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LEARNING CAM –COMPUTER AIDED MANUFACTURING –SKILLS AND COMPETENCE

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***Abstract**: The first step to achieve performance in production area, consist in providing the infrastructure. This means new Computer Numerical Control (CNC) machine-tools, strong Computer Aided Design (CAD) software's and Computer Aided Manufacturing (CAM) software's. But all this, without the detailed knowledge of the machine tools, the software programming capabilities, will not achieve the expected profitability. In this paper are covered the basic steps in a computer-assisted programming CNC machine tools. It focuses how the information's are transferred to someone who wants to learn, the way haw was checked the assimilated knowledge by the trainees. All are customized using a CAD / CAM software implemented in our university. Is underline the CAM software capabilities in educational CNC training applications with interactive communication between user and computer, with test and technical suggestions. Are treated carefully in which ways the information's are transmitted but is important too, their succession . Are highlighted the advantages of visual impact of technical processes simulation as a way to attract attention of the auditors and in the same time, to complete the technical information's who was transmitted in the training process. Was presented the CNC TRAINING CENTER from Timisoara, with his three important divisions : CAD/CAM department, CNC simulation and virtual operating area and the workshop with real CNC machine tools, lathe and milling. With all this three entities was possible to analyze and to go through each stage of the product life : design assisted by computer, computer aided manufacturing and processing on real machine tools.*

***Keywords:** CAM, manufacturing technology, CNC*

I. INTRODUCTION

An important factor to improve student achievement is to create better learning environments. The CNC training center who was develop in "POLITEHNICA" University of Timisoara have:

Figure 1. The CNC workshop

I. Modern and performing CNC machine tools, lathe and milling centers (Fig. 1)

1. CAD/CAM – laboratory (Fig.2) equip with 15 work stations with following CAD/CAM software's, SOLID WORK, KELLER, ESPRIT, ALPHACAM, SHOP TURN, SHOP MILL.

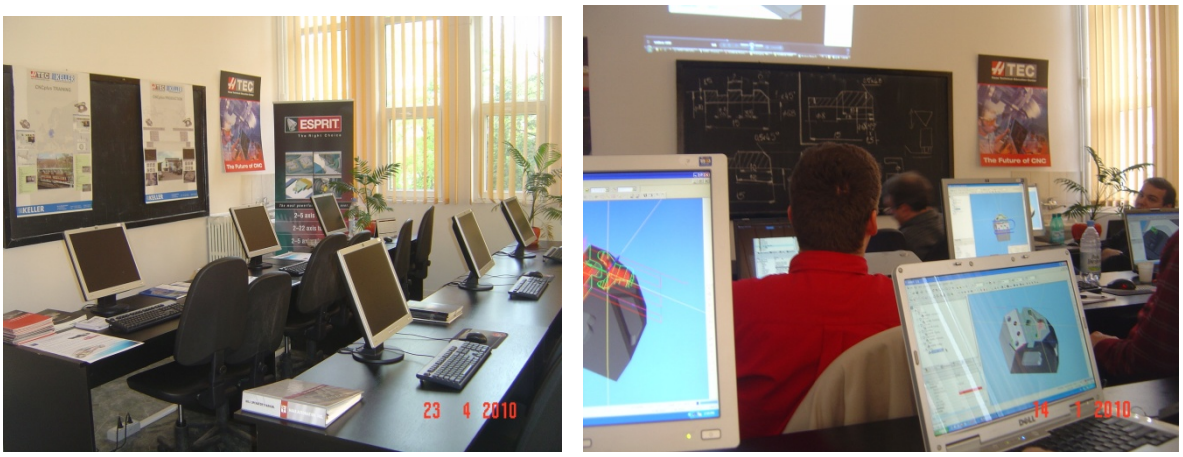


Figure 2. CAD/CAM –laboratory

2. "CNC simulation room" (Fig. 3) where are located the CNC simulators - identical with the CNC control who are equip the machine tools"

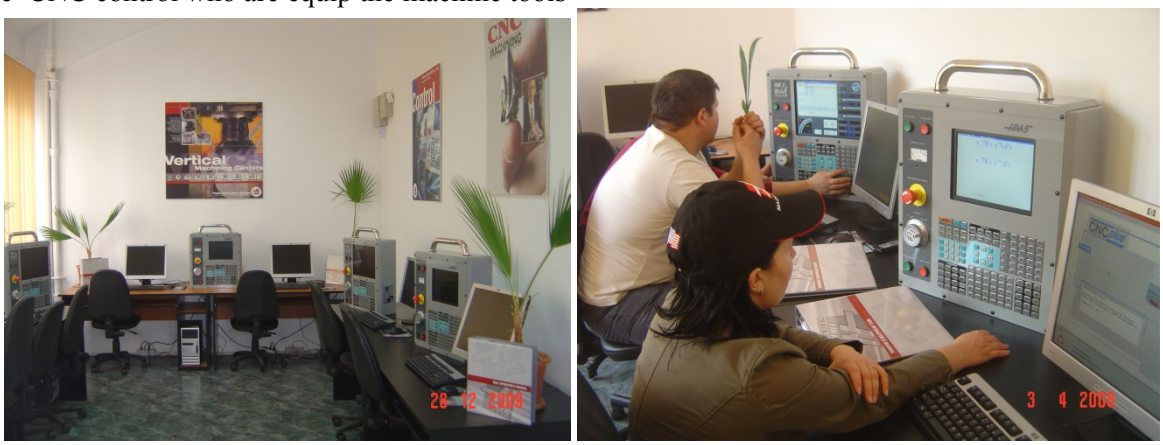


Figure 3. CNC simulation room

Technical education center in operate and programming CNC machine-tools is a research and technological transfer center who is interface between academic area and industrial field who develop the CNC concept.

1. Technical educational activities:

- improve university their training programs

The theoretical curses have now a real support in applications directly on the modern CNC laboratory with real CNC machines tools -an example can be the present course " Machines and advanced systems of manufacturing"[2]

- stimulate young people to learn manufacturing technology

-prepare the young peoples for interesting and rewarding "High-Tech" career opportunities in a vast range of industries

2. Collaboration with industrial companies

- resolve the shortage of skilled technicians
- connect to real-world industry-leading partners
- help customers to train their workforce

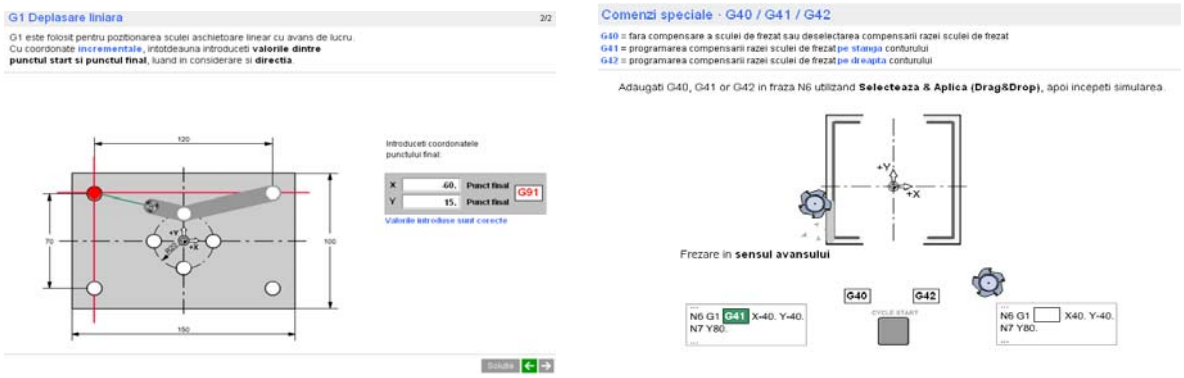
In the CAD / CAM laboratory, our center has software's specialized on both directions: training version and production.

II. METHODOLOGY

In the present paper will highlight the importance of CAM learning software.

The complexity of interlocking data's from many fields, such as automation, technology, computer, mechanical, electronics makes programming CNC machine to be an area with difficult access. [4]

To meet these impediments, we use dedicated learning software 's, where the pure technical information's are supplemented by video presentations, more detail to understand the different command functions, operation of devices.



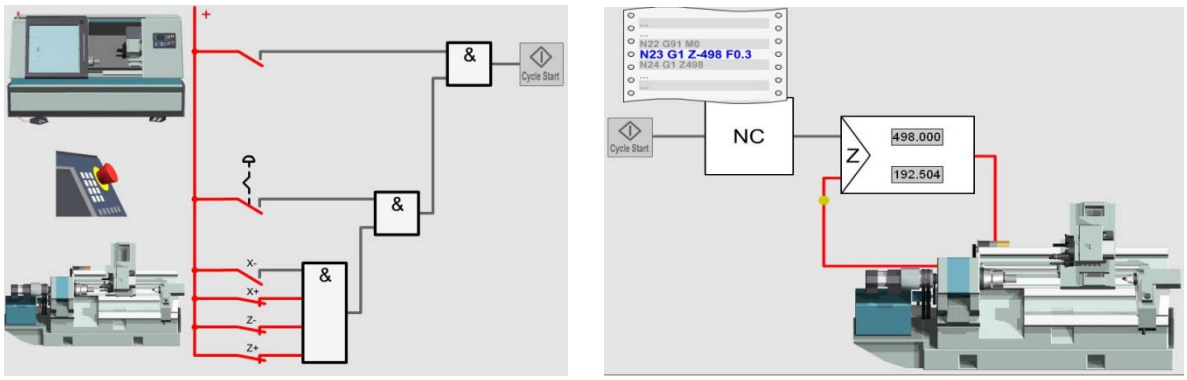
a **b**

Figure 4. Examples with learning G instruction

In Fig.4a is present the G1 instruction with his definition, simulation of the command effect and an interactive communication between user and the computer to validate the correct answer. [3]

In Fig. 4b is presented an application to learn the instruction G40, G 41, G42. With "Drag & Drop" the trainee can chose the correct answer and test the effect thru the simulation. [5]

To know different parts of the machine tool or accessories was used in detailing several sub-assemblies, the graphical simulation on their operation. (Fig. 5)



a **b**

Figure 5. PLC functio, Fig.5a and the modality how the machine tool read the NC program, Fig.5b

On learning and applying different NC commands, there is the possibility of opening a dialog box that are detailed each instruction.

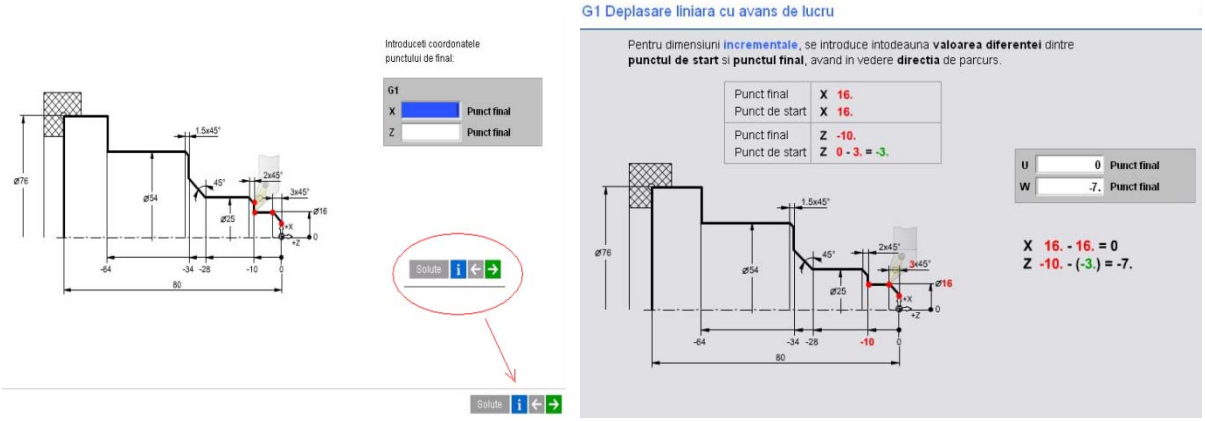


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Figure 6. Explication to establish the correct geometrical points

In Fig.6a, we can see the interactive solution (tasting the "i" button) give by computer to find the correct geometrical determination. In Fig 6b was presented the mathematical solution who explain the calculation. [1]. With this module, the trainer have a wonderful possibility to explain and demonstrate the application.

The complex process of NC programming , requires knowledge of mechanical phenomena (Fig7.-how to explain and understand torque from theory to practice)., how to use the cutting tools, control devices and of course, the machine tool.

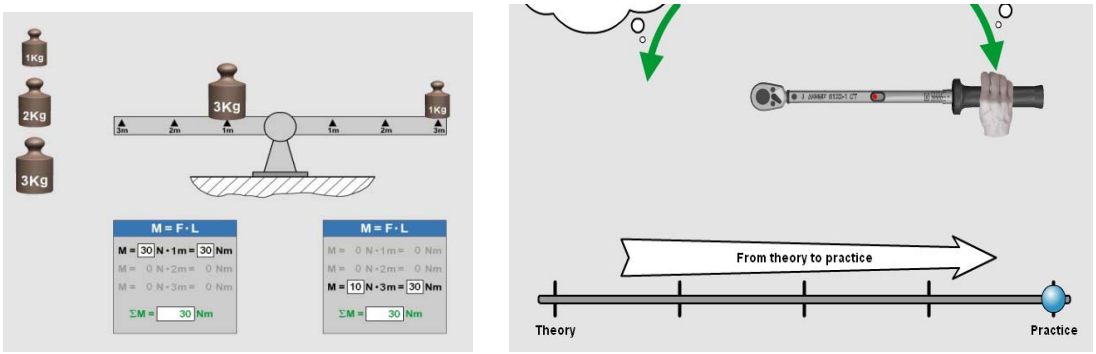
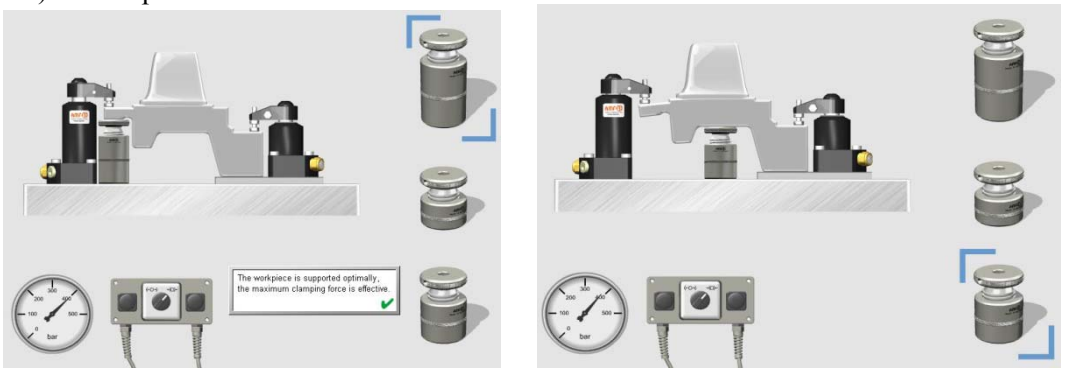


Figure 7. Application to explain the torque

Therefore, software training has specialized modules for their detailed explanation. It turns to video presentations to simulate the functionality, for example, the hydraulic clamping systems (Fig. 8.)

In (Fig. 8a) is presented the correct solution in comparison with an incorrect modality (Fig. 8b) to clamp the material.



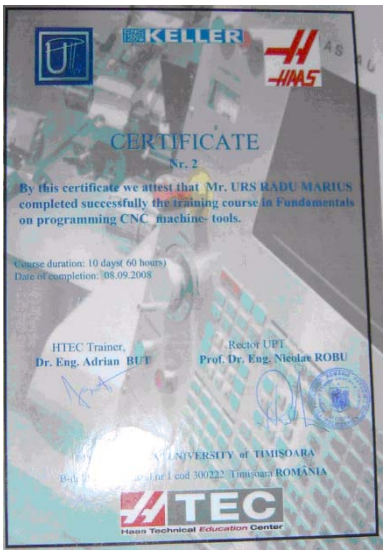
a **b**

Figure 8. In (Fig. 8a) is presented the correct clamping solution;(Fig. 8b) the incorrect solution

Of course, CNC learning teaching program ends with a test aided by computer, that will reflect participation, interest and the results of trainees.

For students these are the marks obtained in the process of learning.

For technical personnel from companies that attended the training, certification is a computer aided reflection and relevant interest in the way of knowledge obtained.



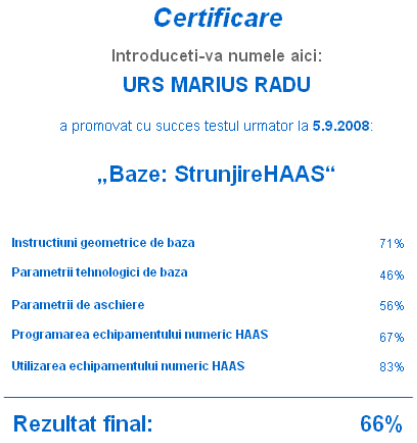


Figure 9. The CNC certification

With occasion of the student's professional events (*Fig.10)* : "CAM with HAAS-, 2008, 2009, 2010, 2011"-Computer Aided Manufacturing applying CNC Machine Tools -event who was organized in our University (this year at the fourth edition), our students was able to project, elaborate the CNC program and manufacturing the parts on real CNC machine tools. The students who succeed to resolve the applications obtain a CNC diploma certification .

Figure 10. Student's professional event

III. CONCLUSION

The synergy to develop this CNC training center with his infrastructure: the investments in modern CNC machine tools, computers, cutting tools, clamping systems, CAD/ CAM software's, to

learn and to implement this software's had prove their efficiency. Many industrial companies ask about their training program to up grade their personal skills, great companies chose our university for the presentation for their last research like: SANDVIK, RENISHAW, AIR TURBINE TOOL, WALTER.

Our students have yet the ability to make the first step to the production challenges, the companies ask for our students and appreciate them.

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