Distance Learning and Simulation Advantage for CNC Students

Reaching out Beyond the Classroom and Lab

David “Otter” Ott  Lt Col Ret.
otter@immerse2learn.com
515.571.9963
Strategic Partners

Support Haas Factory Outlet online training and website portals.

Haas Technical Education Center website and Partner Portal built on Immerse2learn.com software technology.

MastercamU built on Immerse2learn.com Learning Content Management System (LCMS). Immerse2learn.com sells and supports MastercamU online learning and certification.

Delcam University built on Immerse2learn.com Learning Content Management System (LCMS).

Fanuc Mill and Lathe curriculum and virtual CNC emulators.

Implementing NIMS South Africa International Testing system.

National Tooling and Machining Association.
Aptitude testing system and Advanced CNC training.
Over 300 Schools in 2013

- Hawkeye Community College
- Southwestern Illinois College
- Kirkwood Community College
- Plymouth High School
- Calhoun Community College
- Ottawa Intermediate Schools
- Orchard View Technical School
- Saint Clair RESA
- Lenoir Community College
- Randolph Community College
- Guilford Technical College
- BJ Skelton Career Center
- Purdue University
- Rensselaer Polytechnic Institute

- Gateway Community College KY
- Western Iowa Technical Community College
- Michigan Department of Education
- Central Community College
- Pennsylvania College of Technology
- Tennessee Technology Centers
- Lone Star Colleges
- Hennepin Community College
- Dunwoody College
- Saint Paul Community
- Rowan Cabbarus Community College
- Focus Hope
- Vincennes University
- Knox Career Center
- Southern Indiana University
Learning Through Simulation

- Simulation boosts learning rates dramatically

- Study by the National Training Labs (NTL) Institute for Applied Behavior Sciences in Alexandria, VA
  - Students retain 5% of what they hear in lectures
  - 10% of what they read
  - 20% of what they see and hear in audio/visual presentations
  - Add “practice by doing” and “immediate use”, two learning techniques available in simulations, and retention rates jump to 75%

- Students learning via simulation based training become more proficient more quickly
Simulation in the Schools, in the Workplace and at Home

- Breaks down the barriers between what we learn and what we do - We practice virtual hands on while learning

- Bring the worlds of industry and education closer together – reaching out through online learning and simulation

- Highly interactive simulations can create massive increases in productivity and knowledge transfer to students and employees

- Instructors move to a higher role of coaching and diagnosing

- Errors and mistakes cause no damage or safety hazards in the virtual world
Computer Simulations in Distance Education

- Computer simulations are essentially representations of real-life systems modeled for virtual exploration.

- Simulations can provide students with the means to explore environments that would otherwise be prohibitive due to factors of cost, safety and proximity.

- Because **simulations allow exploration and experimentation** they are being more widely used in online learning providing instructors and students an opportunity for **combining the direct virtual experience with the learning environment**.

- **Computer simulations make experience possible in a distance learning setting**.
Opportunities for High Schools and Technical Colleges Combining Simulation and Distance Learning

- Options for students enrolled through high school post-secondary agreements

- Mini-courses/workshops with introductory modules BEFORE starting a high school or CC program. Market to parents and students.

- Online Courses to be added to existing courses in Program lineups
Primary Solution Components:

- Virtual Training Environment (VTE)
- Skills Learning Modules
- Assessment
- Reports
Real-world characteristics accurately mimic actual manufacturing systems:

- Geometric Models
- Motion
- Program Languages
- Control Logics
- Process Times
- Control Alarms
- Control Types: CNC, Robotic, etc.
- Material Removal

“Reality at Your PC- Anywhere! It is like being at the actual machine and control.” -Instructor, Easely, SC
Virtual Training Environment (VTE)

True 3D simulation and emulated controls provide a real-world learning experience.

- Set Work and Tool Offsets
- Write, Edit, and Save Programs
- Load CAM output
- Library of Machines
3D Plotter Included
Quickly View Tool Center Line

G150 General Purpose Pocket Milling

Step over command with I or J less than diameter of tool
Return on Investment

Unlimited access to train and rehearse in a virtual environment enables students to develop greater confidence and proficiency prior to performing actual procedures and operating actual equipment.

- Overcome barriers: student equipment ratio, location, etc.
- Increase Training Contact time with equipment
- Minimize risk of damaging equipment or incurring injuries
Skills Learning Modules

- Step-by-step instruction
- Lessons aligned to skills assessment
- Building-block” exercises prepare student for actual machine time

Sample Skills Modules:
- Introduction
- Safety for Machining
- Shop Math Level I
- Shop Math Level II
- Blueprint Reading w/GD&T
- Precision Measurement Devices
- Machinist Calc Pro
- Feeds and Speeds
- Mill Control Interface
- Mill Setup
- Mill Programming
- Lathe Control Interface
- Lathe Setup
- Lathe Programming
- Mastercam Mill
- Mastercam Lathe
- Advanced CNC, Dies and Molds

Powered by immerse2learn.com
Industry Standard Content

Learn CNC for Haas or Fanuc
- Introduction
- Safety for Machining
- Shop Math Level I
- Shop Math Level II
- Blueprint Reading
- Precision Meas. Devices
- Machinist Calc Pro
- Feeds and Speeds
- Mill Control Interface
- Mill Setup
- Mill Programming
- Lathe Control Interface
- Lathe Setup
- Lathe Programming
- Lathe Intuitive Programming
- Mill Intuitive Programming

Learn CAM for Mastercam X6/7
- Principles of Machining
- Mill Design and Tool Path
- Lathe Design and Tool Path
- Advanced Mill Design and Tool paths
- Multi axis-
  Curve Drill and Circle Mill

Learn Advanced Manufacturing
- CNC multi axis Mill and Drill
- Plastic Injection Molds
- Stamping Dies

 Powered by immerse2learn.com
Safe and Responsible Operation of Machines

Safe and responsible machining requires understanding of:

- Feeds
- Speeds
- Sounds
- Vibration

Machine Sounds

A change in the sound a machine is making can be the first sign something has gone wrong. If the machine doesn’t sound right stop it immediately and have the problem corrected.

Some sounds will be obvious and some will be subtle. A good operator will learn with experience how a machine should sound.

Never rush the speeds and feeds on a machine.

Turn rapid speeds down and turn single block on when running a CNC program that is unproven. This gives the operator time to react if there is a problem.

Always be very cautious when the machine is moving in the Z axis. Most CNC machines have a “Distance to Go” feature which will allow you to monitor the distance an axis has to travel. Watching the “Distance to Go” coordinate display will help prevent crashes.
Interactive Exercises

• State-of-the-Art Exercise and Testing Environment

Programming Worksheet

Fill in the blank program fields. Press 'Cycle Start' to run the program.

Status:
Problem Loaded
New game started.
Your Answer in POINT A requires a decimal point, or not valued number.
Your Answer in POINT C is incorrect.

Beat the Clock

Hours: 0:00:06
Minutes: 0:00:12
Seconds: 0:00:26

3 Strikes - You're Out!

Percentage:
95% T2 M06 S2000 M03
510 G54 G90 G00 X 0.0 Y 0.0
515 G43 H02 20.1 M08
520 G01 Z-0.375 F8
525 G41 G02 X 0.0 Y 0.0
530 G01 Y 0.0
535 G01 X
540 G02 X 0.0 Y 0.0
545 G01 X
550 G03 X 0.0 Y 0.0
555 G01 X
560 G03 X 0.0 Y 0.0
565 G01 X
570 G02 X 0.0 Y 0.0
575 G01 X
580 G28 G91 G00 Z0
585 G28 G91 G00 Y0
590 M30

Work Coordinate Position

X 0.000
Y 0.000

Tool Center Position

X -0.250
Y 0.250

Legend
- Program Zero
- Axis Centerline
- Correct Input
- Incorrect Input

Powered by immerse2learn.com
Interactive Exercises
Dynamic Visuals help to accelerate the learning process

- Track learner progress
- Step by step feedback
- Variable time, attempts, and minimum scores
Course Overview

6) Video or graphical instruction and Virtual CNC interaction
Course Overview

Calculated Industries Machinist Calc Pro with Virtual Calculator

Module 3, Lesson 1, Page 18 of 31

Use the MCP Calculator to Calculate Cutting Feed Rate to the High Limit

This example demonstrates how to use the MCP calculator to calculate the Feed Rate to the high limit.

1. Enter the Feed Rate (IPM)
   \[ 31 \text{ Feed Rate} \]

2. Enter the Spindle Speed (RPM)
   \[ 1910 \text{ RPM} \]

3. Calculate the Cutting Feed:
   \[ \text{Cut Feed} \]

Tool Manufacturer Cutting Data

<table>
<thead>
<tr>
<th>Component</th>
<th>Cutting Speed/SFM</th>
<th>IPM (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylindrical Bar</td>
<td>4.0”DIA</td>
<td>800 - 2000</td>
</tr>
<tr>
<td>Operation</td>
<td>OD Turning</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum</td>
<td>1.5 - 31.0</td>
</tr>
</tbody>
</table>

Powered by immerse2learn.com
Teaching Concept to Creation

LearnCAM
Mastercam Training and Certification

LearnCNC
Virtual CNC, Interactive Learning and Assessment

Advanced Manufacturing

immerge2learn.com
Other Relevant Content

LearnCAD for Solidworks

Revolved Boss

CSWA Preparation
Mastercam Certification Curriculum

- X7 and future release Support
- Mill Design and Toolpaths
- Advanced Mill Design and Toolpaths
- Lathe
- FREE New Home Learning Edition included with curriculum
Mastercam Certification provides: learning pages, video, prints and helpful tips

Part 1 Demonstration

Objectives
- Circle Center Point (radius)
- Line Endpoints (angle)
- Circle Center (edge)
- Trim (three entity)
- Translate (rotate)
- Line Endpoints (horizontal, vertical)
- Line Endpoints Transform (translate join)
- Line Endpoints (midpoint arc)
- Trim (three entity)
- Translate (copy), Create Circle Center
- Circle Center (lock radius)
- Fillet (trim quadrants)
- Line Endpoints (tangent)
- Trim (extend)

Watch the video and learn how.

Videos
- Example Video

Prints
- Large Drawing

Recommended Mastercam Help Topics
- Sketcher
- AutoCursor Overview
- General Selection Ribbon Bar
- General Selection Button Definitions
Advanced CNC, Mold and Die

Advanced CNC 200: Milling and Drilling

- Modern CNC machines
- Multi-axis machining
- State of the art cutting tools and holders
- Advanced Milling Formulas
- High-speed and high-efficiency machining
Dies 100: Introduction to Stamping Dies

- Stamping dies and part functions
- Stamping die types and building processes
- Sheet metal cutting and forming
Molds 100: Introduction to Plastic Injection Molds

- Plastic injection molds parts and functions
- Mold building, spotting and machining
- Molding plastics flow concepts
### Skills Student Assessment Report

**LearnCNC™ for Haas**

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Test Name</th>
<th>Pre-Test</th>
<th>Score</th>
<th>Tests</th>
<th>Score</th>
<th>Change</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Machine Motion</td>
<td>Mar 03, 2013 09:59 PM</td>
<td>7 / 10</td>
<td>Mar 03, 2013 10:14 PM</td>
<td>8 / 10</td>
<td>+10%</td>
<td>80%</td>
</tr>
<tr>
<td>2010</td>
<td>Mill Control Panel</td>
<td>Mar 03, 2013 10:16 PM</td>
<td>8 / 10</td>
<td>Mar 03, 2013 10:22 PM</td>
<td>8 / 10</td>
<td>+0%</td>
<td>80%</td>
</tr>
<tr>
<td>2010</td>
<td>Machine Startup</td>
<td>Mar 03, 2013 10:24 PM</td>
<td>9 / 10</td>
<td>Mar 03, 2013 10:28 PM</td>
<td>9 / 10</td>
<td>+0%</td>
<td>90%</td>
</tr>
<tr>
<td>2010</td>
<td>Job Setup</td>
<td>Mar 03, 2013 10:42 PM</td>
<td>6 / 10</td>
<td>Mar 03, 2013 10:53 PM</td>
<td>9 / 10</td>
<td>+30%</td>
<td>90%</td>
</tr>
<tr>
<td>2010</td>
<td>Editor</td>
<td>Mar 03, 2013 10:56 PM</td>
<td>8 / 10</td>
<td>Mar 03, 2013 11:03 PM</td>
<td>8 / 10</td>
<td>+0%</td>
<td>80%</td>
</tr>
<tr>
<td>2010</td>
<td>Program Entry</td>
<td>Mar 03, 2013 11:04 PM</td>
<td>2 / 5</td>
<td>Mar 03, 2013 11:10 PM</td>
<td>5 / 5</td>
<td>+60%</td>
<td>100%</td>
</tr>
<tr>
<td>2010</td>
<td>Program Run</td>
<td>Mar 03, 2013 11:11 PM</td>
<td>5 / 5</td>
<td>Mar 03, 2013 11:14 PM</td>
<td>5 / 5</td>
<td>+0%</td>
<td>100%</td>
</tr>
<tr>
<td>2010</td>
<td>3-Axis CNC Milling Machine Setup (Old Control)</td>
<td>Examination</td>
<td>Mar 03, 2013 11:20 PM</td>
<td>35 / 40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2310</td>
<td>Machine Motion</td>
<td>Mar 03, 2013 11:24 PM</td>
<td>17 / 20</td>
<td>Mar 03, 2013 11:29 PM</td>
<td>18 / 20</td>
<td>+5%</td>
<td>90%</td>
</tr>
<tr>
<td>2310</td>
<td>Mill Control Panel</td>
<td>Mar 03, 2013 11:30 PM</td>
<td>12 / 13</td>
<td>Mar 03, 2013 11:32 PM</td>
<td>13 / 13</td>
<td>+8%</td>
<td>100%</td>
</tr>
<tr>
<td>2310</td>
<td>Machine Startup</td>
<td>Mar 03, 2013 11:34 PM</td>
<td>15 / 16</td>
<td>Mar 03, 2013 11:36 PM</td>
<td>14 / 16</td>
<td>-6%</td>
<td>88%</td>
</tr>
<tr>
<td>2310</td>
<td>Manual Operations</td>
<td>Mar 03, 2013 11:41 PM</td>
<td>8 / 14</td>
<td>Mar 03, 2013 11:44 PM</td>
<td>9 / 14</td>
<td>+7%</td>
<td>64%</td>
</tr>
<tr>
<td>2310</td>
<td>Job Setup</td>
<td>Mar 03, 2013 11:47 PM</td>
<td>9 / 10</td>
<td>Mar 03, 2013 11:48 PM</td>
<td>10 / 10</td>
<td>+10%</td>
<td>100%</td>
</tr>
<tr>
<td>2310</td>
<td>Editor</td>
<td>Mar 03, 2013 11:50 PM</td>
<td>14 / 17</td>
<td>Mar 03, 2013 11:51 PM</td>
<td>17 / 17</td>
<td>+18%</td>
<td>100%</td>
</tr>
<tr>
<td>2310</td>
<td>Program Entry</td>
<td>Mar 03, 2013 11:50 PM</td>
<td>7 / 9</td>
<td>Mar 03, 2013 11:53 PM</td>
<td>9 / 9</td>
<td>+22%</td>
<td>100%</td>
</tr>
<tr>
<td>2310</td>
<td>Program Run</td>
<td>Mar 03, 2013 11:54 PM</td>
<td>6 / 6</td>
<td>Mar 03, 2013 11:55 PM</td>
<td>6 / 6</td>
<td>+0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Track Student Progress

• Track Progress
Unique Certificate

• Branded to School: Time, date and serial identification

Basic Haas VF-Series Milling Machine Programming

Certificate of Completion

TTC Administrator

has successfully completed the online learning requirements established by:

Office of Tennessee Technology Centers
Tennessee Board of Regents
State University and Community College System of Tennessee

Online learning activities include:
- Interactive Exercises
- Chapter Tests
- Course Examinations
- M & G Code Programming Assignments with the Virtual CNC Emulator and Machines

Chapter Test and Course Examination Scores:
80% Editor
80% Job Setup
80% Machine Motion
100% Machine Startup
80% Manual Operations
80% Mill Control Panel
100% Program Entry
100% Program Run

Certified By: TTC Administrator
Organization: Tennessee Technology Centers

November 12, 2010
7800-2011-8007-78000000
ETTC7800

Mastercam seal included on Mastercam Certification
Total Training Solution

Customer Branded Training System

- Access at home, school and work
- Consolidates Industrial Product Training and Certification in ONE.

TRAIN
Virtual Training Environment

ASSESS
Skills Learning Modules
Pre/Post testing, exams, and reports

CERTIFY
Connect to Industry
Customer Branded Training System
True Virtual Machining Advantage

Streamline Process

Reduce Bottlenecks

Reduce uncertainty

Learn and Verify
M&G Code Program on PC.

Prove-out to Instructor

Save to Storage Device

Load on Machine Control

Powered by immerse2learn.com
January 2007

- Implemented Virtual Training System
- Prepared Student for Skills Competition without a machine.
- Used system to recruit, retain and train.
- Grew program from 7 to 20 students.
- Expanded curriculum to offer professional development to local mold and die shops.
- Students are recruited by local employers directly from high school
  - 2007- Learn CNC
  - 2011- Advanced CNC, mold and die
  - 2012- Mastercam

https://www.youtube.com/watch?feature=player_detailpage&v=35eURqBlNCk
Go Beyond the Classroom

• January 2009
  Implemented Virtual Training System

• Program grew from
  3 to over 35 students per semester.

• Used in Partnership with 5 high schools and
  instructors in college’s district.

• Serves over 100
  high school students per year.

• Enables high school students to earn 4 SWIC
  credit hours, free of charge!

• Building deep bench of CNC machining
  talent to compete in Skills USA competitions.

2011 National Skills USA Winners:
  - 3rd place Precision Machining Technology
  - 5th place CNC Machining
Using Immersive for NIMS Credentialing

LearnCNC will help Prepare students for the NIMS Credentialing Test And The performance Exams
Immerse2learn for NIMS

- Prepares students for NIMS Credentialing Test
- Measurement, Materials & Safety
- Job Planning, Benchwork & Layout
- CNC Turning: Programming Setup & Operations Level I&II
- CNC Milling: Programming Setup & Operations Level I&II
- CNC Lathe Operator
- CNC Mill Operator
NIMS Credential

• Materials, Measurement, and Safety

LearnCNC

Safety for Machining
Shop Mathematics Level I
Shop Mathematics Level II
Reading Manufacturing Blueprints
Precision Measurement
Speeds and and Feeds
NIMS Credential
CNC Lathe Operator

LearnCNC Modules

CNC Lathe Control (Old and New)
CNC Lathe Programming
Shop Mathematics I&II
Reading Manufacturing Blueprints
Speeds and Feeds
Precision Measurement
NIMS Credential
CNC Mill Operator

LearnCNC Modules

- CNC Mill Control (Old and New)
- CNC Mill Programming
- Shop Mathematics I & II
- Reading Manufacturing Blueprints
- Speeds and Feeds
- Precision Measurement
NIMS Credential

- Job Planning, Benchwork, & Layout

LearnCNC

Safety for Machining
Shop Mathematics Level I
Shop Mathematics Level II
Reading Manufacturing Blueprints
Precision Measurement
Speeds and and Feeds
NIMS Credential
CNC Lathe Programming and Setup
Levels I&II

LearnCNC Modules

CNC Lathe Control (Old and New)
CNC Lathe Programming
Shop Mathematics I&II
Reading Manufacturing Blueprints
Speeds and Feeds
Precision Measurement
NIMS Credential

CNC Mill Programming and Setup
Levels I&II

LearnCNC Modules

CNC Mill Control (Old and New)
CNC Mill Programming
Shop Mathematics I&II
Reading Manufacturing Blueprints
Speeds and Feeds
Precision Measurement