skills. The level of computer expertise will vary from one organization to the next; some organizations require that CNC

Operators have programming skills, while other companies will have a separate programmer which will require fewer programming skills from the CNC Operator. The complexity of the CNC machine will depend on the type of work required and the level of sophistication of the organization. Woodworking machine operators set up, program and operate one or more woodworking machines to fabricate or repair wooden parts for furniture, fixtures or other wood products. They are employed in furniture, fixture and other wood products manufacturing establishments.

Main duties

Woodworking machine operators perform some or all of the following duties:

- Set up, program and operate one or more computer numerically controlled (CNC) or manual woodworking machines such as saws, moulders, lathes, routers, planers, edgers, pressing machines, shapers, drills and sanders to fabricate or repair wooden parts for furniture, fixtures and other wood products
- Operate gluing machines to glue pieces of wood together or press and affix wood veneer to wood surfaces
- Operate preset special-purpose woodworking machines to fabricate wood products such as coat hangers, mop handles, clothes pins, cabinet doors, ornate carvings, and other products
- Read and interpret specifications or follow verbal instructions
- May clean and lubricate equipment, and replace parts as necessary.

Qualification requirements for skilled woodworkers		
Basic qualification skills	Advanced qualification skills	Positive skills
General		
Understanding and implementing technical drawings	Dealing with CAD	Spatial perception
Knowledge of the material and knowledge of machine work	EDV-Knowledge	Willingness for further qualification Understanding of manufacturing process Foresighted and planning oriented thinking and acting
Concerning machines		
Setting up, calibrating, setting the machine options	correction and optimization of existing programs	self-reliant action creativity quality consciousness
Workpiece maintenance and repair	taking into account the economy	

4. Introduction EBG

The European Association for Vocational and Social Education (EBG) is a non governmental and non-profit private company and is active in the eastern federal countries in Germany and in SK, CN and VN . The present 30 training centres in Germany address adult and young learners in a great variety (children, youth, adults, migrants, social disadvantaged people, workers, teachers, and educational staff). EBG offers several training activities (train the trainers, basic and further

vocational education, vocational retraining, development of teaching and learning materials, curricula and certification) by strong practical component, close alignment with working methods and processes as well job market requirements.

One of the reasons for strength and success of German economy is German vocational education and training system and particularly the blue collar workers of enterprises. The emerging markets like in China and Vietnam are asking for qualified and skilled workforce not only in terms of knowledge but also with a practical approach for high qualified training and vocational technique.

EBG's strength and success is based upon vocational training with a strong practical component and market-oriented development of tailored training activities to the specific needs and requirements. EBG offices and trainers are present and in close cooperation with partners, enterprises, costumers and business associations in respective countries

Since 2003 the EBG is providing further qualification for Chinese, since 2008 Vietnamese vocational teachers, students and workers in branches CNC –Technique (turning, milling, eroding), welding training and Mechatronics. EBG developed and implemented successfully CNC-Modules in in Shanghai, Shenyang and Chongqing and upcoming in Xian. In cooperation with the AHK in Shanghai EBG is issuing the respective certificates as well.

In the frame of a Public Private Partnership (PPP) EBG, GTZ - Technical Vocational Education and Training (TVET) Project - and four Vietnamese vocational schools and colleges set up specialized training modules in the field of 'CNC-turning' and 'CNC-milling' in Hung Yen, Nha Trang, Ho Chi Minh, Nam Ding and Thái Nguyên.

Private Pedagogy and Social Academy, Brezno, Slovakia is a secondary school with German language classes in three specialization fields : The Mistress-ship and Tutorage for Children in Nursery Schools, The Educatory and Health Visitory Movements and The Social and Educational Operator.

Since 2013 EBG cooperates with Steinbeis University and offers an integrated professional Bachelor's degree (B. Sc.) as "European social and educational management in the field early childhood care and education".In developing its programmes EBG takes into account current labour market trends and vocational qualification requirements for the respective target group and ensures a high level of relevance to the field of practice. With the objectives of development of employment and equal opportunities we actively took and take part in miscellaneous European programs.

EBG is certificated according to the DIN EN ISO 9001:2008 and to national regulations for education provider. EBG is member and of EVBB, European association of institutes for vocational training www.evbb.de

5. Courses for CNC operators

We are well positioned to track the latest developments in computer numerical control technology for the wood products manufacturing industry. With the support from machinery manufacturers and distributors we ensure that our wood processing lab continues to reflect the state of the art in CNC manufacturing equipment. We start with training questionnaire asking the background and education level of each employee attending so that our class can be customized to meet of needs. We offer a variety of flexible training programs that can be customized to fit the individual needs of the clients. Programs normally include a mix of classroom sessions, practical demonstrations and hands-on exercises. Course content varies according to target audiences and their learning goals.

The Training program provides capabilities of CNC technology; most appropriate applications; benefits and limitations of CNC technology; overview of CNC machining principles; designing parts using CAD programs; generating CNC control files using computer-aided manufacturing software; 3D programming and advanced applications.

The aims of the training are:

- Teach operators how to safely operate the machine
- Provide a solid foundation upon which the programmer can grow and utilize the basic programming skills
- Give the operator/maintenance employee an overview of the diagnostics capabilities of the software so they can use their knowledge to maximize the efficiency of the machine.

Androgical approach of courses

Adults learn differently and have different strategies in learning. The concept of Andragogy is defined as “the art and science of helping adults learn”. Andragogy emphasises the value of the process of learning. It uses approaches to learning that are problem-based and collaborative rather than didactic, and also emphasises more equality between the teacher and learner:

- Adults are internally motivated and self-directed
- Adults bring life experiences and knowledge to learning experiences
- Adults are goal oriented
- Adults are relevancy oriented
- Adults are practical
- Adult learners like to be respected

5.1. Curriculum Modular Advanced Training Woodprocessing /CNC Specialist

Modul 1: CAD/CAM/CNC	Teaching Hours
i. AutoCAD®	120
ii. WoodWOP®	112
iii. Theoretical fundamentals of CNC-Programming	24
iv. Vectorworks® interiorcad®-Sector Software	64
Total Hours	320
Modul 2: CNC-Machining	Teaching Hours
i. CNC-Programming WoodWOP®	136
ii. CNC-Programming NC-HOPS®	24
iii. Mounting and Operation of a CNC-Machining Centre	160
Total Hours	320
Modul 3: Chamber of handicrafts with Exam	Teaching Hours
i. Vectorworks®	32
ii. Palette-CAD®	8
iii. Project work	40
iv. Presentation Laser beam technology	8
v. Follow-up Vectorworks®	16
vi. Preparation for CNC-Specialists Exam	8
vii. Examination of CNC-Specialist	8
Total Hours	120

Modul 1: CAD/CAM/CNC**Teaching Hours**

i.	AutoCAD®	120
•	Drawing, Editing, Measurement	
•	Organisation of a Drawing, Blocks	
•	Design Centre, Data Exchange	
•	Scaled Printing/Plotting, Modelling Area/Layout	
•	Spatial Representation of Bodies in Parallel Perspective	
•	AutoCAD® and Internet, Downloading Detail Drawings from Various Producers	
•	Preparation of the Drawing for the Transmittance of Data to CNC-Programming	
•	Basics of 3D, Producing and Editing Solid Bodies	
ii.	Vectorworks®- Sector Software	64
•	Workspace and Programme Settings	
•	Viewing Preferences	
•	Drawing and Changing of Objects, Duplication	
•	Free Drawing Elements and Bodies	
•	Construction of Carcass Furniture	
•	Joints, Fittings, Holds	
•	Drawing Derivation, Detailed Section	
•	Rendering	
iii.	Theoretical fundamentals of CNC-Programming	32
•	Geometrical Foundations	
•	Calculation of Surfaces and Contours	
•	Computing of Coordinates and Vectors	
•	Material Science	
iv.	WoodWOP®, Creating Contours	104
•	Configuring of Tools	
•	Processing Steps and Machine Simulation	
•	Data Takeover from AutoCAD®	
•	Programme-Generating a NC	
Total Hours		320

Modul 2: CNC-Machining**Teaching Hours**

1. CNC-Programming	160
•	Fundamentals of Programming
•	DIN-Programming
•	Programming with WoodWOP®
•	Processing of Foreign Data
•	Search for and Correction of Errors
•	Programming of Given Training Material
2. Mounting and Operation of a CNC-Machining Centre	160
•	Presentation of the Machining Centre
•	Arranging of the Tools
•	Working Through Example Programmes
•	Writing and Testing of own CNC-Programmes
•	Closing Assignment CAD/CNC
Total Hours	320

Modul 2: CNC-Machining**Teaching Hours**

1. CNC-Programming 160

- Fundamentals of Programming
- DIN-Programming
- Programming with WoodWOP®
- Processing of Foreign Data
- Search for and Correction of Errors
- Programming of Given Training Material

2. Mounting and Operation of a CNC-Machining Centre 160

- Presentation of the Machining Centre
- Arranging of the Tools
- Working Through Example Programmes
- Writing and Testing of own CNC-Programmes
- Closing Assignment CAD/CNC

Total Hours 320

5.2. Basic course

CNC-Specialist Wood (Deepening: Furniture Manufacturing)		
Framework Curriculum with thematic priority	Self-learning (SL)	Part (in TU)
Build-up and Functioning of Computers	T	1
Build-up of a PC	P	1
Data carrier	SL	3
Data files and directories (<i>exemplified on a WOP-Software</i>)		
Installation of a WOP-Software		
Computer Operating Systems	T	0,5
IBM- OSx and MS-Windowsxx (<i>regarding their usage with CNC controls</i>)	P	1
Important functions in MS-Windows (<i>setting up a directory, copying data files</i>)	SL	1
Working with Windows applications (<i>Notepad</i>)		
Introduction to the CNC-Technology	T	1,5
Evolving history	P	-
Explanation of terms (<i>NC, CNC, CAM, Textual-Progr., WOP-Progr., CAD/CAM-Progr.</i>)	SL	1
Operating principle of the CNC-Technology (<i>many processings with one clamping, position control loop</i>)		
Application fields of the CNC-Technology		
Structure of a CNC-Machine for Woodworking and Production of Furniture	T	2,5
Construction types of CNC-Machines (<i>Portal, Gantry, Cantilever, Parallel kinematics</i>)	P	-
Driveline technology (<i>AC- and DC-Servo-drives, ball screw, steering rack, gearings, linear drive</i>) (Displacement and angle measurement systems (<i>absolute and incremental</i>))	SL	1
Processing aggregates (<i>fixed and exchangeable, div. arrangements</i>)		
Clamping systems (<i>console tables, flat and grid table, vacuum clamping elements</i>)		

Mounting aids (<i>optical position indicator, automatically positionable ones</i>)		
Security equipment		
CNC-Controls	T	1
Components of the CNC-Control system	P	-
Types of control (<i>point-, frame- and trajectory control</i>)	SL	0,5
Varying controls: e.g. the SINUMERIK-Control, the NUM-Güttinger-Control, the HOMATIC-Control		
Machine Operation	T	2,5
Health and safety provisions	P	7
Reference point run	SL	3
The different modes of operation (<i>manual, automatic, MDI</i>)		
Machine set-up		
Clamping of the workpieces		
Assured testing of the programme		
"Dry run"		
Loading of programmes		
Processing of programmes		
Targeted programme abortion		
Defining and changing of work lists		
The tool data base		
Specific functions of the machine		
Cleaning and maintenance		
Tools	T	1
Tool fittings	P	2
Tool changing unit	SL	1
Changing tools (<i>manually and automatically</i>)		
Structural shapes of tools		
Cutting materials		
Care of tools and tool fittings		
Tool measurement		
Systems of coordinates and points of reference	T	0,5
Cartesian coordinates system	P	1,5
Axes of coordinates and directions of motion	SL	1,5
Main axes (X, Y, Z)		
Auxiliary axes (I, J, K)		
Rotary axes (A,B,C)		
Machine zero point		
Reference mark		
Workpiece zero point		
The G-Code Programme	T	2
The CNC-Programme set-up		7
DIN 66025	P	10
Programme-related commands (<i>programme number, line number</i>)	SL	
Geometrical and technological informations		
Absolute dimensional setting, relative dimensional setting (<i>G90, G91</i>)		
Rectilinear rapid traverse (<i>G00</i>)		
Linear interpolations with programmed feed (<i>G01</i>)		
Circular interpolations with programmed feed (<i>G02, G03</i>)		
Tool radius correction (<i>G40, G41, G42</i>)		
Technology-related commands (<i>F, S, T, D</i>)		
Important additional commands (<i>M</i>)		
Circular interpolation with I and J		
WOP-Programming	T	2
Basics: e.g. of HOPS and WOODWOP	P	14
Starting the applications	SL	10
Writing of new programmes		

Opening of existing programmes Saving of programmes Basics of drilling programming Horizontal drilling Vertical (<i>individual-, assembly hole boring</i>) Formatting (<i>with cutting- and milling-tools</i>) Basics of milling programming Grooving and sawing Parameterized programming (<i>programming with variants</i>) Generating the DIN-Programme		
Outlooks CAD/CAM-Programming	T P SL	1 1 -
Total duration of the action(T + P)		50 TU
Total duration of the action in self-learning at home (SL)		32 TU
		82 TU

5.3.Advanced course

Advanced Training Course: CNC-Specialist Wood(Deepening: Furniture Manufacturing)		
Framework Curriculum with thematic priority	Pract (P) Self-learning (SL)	Sub- heading (in TU)
Computer Operating Systems Extended Common file extensions used in C-Technology (<i>TXT, DWG, DXF, MPR, SCR, ...</i>)	T P SL	0,5 0,5 -
Advanced Build-Up of a CNC-Machinery Aggregates for edge banding and finish processing	T P SL	1 - -
Advanced Machine Operation Archive pages of the tools The operation mode MDI Defining and changing a work list Specific machine functions Templates and clamping tools Tips and tricks Maintenance works	T P SL	1,5 4 1
Advanced Programming with G-Code Programming of jumps (<i>G77, G79</i>) Line repetition (<i>S</i>) Loading of sub-programmes Parameterized programming	T P SL	2 1 13
Advanced WOP-Programming Horizontal milling Milling cycles (<i>pocket milling, ellipse,</i>) Grooving and sawing Zero point offsets Sub-routines Grinding Parameterized programming Conditions	T P SL	2,5 14 16

Stop functions		
Additional functions		
Edge banding and finish processing		
CAD/CAM	T	3
CAD-Basics	P	18
Differentiating between pixel-oriented and vector-oriented graphics (e.g. CorelDraw and AutoCAD)	SL	5
Constructing using CAD (lines, polylines, circle)		
Commands for modification		
Layer technology		
Data exchange formats		
Fundamentally on interfaces (DXF and others)		
Postprocessor technique		
Data import (DXF and others)		
Other data exchange formats		
Profitability review	T	1
Planning of a CNC-Investment	P	3
The necessary environment	SL	3
Cost calculation		
Excursion to producers of CNC-Woodworking machines	SL 5	
Production of CNC-Machines		(possible)
Visiting the training centre and the showroom		
Total duration of the action(T + P)		50 TU
Total duration of the action for self-learning at home(SL)		43 TU
		93 TU

6. Short term training in Germany

6.1. Contents of short term training in Berlin (22.-26.June 2015)

-During this period, EBG organized a study visit in Berlin for the participants to observe existing andragogical training in Germany concerning the course that is offered in Germany to get a certification as CNC Operator for wood. The participants was given information how the continuing training is performed: methods, machines, programs, modules, contents, conditions on prior learning etc. so understand which CNC andragogical educational principles are appropriate in which context. Additional we visited a companies and had a look at the CNC operators on the job. Another visit was the company that is marketing the CNC machines, EBG and also TR partners are working with. Here we got info about the hard- and software CNC machines incl training. Beyond the training the participants observed the real training and working conditions in the furniture industry and particularly working and training on CNC. One of the reasons for strength and success of German economy is German vocational education and training system and particularly the blue collar workers of enterprises. The companies are asking for qualified and skilled workforce not only in terms of knowledge but also with a practical approach for high qualified training and vocational technique.

EBG's strength and success is based upon vocational training with a strong practical component and market-oriented development of tailored training activities to the specific needs and requirements. In developing its programmes EBG takes into account current labour market trends and vocational qualification requirements and ensures a high level of relevance to the field of practice.

Beyond "technical" part cultural interaction= business culture, training culture (how the trainers and students/workers act with each other's) were also inputs of the study visit. Last

but not least exploring the country and its people, history, multiculturalism (people from 190 counties are living in Berlin, though the biggest population are Turks), daily life, remains of the Berlin wall, 2100 bridges of the city....

- Monitoring arrangements: Monitoring involved reflecting and was focused on the measurement of the following aspects of the study visit: On quantity and quality of the activities, andragogical educational principles appropriate in which context, knowledge transfer, which broader, long-term effects could be triggered by the visit, the effects produced by the visit and the overall impact.

- Expected use of outcomes, assessment: The knowledge gained from the visit observations will be debriefed and reported for input into the development of the training curriculum. Comparing curricula in each context, the project will then develop the training curriculum. At this site visit, the Steering Committee performed an evaluation of the work and outputs done to date and provide feedback.

Days1-3

- 1) Presentation of training concepts, didactic and technical structure of the training
- 2) Presentation of CNC machine, axes and applications
- 3) Object oriented programming und implementation on CNC machine
- 4) Parameter and variables for programming (Furniture, door, interior constructions, fair constructions
- 5) CAD-CAM
- 6) Creative design of millings, engravings and decorative panels
- 7) Free forms and their applications; examples on the machine, engraving and inlaying; milling of solid surface materials, for example, Corian; template building and their applications.
- 8) Handouts for documentation to each topic (paper or e-version)

Location: QEU Wolfener Straße 32/34, 12681 Berlin (training workshop of the cooperation partner of EBG in Berlin)

Day 4

Excursion to 4 enterprises

- 1) Varius; Messe- Event- Innenausbau GmbH; Tischlermeister Mario Grassmann Zum Mühlenfließ 4 15366 Neuenhagen bei Berlin
- 2) Hmr holzmanufaktur richter GmbH Handwerkerstr. 25 D-15366 Berlin – Hoppegarten
- 3) Tischlerei Streidt Hegermühlenstraße 47 D-15344 Strausberg
- 4) LIGAS Tischlerarbeiten GmbH Gerichtsstraße 12-13 D-13347 Berlin

In all companies we observed typical CNC operating activities: fair construction, store building, costumer`s individual orders and the renovation.

Day 5

- 1) Presentation of new CNC techniques by main distributor of CNC machines in Berlin; Heinrich KUPER GmbH & Co. KG Großbeerenstraße 194 – 196 12277 Berlin
- 2) Evaluation of the short term training: summary of the week, reflection, evaluation and conclusions

EBG trainer: Roberto Lorang and Karl-Heinz Thiemann
Translator: Türkan Yilmaz (German-Turkish)

Minutes of short term training

The training took place with participants from IKOOR, ODTÜ and OMSID. Basically, we could keep to the schedule, which was agreed in advance with the partners.

On the first day EBG picked up the participants from the hotel and in the evening also brought back. On the first three days the training began 09:30 and ended around 17:00 clock. During the breaks coffee, tea, water, dates, figs, nuts and biscuits were provided.

The participants were very receptive, and it came from the very first day to very creative discussion. The interpreter was good accepted by the participants, so that smaller uncertainties in certain technical terms not stood out. Concerning certain technical terms the participants understood me without an interpreter. Since the mixture of the delegation was great, very broad, in my view, always resulted in new considerations for discussions. So we were able to illuminate the formation of CNC specialists from the perspective of entrepreneurs, architects, designers, vocational school teachers and university lecturers.

After the introduction, we were able to come to practical examples on the technical competence of the participants quickly. The participants could try in AutoCAD, VectorWorks and WoodWOP examples and this accompanied to the CNC machine. The participants received different exercises in a variety of softwares in file form. WoodWOP 6.1. beyond training software was handed out too.

The excursions to operational areas were found to be very good selection. The participants were warmly greeted and entertained in all companies. All managers were very informative friendly so intense discussions took place in the company.

The presentation at the company Kuper was carried out very professionally and with great expertise. Even the most difficult questions about specific machines, also with the help of our interpreter were answered.

The transport of participants on days 4 and 5 has been realized by the vehicles QE&U. Finally, we asked the participants to rate the training. The evaluation is in the Annex.

To sum up we can say the participants enjoyed a very productive and interesting week in Berlin. Even during dinner we hardly come to eat, since the technical discussions went on also there.

6.2. Evaluation

Assessment of the contents of course or training content regarding the objectives and learning outcomes is one of the major requirements in order to evaluate the skills, knowledge and competency of students/learners no matter what the level is or which discipline the content is designed for. The following matrices based on Bloom's Taxonomy is used to assess the training contents in order to clearly identify the problems/deficiencies etc. in CNC training.

EBG Matrice

	Knowledge	COGNITIVE						
Objectives of the training		COGNITIVE	REMEMBER	UNDERSTAND	APPLY	ANALYZE	EVALUATE	CREATE
	Knowledge							
1.day: Presentation of training concept shortterm training (up to 5 days) Intensive training, over one semester Presentation of CNC machine, axes and applications	Factual		X	X	X			
	Conceptual		X	X		X	X	
	Prozedural		X	X		X		X
	Metacognitive			X		X	X	X
2. day: didactic and technical structure of the training Object oriented programming und implementation on CNC machine Parameter and variables for programming (Furniture, door, interior constructions, fair constructions)	Factual		X	X		X		X
	Conceptual		X	X		X	X	X
	Prozedural			X		X		X
	Metacognitive		X			X	X	X
3.day: Integration of CAD-CAM	Factual		X			X	X	X

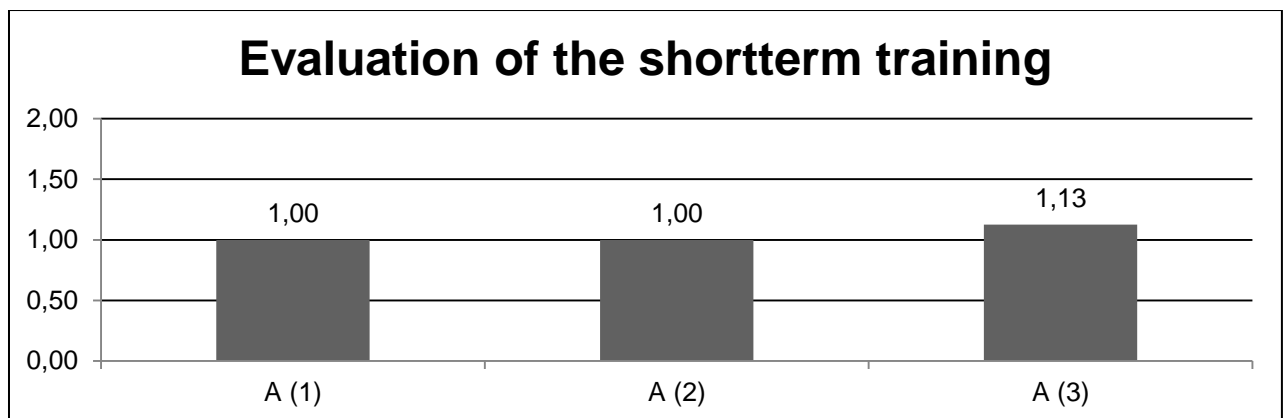
Software	Conceptual		X		X		X
Creative design of millings, engravings and decorative panels	Prozedural	X			X	X	
Free forms and their applications; examples on the machine, engraving and inlaying; milling of solid surface materials, for example, Corian; template building and their applications.	Metacognitive			X	X		X
4.day: Excursion to 4 enterprises	Factual	X	X	X			
In all companies we observed typical CNC operating activities: fair construction, store building, costumer`s individual orders and the renovation.	Conceptual	X			X	X	X
	Prozedural	X			X		X
	Metacognitive				X	X	X
5.day: Presentation of new CNC techniques by main distributor of CNC machines in Berlin	Factual	X	X	X	X	X	X
	Conceptual	X			X		X
	Prozedural	X			X	X	X
	Metacognitive						

Evaluation sheet for participants

(1 excellent, 2 good, 3 sufficiently, 4 unsatisfactorily)

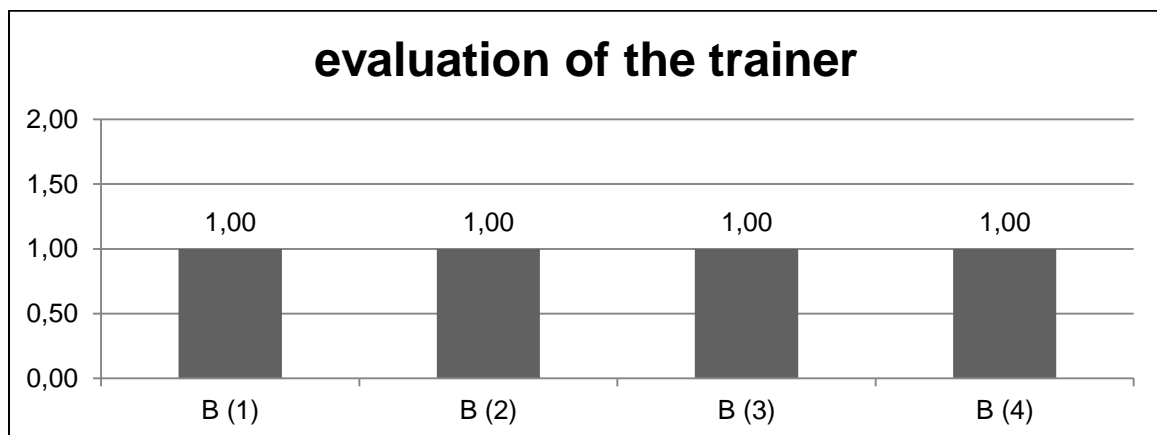
A. How was the training?

- (1) The topics match to my needs and met my expectations
- (2) The technical equipment was appropriate (machines PC and tools)
- (3) The training was very efficient and I gain relevant knowledge and information

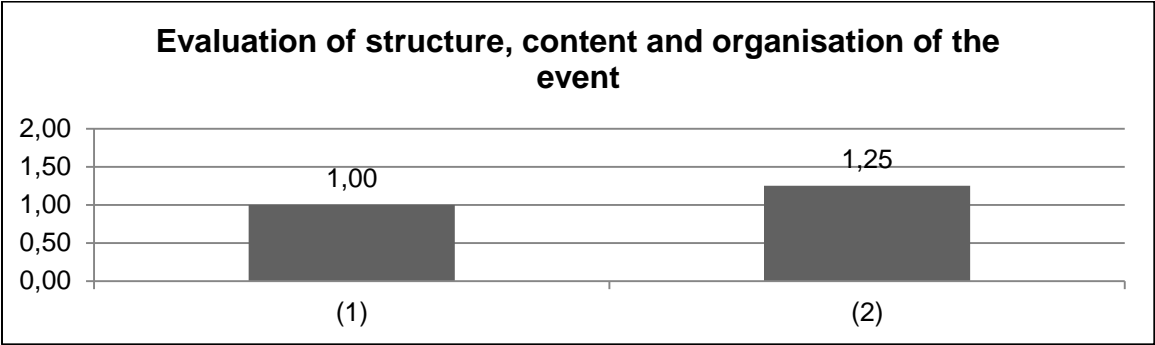


B. How was the performance of the trainer?

- (1) He has the appropriate subject competence and knowledge as well didactic experience
- (2) He takes the needs and expectations of participants into account and support them
- (3) He gives feedback to questions and problems of participants
- (4) He gives participants the opportunity to build their own expertise

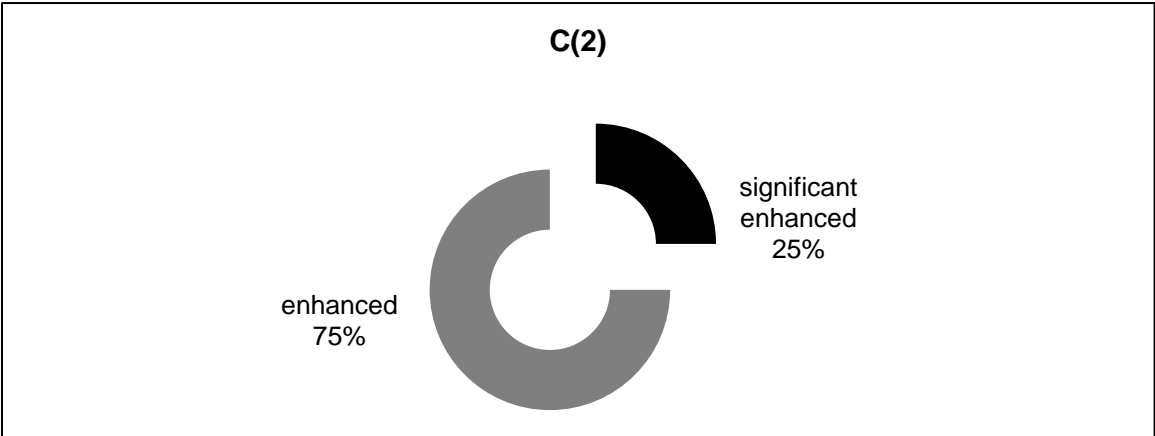
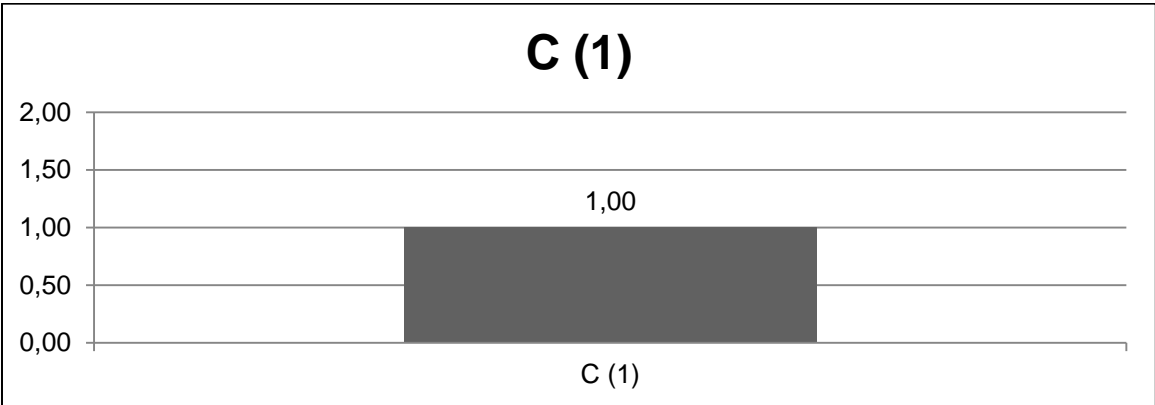


Structure, content and organization of the training



C Evaluation for the event as whole

- (1) Summed up; I give the point ...
- (2) The short term training improved my knowledge concerning CNC technic and training
- (3) If I would again have to choose a provider for this training I would choose



C (3) all participants would choose this training

7.ANNEX



CERTIFICATE OF ATTENDANCE

It is hereby certified that

Ms Özlem Can

has participated the short-term joint staff training of Erasmus+ KA2 PRO-CNC Project, to observe existing andragogical trainings with CNC operations as for the Project of "Design of Curriculum for Woodworking CNC Operators in Turkey" between 22-26 June, 2015
Berlin, Germany

Project Partner EBG



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