The third step to develop a CNC training course (step 1 is in issue 4, step 2 is in issue 5)

Look for variations to include in presentations

In basic CNC courses (or basic courses of just about any kind), most instructors are primarily concerned with presenting material that will bring a novice to a level that he or she can *begin* working in the area covered by the course (programming, setting up, and running CNC machines in our case). Indeed, topics being covered may be so complex that students may just be beginning to fully understand what's required to be proficient as the class is ending.

CNC students must understand, however, that the methods they are taught in a basic CNC course will probably not match what they must actually do when they begin working in industry. You may not, for example, have the most up-to-date equipment for practice. Or you may be so concerned with presenting *safe* methods that you cannot relate the most efficient methods. But most importantly, companies vary when it comes to what they expect of their CNC people. It is this area that we wish to address in this short article.

Three company types using CNC

While going beyond the basics may not be within the scope of your course, you should still prepare students for what to expect in industry. Point out that companies vary most in CNC usage based upon *company type*. ***Product producing companies*** get their revenue from the sale of a product. In a sense, profit is one step removed from manufacturing. Product

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.

Notes Pages make it easy to create great course handouts!

Past issues of *Instructor Notes* have stressed the importance of including effective handouts with your course materials. Students must have something to study during your course (possibly reading assignments) and even after the course is finished. The better your handout/s, the easier it will be for students to learn.

I've seen instructors that simply print the collection of slides in their presentation and use it as the course handout. While you can easily print up to nine slides per page, and while having slides may be better than nothing, the slides by themselves do not make for very effective handouts. It is unlikely that students will remember your presentation with just the slides to study. To print this kind of handout, in the FILE menu, choose PRINT. Under Print what:, choose Handouts. To the right of this selection you can choose how many slides you want to print per page.

PowerPoint allows presenters to include *notes* in presentations. These notes do not appear as you actually display the slide show – but when you print *Note Pages*, each slide (your graphics) will be printed at the top half of each page and any notes you've included on the slide will be printed at the bottom of the page. You're even allowed to structure the format for your handouts, including header, footer, page numbering, and several other features that will make your handouts more appealing.

Notes can be used for several purposes. Some instructors like to use them like note cards, including reminders about what they are to say during the presentation of each slide. They'll keep the notes pages handy while they teach, providing another way to help stay on track. Others instructors may keep track of changes made to presentations with notes.

Our suggestion is that you place notes in your presentations aimed at helping students. Think of each slide as like an illustration in a book. Your notes will be the text, explaining (like you do verbally during class) what's happening on each slide. When printed, these note pages will make an effective course handout. They will allow students to more easily recall what was presented during each slide (much better than the slide by itself). With this technique, you can actually rival the best instruction manuals!

Adding notes

Adding notes to your presentation is simple, and possible with any version of PowerPoint. With PowerPoint 2002, and when in the "normal view", there is a blank white window at the bottom of the display. The message "Click to add notes" will appear in this window. Simply click in this area to begin typing your notes for the current slide.

Viewing notes pages

To see the notes pages, from the View menu, click notes pages. You'll be shown the current slide with notes in the same format as they will appear when printed. By the way, you can also type or edit notes from this screen as well (it's actually easier to do so from this screen).

Saving changes

When you save the presentation, the notes you've typed will be automatically saved with each slide.

Printing notes pages

From File menu, choose Print, under Print what: choose Note Pages).

Getting fancy – adding headers, footers, and page numbers

You can even give your handout the look and feel of a true manual by structuring its format to your liking. Headers and footers can be created that will appear on every page of your handout. To do this, from the View menu, choose Header and Footer and then choose the Notes and Handouts tab. At the bottom of this pop-up menu, you can enter your header and footer, and check the box to include page numbers. When finished, select "Apply To All" to format all Notes Pages.

If you don't like the look of the "standard layout", this too can be changed. From the View menu, select Master, and then select Notes Master. This will bring up the Master Notes page. You can reselect fonts or move things around, and in general, change the appearance of handouts to suit your needs.

A warning about animations

Note that PowerPoint allows you to include all kinds of animations to spice up your presentations. If you use them, and if you intend to use Notes Pages as handouts, be careful not to let objects overlap each other during animations. While overlapping objects may look great during the presentation (while teaching), they will block out important information when printing notes pages.

View/print an example

We've included an example (one page) related to our Machining Center Programming, Setup, And Operation curriculum showing what can be done with notes pages. This example is on our web site (www.cncci.com) and can be downloaded from the *Instructor Notes* newsletter page. Click on the link to the right of this issue (Issue 6). End

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!

The 3rd step… *(continued from pg 1)* producing companies tend to break up the tasks related to CNC usage (one person to program, another to setup, another to run production, and possibly other people to provide other kinds of support). **Workpiece producing companies** (also called job-shops) get their revenue from the sale of component workpieces to product producing companies. These companies tend to have one person performing all tasks related to CNC usage. And **tooling producing companies** get their revenue from the sale of production tooling (jigs, fixtures, dies, molds, etc.) to product and workpiece producing companies. These companies tend to have one person do the programming and another do everything else.

What varies?

As you make presentations, be sure to point out that you are presenting material in a fashion that stresses safety, ease-of-use, and most importantly, *full comprehension.* You want students to fully understand how the various facets of CNC function. But in the real world, companies are most interested in productivity and efficiency. They may have found ways to minimize the effort required to utilize CNC machine tools. Here's but one example:

Program zero assignment

All CNC users must understand how program zero is assigned. With the most basic method (probably what you're teaching), the setup person must take measurements on the machine during setup to determine the distances between program zero and the machine's reference point.

I like to point out, however, that not all companies require that program zero be assigned during setup. Companies that make qualified setups and have a lot of repeated jobs (most commonly product producing companies) have found ways to eliminate the task of program zero assignment during setup. They include the program zero assignment *in the program.* While it is still very important that the setup person knows how measure the program zero assignment values (they'll probably have to do this with new jobs), they won't use the techniques you're teaching in every job. Frankly speaking, this is but one

example of the countless times when actual techniques used by companies will stray from what you're teaching.

The key concepts approach

This is the reason why you must stress the reasons *why* things are done as strongly as *how* they're done. The key concepts approach (used in our CNC curriculums) will help you relate general information first, stressing the reasons *why*, and then dig into details as deeply as you want. In the case of the program zero assignment example, our method would have you first relate what program zero is, how to determine its position, and why it is so important. When it comes to the specific task of program zero assignment, we'd ask you to relate something like, "The CNC machine must be told, by one means or another, where the program zero point is located. Program zero assignment marries the program to the setup. There are many ways to assign program zero. We show one way. Our goal is to provide you with one (crude) method that works. You must be prepared for variations". End

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 things to them that are familiar and easier-to-understand. In these discussions (which will be included in each issue of *Instructor Notes*), we will relate a few favorites. Note that these analogies are commonly incorporated right into the slide shows included with our curriculums.

Analogies to help you explain the advantage of the metric mode

While most companies in the United States work in the Inch system, I still like to make sure students understand the benefits of working in the Metric system with CNC machines. Yet this can be the source of great confusion. As I relate the benefits of using the Metric mode, many students tend to think I'm saying that the machine is more accurate when working in the Metric mode than when working in the Inch mode. While the Metric mode does make it easier to hold tighter tolerances than does the Inch mode, the machine itself is equally accurate (and repeatable) in either mode.

To relieve this confusion, I'll begin by saying the benefit of the Metric mode has to do with the least programmable increment. With most machines, the
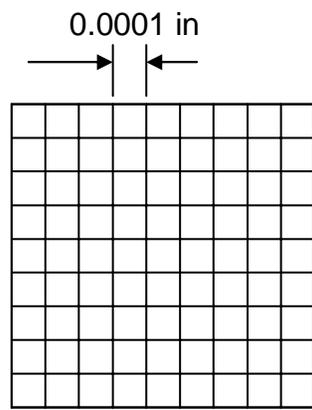
0.0001 in

Resolution of inch mode
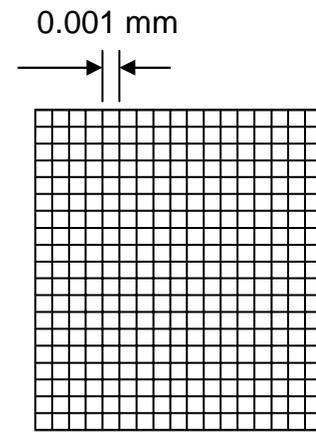
0.001 mm

Resolution of metric mode

The Metric Mode has a much finder resolution than the Inch mode.

least programmable increment in the Inch mode is 0.0001 inch. In the metric mode, the least programmable increment is 0.001 millimeter. I point out that 0.001 millimeter is less than half of 0.0001 inch. (Actually 0.001 millimeters is equal to 0.000039 inch.) This gives the Metric mode a much better *resolution* than the Inch mode. I'll give two analogies to help stress the point.

First, I'll say "Think of it this way. A ten inch long linear axis has one hundred-thousand (100,000) programmable positions in the Inch mode. While this is very good, the same ten inch linear axis has over two-hundred-fifty-four thousand (254,000) programmable positions in the metric mode! So the metric mode has over 2.5 times the number of programmable positions!"

Second, "This doesn't make the Metric mode any more accurate than the Inch mode. Consider a one-degree indexer and a 5-degree indexer. The one-degree indexer has 360 index positions while the 5-degree indexer has but 72 positions. This doesn't make the one-degree indexer any more accurate than the five-degree indexer. The one-degree indexer simply has more index positions. When you think about it, using the Inch mode when the Metric mode is available is kind of like having a one-degree indexer but only utilizing every 2.5 degrees."

I'll also point out that this benefit has the most impact in two areas. Both have to do with close tolerance work. I'll be quick to point out that if tolerances are wide open, it truly doesn't matter which measurement system mode is used.
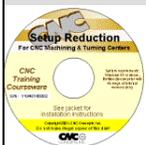
First, using the Metric mode (even when prints are dimensioned in Inch) will commonly make it possible to program a value closer to the mean value of a tolerance band. Consider a dimension and tolerance (in inch) of 3.0001 +0.0005, -0.0004. The mean value is 3.00015. In the inch mode, this value must be rounded to 3.0001 or 3.0002 (rounding by 0.00005 in). But in the metric mode, the mean value (3.00015 in inch) can be specified as 76.204 mm, which is within 0.0002 mm (0.00000078 inch) of the actual mean value.

Second, and more importantly, offset adjustments can be made in smaller increments. A 0.001 inch overall tolerance will have less than ten offset setting positions in the Inch mode. The same 0.001 tolerance will have twenty-five offset setting positions in the Metric mode. And by the way, each setting increment in the inch mode is 10% of the tolerance band! In the metric mode each setting increment is less than 5% of the tolerance band.

Admittedly, most programmers simply program using the mode that all (or most) prints are dimensioned. But even novice programmers should be acquainted with the benefits of the Metric mode. End

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!*

Instructor Notes Newsletter Enclosed!

Tips for teaching CNC courses from CNC Concepts, Inc.

Machining Center Course!

CNC Instructors!

If you're using one of our proven curriculums to teach CNC machine tool usage, be sure your students know that your course is also available on a reasonably priced CD-rom disk. They'll already have the manual and workbook, so they'll only have to purchase the courseware ($149.00 for six hour presentation).

As a CNC instructor, *you* may want to make this courseware available for students that miss a lesson or want to review material you present.

Do you feel at all weak in your CNC skills?
With our CNC curriculums, we provide audio guidance for each lesson to help instructors know how to present our courses. This is sufficient for instructors that are quite familiar

see below

New computer based training course! CD-ROM disk: over 6 hours!

CNC Machining Center Programming, Setup, and Operation

Affordable courseware for CNC machining centers!

A very popular CNC machine type!
CNC machining centers are among the most popular types of CNC machine tools. Most companies that have any CNC machines have at least one. Unfortunately, companies are finding it more and more difficult to find and hire qualified CNC people. Many are realizing that they must provide extensive training to new hires and provide at least some continuing training to established employees.

A proven method
This affordable courseware makes it possible to train CNC people from scratch. While we assume the student has some basic machining practice experience, we assume nothing about their previous CNC skills. Using our proven *key concepts approach*, we bring students up to speed gradually – constantly building upon previously presented information – and we stress the reasons *why* things are done as importantly as *how* they're done. Six of the ten key concepts are most related to programming, and four are related to setup and operation.

24 lessons!
We further divide the key concepts into twenty-four lessons. Lessons range from under five minutes to just over twenty minutes in length (total course presentation time is just over six hours on one CD-rom).

The most popular control!
All examples are shown in the format for the most popular control in the industry – the Fanuc control. Note that many control manufacturers claim to be Fanuc-compatible.

What you get!
The CD-rom disk is jam-packed with over six hours of information about CNC machining centers. By itself, it makes formidable training tool. It's price is $149.00.

When purchased with the workbook answer combination ($30.00), you'll be able to confirm that you truly understand the material (24 exercises, one for each lesson).

When purchased with the optional student manual ($60.00), you'll have a way to easily review information after you finish the course.

If all items are purchased (total: $239.00), we include a one-year subscription to our newsletter, The Optional Stop.

The price for unlimited training? … $149.00 (courseware only)
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Contact CNC Concepts, Inc. (847-639-8847) to order!

New computer based training course! CD-ROM disk: 5.8 hours!

CNC Turning Center Programming, Setup, and Operation

Affordable courseware for CNC turning centers!

A very popular CNC machine type!
CNC turning centers are among the most popular types of CNC machine tools. Most companies that have any CNC machines have at least one. Unfortunately, companies are finding it more and more difficult to find and hire qualified CNC people. Many are realizing that they must provide extensive training to new hires and provide at least some continuing training to established employees.

A proven method
This affordable courseware makes it possible to train CNC people from scratch. While we assume the student has some basic machining practice experience, we assume nothing about their previous CNC skills. Using our proven *key concepts approach*, we bring students up to speed gradually – constantly building upon previously presented information – and we stress the reasons *why* things are done as importantly as *how* they're done. Six of the ten key concepts are most related to programming, and four are related to setup and operation.

28 lessons!
We further divide the key concepts into twenty-eight lessons. Lessons range from under five minutes to just over twenty minutes in length (total course presentation time is five hours fifty-two minutes on one CD-rom).

The most popular control!
All examples are shown in the format for the most popular control in the industry – the Fanuc control. Note that many control manufacturers claim to be Fanuc-compatible.

What you get!
The CD-rom disk is jam-packed with 5 hours, 52 minutes of information about CNC turning centers. By itself, it makes formidable training tool. It's price is $149.00.

When purchased with the workbook answer combination ($30.00), you'll be able to confirm that you truly understand the material (28 exercises, one for each lesson).

When purchased with the optional student manual ($60.00), you'll have a way to easily review information after you finish the course.

If all items are purchased, we include a one-year subscription to our newsletter, The Optional Stop.

The price for unlimited training? … $149.00 (courseware only)
Companion manual: $60.00, workbook/answer combination: $30.00

Turning Center Course!

with CNC. For those instructors that may feel a little weak with their CNC skills, or for those who may be trying to teach a different machine type, these concise courses let you bone up on subject matter as quickly as possible.

Each course follows its companion curriculum to the letter (ten key concepts, number of lessons, presentation method, graphics, etc). In fact, we use the same manual and workbook in the courseware that you use with our curriculums! So if you're already using our curriculums, all you need is the courseware.