



Attributes of a well designed training course

I'll be the first to admit that training is a very subjective subject. There are many ways to get a point across and students can learn in a variety of learning environments. I'm amazed at how much a student can learn even under the most adverse conditions (I'm thinking about some of the in-plant training I've seen where a qualified CNC person that has no teaching experience is assigned to teach with a trainee with no CNC experience – it isn't a pretty sight).

This said, training experts would agree that a well structured training course should maximize the potential for successful learning. The key elements of the course should be considered during the planning stages of a course's development. And it doesn't just happen. A conscious effort must be made. Here are some important attributes of a well designed training course.

Course objectives must truly meet with students' needs – What you're teaching must match the student's needs. While this sounds like a basic statement, I'm amazed at how many people in the industry complain that students coming from their local technical school don't have the skills needed to begin working in industry. You must, of course, solicit the help of local industry to gain a firm understanding of real world needs. You must then develop a curriculum to match these needs. Too many instructors (including myself) find it too easy to "teach what we know". While this may be valuable information, what we know may not be all the student needs!

continued pg 2

Instructor Notes is published quarterly by CNC Concepts, Inc. and distributed free of charge to instructors that teach CNC courses. Simply contact us to begin your subscription!

PowerPoint Tips

Editor's note

Microsoft PowerPoint is fast becoming the software product of choice for professional presenters. Each issue of *Instructor Notes* will include PowerPoint Tips to help you improve your slide show development skills.

How do you create those great animations?

Many students attending my courses are curious about how I incorporate animations to show machine and tool movements. This is especially helpful when illustrating a program's execution, making a tool move from one position on the slide to another. Note that we do this quite often in the slide shows that come with our curriculums. It's really easy to do.

What is animating?

Think of a traditional cartoon animator (memories of watching Walt Disney's animators as a kid come into mind). The artist simply incorporates a subtle change in a character's position from one frame to the next. Each frame will incorporate this kind of change, and when many frames are quickly and sequentially displayed, it will appear to the viewer that the character is moving. The more frames played in a given amount of time (smaller changes from frame to frame), the smoother the animation will appear to the viewer.

You don't have to be a cartoonist to generate animations that look pretty good. PowerPoint has some features that help, and we'll offer three methods that should be relatively easy to understand and incorporate.

Moving an object frame to frame

Though it's not really animating, one way that works pretty well when you don't have much time is to simply make the object appear in a different position on the next slide. If I want to animate a tool's rapid movement into position, for example, I may start with the tool in the upper right hand corner of the slide. I'll copy the all objects on

the slide and paste them on the next (blank) slide. I'll then move the tool from its position in the upper right hand corner to its approach position. (I'll also use "wipe left" slide transition for the new slide to help with the illusion of movement.) As the slide show is displayed, the tool will appear in the upper right hand corner. In the very next slide it will be in its approach position, giving the illusion of movement.

Smoother movements

Getting a smoother animation requires a little more work. If, for example, you want to actually display the tool's movement along a path (as may be helpful with G01 or G02 movements), one way to do so is to create a series of slides that will be quickly displayed (you can set the advance slide time to zero so one slide will be displayed immediately after another). The moving object must appear in a different location on each successive slide. This can involve a lot of copy-paste-move actions, but the finished product will reflect the effort.

PowerPoint animation functions

Though I wish Microsoft supplied more animation functions, you do have a formidable supply of tools with which to work. I find the "fly from" (left, top, right, top-right, top-left, etc.) action to be quite helpful. With it, you can make an object (tool) fly from off the screen to its position on the slide. You can't control the motion rate (to my knowledge), meaning this works well only for simulating rapid approach movements.

Another great technique that minimizes the number of slides needed for an animation (and executes faster) is using the "flash once" action. Here's how it works. On the first slide, create all objects including the one that will be moving (the tool). Place the object to be moving in its original position. Copy all objects and paste them on the next .

PowerPoint Tips (continued from pg 1)

Reposition the moving object slightly (its first new position) and make it's animation attribute "flash once". Also set the order and timing for this object to "automatically" and time to zero seconds. Copy and paste the object repeatedly, placing the object in new positions successively closer to its ending position. The slide may appear rather cluttered, showing the moving object in many positions. For the last position of the object, make the object's animation action "appear".

When displaying the slide show, the object will appear stationary in its first position (starting point for the tool). As you transition to the next slide, the tool will "flash once" for all positions it is placed, giving the illusion of movement. In its last position, it will simply "appear", causing it to remain on the screen. It will look as if the tool is simply remaining at its ending position.

If you have more movements for the tool (throughout its tool path), you can repeat this technique. Admittedly, this takes some practice to master. But it's really not that tough to do, and doesn't take that long to do, and boy does it add pizzazz to your visuals!

One more point. If you are making the object (tool) move along a straight line, you can use the "duplicate" editing function (instead of copy and paste). When you duplicate an object for the first time and position it to its new position, successive duplication will cause the copied object to appear in incrementally changing positions along the straight line. This can save a lot of repositioning time.

Publicize your school

We maintain a **schools forum** on our website (www.cncci.com). It's free – and it's a great way to let potential students know about your CNC-related courses!

Simply fill in an online form that asks for some general information about your CNC courses, lab equipment, and degree information. About half the schools currently listed are using our CNC curriculums to help them teach CNC courses!

Attributes of... (continued from pg 1)

Material must begin just below the students' current level – Ideally, you should tailor the beginning of a training program to pick up at a level that most students already know. This way, you can carry students from what they know to what they don't know with a smooth transition. Admittedly, it can be difficult enough to accurately gauge every student's current level. But the closer you come, the easier it will be for students to catch on to your (extremely important) early presentation.

Course content must follow a logical and progressive flow – This is the building blocks approach. Each successive topic requires an understanding of previously presented information, yet pushes the student further and further toward complete understanding. There will likely be a "putting it all together" topic that draws from all presented material.

You must provide a light at the end of the tunnel – Students must know where they stand throughout the course, knowing what is involved with completing the course. A course outline is helpful for providing this information.

Course completion includes a fair and accurate way to gauge success – While the most basic goal of most students may be to get a good grade, remember that what we're doing in most CNC courses conducted in technical schools borders on industrial training. Many of the skills learned will be carried into CNC-using companies and students will apply what they've learned in the manner you teach them. And gauging their understanding of presented material may not be as easy as checking how well they do on exercises and tests. The best CNC training courses I've seen incorporate a great deal of hands-on practice and testing – and the greatest percentage of the student's grade is based upon how well they do in this area.

Again, work with local industry to get suggestions for testing students. Find out what they want students to know when they complete your course. Also ask them to help you spot the problem areas: What are the biggest causes of machine crashes? What causes the most scrap? What do entry level CNC

Please help us!

We've included a questionnaire with this issue that takes just a few minutes to complete. For doing so we're offering a 10% discount toward your next purchase.

(instructors only)

people struggle with the most? What would you like new employees to know that they currently don't? What attributes are you looking for in a new hire? If an employee doesn't work out, what caused the failure?

While these may sound like elementary questions, one way to ensure that local industry will hire graduates of your program is to provide the kind of training companies would provide for themselves if they had unlimited resources. Indeed, many of your current students may have been sent by local companies. You must think of them as your primary customers!

**Teach an Advanced CNC Course!****Maximizing CNC Utilization!**

You've probably taught many basic CNC courses. In fact, your school may have conducted *so many* basic courses that you're starting to run out of potential students. With this new curriculum, you'll be drawing from newly trained as well as highly experienced CNC people. You'll be connecting with a whole new target audience!

Eight Modules:

- ☆ Basic premises for improving utilization
- ☆ Review of basics
- ☆ Basic features w/ advanced implications
- ☆ Advanced features and concepts
- ☆ Parametric programming
- ☆ Setup time reduction
- ☆ Cycle time reduction
- ☆ Spindle probe programming

Each module is self-contained, meaning you can pick and choose those topics you wish to include in your advanced course!

Instructor materials on CD-rom disk: PowerPoint slide presentation (over 3,000 slides!), audio guidance, PowerPoint Viewer, instructors outline, and promotion materials.

Student manual is 650 pages long and supports all modules.

FREE with initial textbook order!

Purchase just 20 sets of student manuals (\$95.00 each, suggested retail: \$120.00) and receive the instructor's materials FREE!

Free samples in our web site:
(www.cncci.com)

Favorite analogies

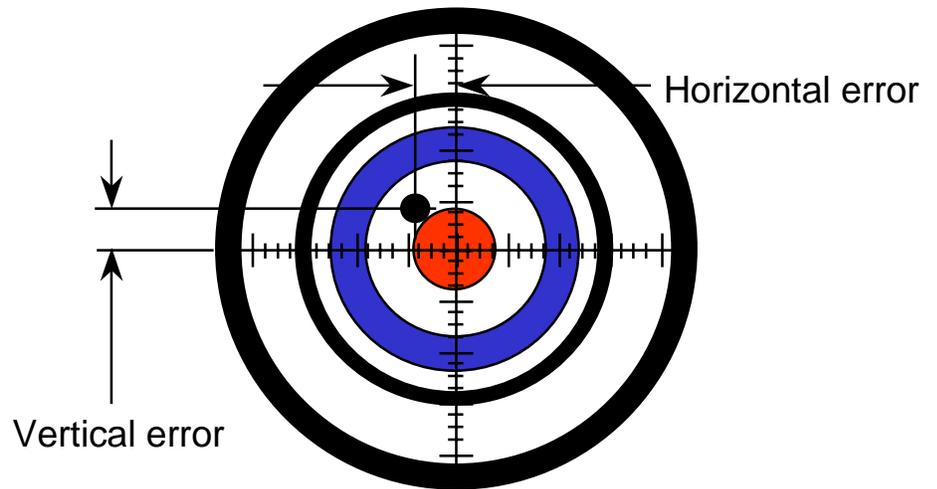
You can't have enough analogies in your basket of teaching tools. Analogies make it easier for students to understand complex topics by relating them to things that are familiar and easier-to-understand. In this discussion (which by the way, we'll be including in each issue of *Instructor Notes*), we'll be relating a few of my favorites. Note that these analogies are commonly incorporated right into the slide shows included with our curriculums.

Explaining CNC compensation types

You know that CNC machining centers have tool length compensation and cutter radius compensation. Turning centers have wear offsets and tool nose radius compensation. It can be difficult to explain how to take full advantage of these compensation types. I like to relate an analogy to help students to understand. It goes something like this. "You know that compensation is used in everyday life. An airplane pilot must compensate for wind as they set a heading. A race car driver must compensate for track conditions as they negotiate a turn. A marksman must compensate for the distance to the target before they can fire a shot.

"This marksman analogy is amazingly similar to what happens with CNC machine compensation. Let's take it a little further. Before they fire a shot, say the marksman judges the distance to the target to be fifty yards. Of course the quality of the sight adjustment will be based upon this judgment of distance. But even once they adjust the sight, the marksman won't know for sure that they have the sight perfectly adjusted until they fire the first shot. Once they do, they may find that the initial sight adjustment is wrong. Possibly they judged the distance incorrectly. Of possibly some other variable, like wind, is affecting the quality of the initial adjustment. Either way, it's likely that another adjustment will be necessary to fine tune the sight." Now I relate this to the various CNC compensation types.

"In similar fashion, a CNC setup person will do their best to make certain judgments and measurements. Then they'll enter these values into compensation offset registers. But until



the tool cuts a workpiece for the first time, they won't know for sure whether the initial offset setting is correct. They may have incorrectly performed the measurement, or some other variable, like tool pressure may be affecting the quality of the initial adjustment. Again, it's likely that further adjustment will be necessary after the tool cuts for the first time."

At this point, I'll give a specific example based upon the type of machine I'm teaching. I'm showing my example for turning center offsets, but you can easily modify it for any compensation type.

"A CNC turning center setup person will, for example, do their best to measure and enter the program zero assignment (geometry) offset values for a finish turning tool. Say the tool is machining a 2.000 plus or minus 0.001 inch diameter. The setup person won't know for sure that this tool will machine properly until the tool actually cuts for the first time. After it does, say the 2.000 diameter comes out to 2.0008 inch."

I like to ask at this point "What caused the deviation?". Of course the answer is tool pressure.

"In this case, the initial adjustment is not perfect. A second adjustment will be necessary if the setup person wants the tool machining the workpiece to the mean value of the tolerance band. The initial offset setting must be reduced by 0.0008 inch."

This also makes a great point to introduce trial machining. I'll continue,

saying something like:

"In the previous example, the workpiece happened to come out within its tolerance band. A good workpiece was machined. However, the smaller the tolerance band, the more unsure the setup person will be that the tool will machine within its tolerance band on the first try.

"When there is any doubt, the setup person can modify the initial adjustment in such a way that they ensure that the tool will machine with excess stock on its first try. Again, the size of the tolerance band will dictate when this is necessary. The smaller the tolerance band the more likely it will be to trial machine. After modifying the initial adjustment, the setup person will allow the tool to machine for the first time. The workpiece will, of course, have additional stock on the machined surface. The setup person will then measure the workpiece and adjust the initial setting based upon the current workpiece size. They will then rerun the tool. When the tool cuts the second time, the surface will be within its tolerance band."

Again, you can easily modify this specific example to pertain to tool length compensation and cutter radius compensation for machining center discussions.

What are your best analogies?

If you'd like to share a favorite analogy, just let us know and we'll publish it in a future issue of *Instructor Notes*!

CREATED & SUPPLIED BY
CNC Concepts, Inc.

CNC INSTRUCTORS!

Two curriculums to help
you teach CNC courses

1 **Machining Center Programming,
Setup, & Operation**

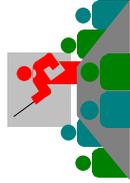
2 **Turning Center Programming,
Setup, & Operation**

Teaching CNC has never been so easy!

Our CNC curriculums give you a proven, easy to use, concise, yet comprehensive ready-made training program to minimize the preparation you must do to teach CNC courses. Right out of the box you get PowerPoint slide shows, audio guidance, written instructions, course outlines, textbooks, workbooks, final tests, and answer books — everything you need to effectively teach CNC courses for the two most popular types of CNC machine tools in existence today — and with a time-tested approach! We nearly eliminate the preparation you must do in order to teach!

"I bought into the key concepts approach right away. It really makes teaching easy — and students can easily follow my presentations..."

Scott McKenzie
Fullerton College



847.639.8847
www.cncci.com

They're FREE with textbook Order!

Not only will you be teaching with the best state-of-the-art CNC curriculums in the industry, you'll be doing so free of charge! All we ask is that your school bookstore buys textbooks/workbooks from us! With an initial order of just 20 sets of student materials for a given curriculum, we'll ship the instructor's materials for that curriculum free of charge! Textbooks are \$50.00 each — workbooks are \$14.95 each. Future orders can be in any quantity. This cost will be recovered, of course, as students enroll in your classes and buy textbooks. In essence, your first 20 students will be paying for the curriculum!

Who will benefit?

Instructors working for educational institutions will find our course curriculums especially easy to learn and implement. *Instructors working for manufacturing companies* will also find these curriculums very easy to instate. *Training consultants* will find that these course curriculums make it easy to teach CNC to their clients.

Proven Key Concepts approach

Most training experts agree that students learn best when they have a light at the end of the tunnel. The more complex the subject matter, the more important this point. With our curriculums, there are ten key concepts to CNC. The first six are programming-related and the last four are setup- and operation-related. Early in the course you can honestly say "if you can understand just ten basic ideas, you are well on your way to becoming proficient with CNC!"

Another benefit of our key concepts approach is that it lets you explain topics at a broad level — which helps your students get the big picture. With so many different CNC machine and control manufacturers, it's impossible to relate every detail of how each is handled. For this reason, students must have the ability to adapt what they learn to their own machines once they complete your course. In each key concept, you first stress the broad and general reasoning behind how CNC functions, showing students *why* they must do things just as importantly as *how* to do them. The same reasoning can be applied to any form of CNC machine tool.

Once the student understands this reasoning, you show them specific techniques needed to apply the key concept to the most popular CNC control in the industry, the *Fanuc* control (many controls claim to be Fanuc-compatible).

Programming key concepts

- 1 Know your machine (programming)
- 2 Prepare to write programs
- 3 Understand the motion types
- 4 Know the compensation types
- 5 Know how to format CNC programs
- 6 Special programming features

Setup & operation key concepts

- 7 Know your machine (operation)
- 8 Know the three modes of operation
- 9 Know the key operation procedures
- 10 Know how to safely verify programs

Lesson structure

The ten key concepts are divided further into lessons. (24 lessons in the machining center curriculum and 28 in the turning center curriculum). Lessons vary in length based upon complexity and content (from 10 minutes to about an hour). See back page for list of lessons.

Student materials

Student course materials are copyrighted and must be purchased directly from CNC Concepts, Inc.

Textbook - Our highly tutorial textbooks precisely follow the slide show presentations you will be making. Each is very detailed (over 275 pages) and provides students with a way to review what you present — during the course and long after the course is finished.

Workbook - including one exercise per lesson. Some of the lessons include programming activities

Instructor materials

While we do not completely eliminate the preparation you must do to get ready to teach, we really minimize it! All instructor materials are included on the CD-ROM disk/s. The machining center curriculum comes with two CD-ROM disks and the turning center curriculum comes with one. Written documentation includes instructions, course outline, answer book, final test and answers to final test. All written documentation is provided on the CD in Adobe Acrobat (PDF) format and can be printed. Adobe Acrobat reader is also provided.

CD-rom including PowerPoint presentations

- Over 7,200 slides in machining center curriculum
- Over 3,000 slides in turning center curriculum

Two sets of PowerPoint presentations are provided per curriculum, one with audio guidance and one without.

Fill in this questionnaire and get a 10% discount on your next order!

We're trying to learn more about you so we can provide/improve products to better suit your needs. And for helping us, we'll provide you with a discount toward your next purchase. Thank you for your help!

About you: (if you provide detailed contact information, we can provide you with product update notices and our free quarterly *Instructor Notes* newsletter.)

Name: _____

Title: _____

School: _____

Address: _____

Phone number: _____

Email: _____

YES! I'll take 10% off my next order!

Just mention this questionnaire as you place your order

Offers end 12/31/01

About how you keep up-to-date:

What trade journals do you read regularly?

Do you know of any trade journals specifically targeting industrial training? If so, what are they?

Do you read any magazines targeting training/presentation? If so, what are they?

What trade/education expositions are held in your area that you attend on a regular basis? What city are they in?

What seminars/conferences have you attended in the last two years? Who were they sponsored by?

About your CNC courses:

Name the titles of your CNC-related courses as they appear in you school's catalog.

Do you teach both CNC machining center and turning center courses? yes or no: _____

What is the total class time in hours for one of your CNC courses? _____

What textbook/s are you currently using for your CNC courses? Please include publisher.

What percentage of your school's CNC machines have Fanuc controls (or are Fanuc-compatible)? _____

How much time per week do you spend preparing to teach? _____

Do you completely develop the curriculums for the courses you teach? yes or no: _____

What percentage of time during a typical CNC course is spent during class on each of the following learning methods? (please total 100%)

_____ Lecture/presentation

_____ Hands-on practice

_____ Visuals (presentation graphics, videos, etc.)

_____ Self-paced learning (video courses, CD-roms etc.)

_____ Exercises and tests

_____ Other (name) _____

If you had unlimited resources, what would be your next purchase for your school's CNC training center?
