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Effective Training Inc., Westland MI, 800.886.0909

Volume 02: Issue 1



Known as the "Doctor of Dimensioning," [Alex Krulikowski](#) is a noted educator, author, and expert on Geometric Dimensioning and Tolerancing (GD&T). He has more than 30 years of industrial experience putting GD&T to practical use on the shop floor.

Alex has taught GD&T to tens of thousands through his workshops and seminars, and to countless others through his books, self-study courses, videos, and computer-based training programs.

ETI Mail is a regular online publication devoted to Geometric Dimensioning & Tolerancing. Each edition features a host of GD&T resources and links, as well as dimensioning tips by noted GD&T author and ETI founder, Alex Krulikowski. We also invite you to visit our website, [etinews.com](#). To view past issues of ETI Mail, see the [archives](#).

ETI Mail is now available in [PDF format](#). To read the PDF file, you will need [Adobe Acrobat Reader](#).

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A Tale of Two Cultures: Rewarding Skills That Enhance Job Performance

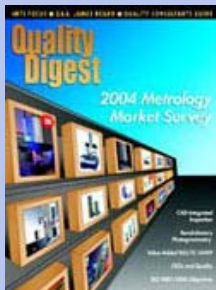
[Alex Krulikowski](#)

Companies whose employees have GD&T skills produce better designs for their customers. Some U.S. companies may need to follow the example of a different culture's perspective.

Last fall, I was teaching a GD&T fundamentals course to a group of designers, engineers, and quality employees at a well-known company in the United States. I was hired to teach geometric tolerancing because they were having difficulty with drawing quality and wanted to ensure that their employees understood GD&T on the drawings. I was excited about teaching the class, because I knew that I could help this company.

GD&T training could help this company in two ways: first, by reducing the number of drawing errors made in engineering, which is the least expensive place to fix the errors. The second benefit of GD&T training is that it would help reduce drawing interpretation errors when the drawing is released from engineering, which is where an interpretation error costs the most. Figure one shows how much impact these drawing errors have on an organization.

Web Highlights



CAD-Integrated Inspection Planning

Ken Woodbine discusses the need for a paperless methodology that will

move inspection plan information from the design environment to the final inspection device in this September 2004 *Quality Digest*.

To read the article, [click here](#).



Quality Digest is a monthly publication that presents all facets of quality, including metrology, Six Sigma, TQM, inspection, testing, SPC, software and international standards.

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New at ETI

ETI Brings Hands-on GD&T Training to You

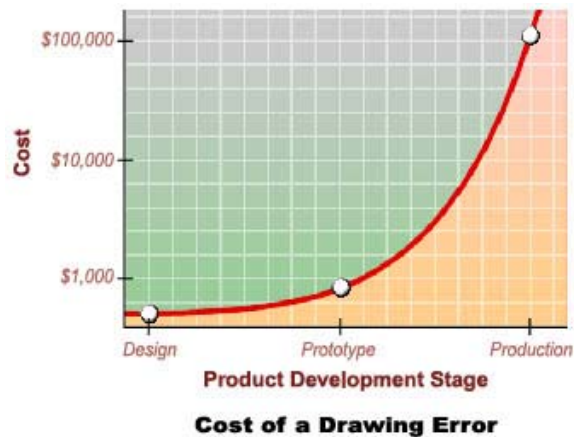


Public Workshops Available Throughout the U.S.

ETI's 2005 public workshop series brings GD&T fundamentals, tolerance stacks and solid model tolerancing workshops to a city near you.

[ASME Y14.41 - 2003 GD&T Fundamentals Fundamentals Overview](#)

Dimensiones y Tolerancias Geometricas La Ultima Guia Del Bolsillo



The management seemed excited about the impact GD&T training would have on their organization. However, on the day I began teaching the class, I found that several of the students hadn't even known that they were attending the class until the day before it began. (This is not the first time I've experienced this.) I passed out the materials and we started the activities.

It was a three-day class, and the class format included a pretest before the instruction and a post-test afterwards. This pretest class average was 19.5, which was unusually low. The average pretest score is often around 30-35% for companies using GD&T. Although the average results were low, there were a few students that were in the 30-50% range.

The second day of the class was pretty typical. Some of the students were trying hard to learn as much as they could, while other students were attending but not working very hard to learn.

On the third day, most of the students seemed to be enjoying the hands-on practice. Some of the students were grasping the GD&T concepts well. However, some of the students didn't grasp the importance of GD&T and standards and didn't take the opportunity to learn as much as they could. Other students were nonchalant about the need to learn GD&T.

One student in particular seemed far ahead of the pack. He was a young engineer that had been with the company for about a year. I'll call him Mark. Mark scored the highest in the class on the pretest, with a score that was over double the class average. Mark also made many insightful comments during the class. His questions demonstrated that he understood the material and was trying to figure out how to apply the new concepts on the projects he was involved in. Because of his high pretest score and class participation, I thought Mark might be one of those exceptional students who would score in the high 90's in his post-test.

Midmorning, another employee came into the room and talked quietly to Mark. Mark then left the room with him. I assumed there was some question that Mark was needed to answer relative to his job and that he would return shortly. Sometime in the late afternoon I became curious about Mark. His class materials were still on the table in front of his empty chair and he had not returned. I also sensed that the students seemed a little distracted.

Finally, my curiosity got the best of me and I asked the class, "Has anyone seen Mark? We're getting close to the end of the class, and I'm just wondering if Mark will be back in time for the post-test?"

One student hesitantly remarked, "There was a work force reduction today, and Mark was laid off."

I didn't say anything. What could I say? I just kept thinking that this wasn't right. How could the employee with the most advanced GD&T skills-this young engineer with the highest quiz scores, who had mastered concepts easily, and who seemed to be the most promising in the group-be one of the employees being laid off by the company? It was frustrating to witness this obviously talented employee lose his place in the organization.

Many thoughts were racing through my head, one I recall is that they just laid off the person who could help them the most. I don't know what criteria they used for the head count reduction, but, Mark had the skills (or potential to gain them) that were sorely lacking in this company.

It appeared to me that employee skills were not highly regarded in that company or by many of the employees, and this problem is far too common in many companies I visit. Based on my experiences this is representative of the U.S. industrial culture. Many companies do not reward



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those who learn the skills needed to do a good job, and many employees only care to learn enough to get by. I don't mean to say that all students in my classes are not giving their best effort, but a significant number of them - enough to notice - only want to learn enough to get by.

A different approach

Now, let me describe a similar event that happened just a few months later. A good friend of mine was teaching GD&T tolerance stacks for an engineering contract shop in India. He told me the following story about his experience with the class, the culture and the company.

The students were excited about learning the new skills. The class was very attentive and everyone seemed to work hard. The company had passed out the books a day early so the students could take them home and study before the class the next day.

The first day, the students came to class prepared and we were able to cover the material at a good pace. They were eager learners and wanted to gain as much knowledge as possible.

The second day went equally as well, I never had so many good questions from a group.

On the third day of the workshop, a final exam was given. It consisted of doing a series of tolerance stacks. Upon completion of the exam, the students were very anxious to learn the results. I corrected the exams in class and gave each student his or her score on a piece of paper. I announced what the highest score was from the group and the students were anxious to know who had achieved it. I told everyone that the person with the highest score was Raj, and they immediately went to him and began shaking his hand and congratulating him.

This wasn't the end of the recognition for Raj. When a tolerance stack job was received in the department, it immediately went to him. When Raj's capacity to do stacks was full, the jobs went to the person from the class with the next highest score. The company valued and rewarded the skills of the employees.

The company also benefited because they produced better designs for their customers which translates into more business. By encouraging the skills, the company became more capable and competitive and was able to prosper.

Compare the value placed on learning skills in these cases

The contrast between how training was valued in India compared to the United States was remarkable. In our country, Mark's skills were not an important factor; in fact, he was laid off. In India, Raj's management acknowledged the brightest and most highly skilled employee and immediately rewarded him for his accomplishments. Even Raj's coworkers gave praise and acknowledged his accomplishments.

Organizations in the United States strive to save money and cut costs. One of the ways they attempt to do this is through reducing head count. In my opinion, reducing the employee payroll in the manner I witnessed is a simplistic measure that won't save in the long run, especially when the most skilled employees are part of the cut.

Real cost-savings result when a product is produced economically and efficiently. Designing a quality product requires skilled workers and the consistent use of standards.

Company management should reinforce and reward the efforts of employees who excel in company-sponsored training programs and who display skills that will enhance job performance.

Does your management value employee skills?

The real test to determine if skills are valued in your organization is to look at your compensation system. A good compensation system will serve three main objectives:

1. Employee procurement and retention
2. Consistency in application of the system
3. Reinforcement of positive behaviors

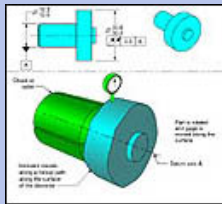
Figure 2 shows a list of questions that will help reveal if your management values employee training and skills.

How to Know If Your Company Values



GD&T Training Made Easy

The GD&T Trainer Professional Edition (Y14.5M-1994) contains 28 student-focused lessons covering the fundamentals of GD&T. Instant lesson feedback and quizzes reinforce the material.



[Click for animation sample](#)

Highlights include a GD&T glossary, tolerancing application and inspection examples, audio narration, full-color technical animations, 3-D solid part examples, and a certification exam.

To read more about it, [Click here](#)

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GD&T Advanced Concepts taught by the experts. . .



Advanced Concepts of GD&T Textbook

Employee Training & Skills

Does your company's management encourage and value employee training and skills? Here are some indications:

1. Is there a published list of required job skills necessary for each position?
2. Are the required job skills part of the employee performance evaluation?
3. Do employees have training opportunities available to them each year?
4. Does the training supplied by your company produce a way to measure the employee skill level?
5. Does the compensation system recognize employees who learn and apply new skills?
6. Are high levels of skill attainment recognized or rewarded?

Are you preparing yourself to be the best you can be?

Even if your management doesn't value training as much as it could, there are several reasons why you should. From a personal standpoint, there is a message here. As engineering jobs become more competitive, your skills will be an important factor in helping you to have a promising career. Don't wait for external rewards from your management, they may not come. Think about your future and strive to become more competitive. As good jobs become scarcer, your skills will be an important asset.

Whenever you attend training of any nature, answer the questions in the chart in Figure 3. This will help you to understand the value of the training and help to apply the training to your job.

Using Training and Skills to Become the Best You Can Be

Understanding the value of training will help you apply the training to your job and better utilize your potential.

What specific new concepts did I learn from this class?

- 1.
- 2.
- 3.
- 4.

How can I put these new concepts to use on my job?

- 1.
- 2.
- 3.
- 4.

What concepts need additional study after the class?

- 1.
- 2.
- 3.
- 4.

What is my study plan?

- 1.
- 2.
- 3.
- 4.

The rest of the story...

I have since heard from Mark. He is working at another automotive supplier and doing well. He is using and expanding his GD&T skills and believes that knowing GD&T is important to his job. I'm

The textbook stresses the application of GD&T in industry and takes an in-depth look at many GD&T topics. Position, profile, and datums are covered in detail. Covers common industry tolerancing practices not documented in ASME Y14.5M-1994. An indispensable on-the-job reference.

To read more about it, [Click here](#)

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Knowledge of stacks separates the exceptional engineers from the rest



Learn Tolerance Stacks With On-The-Job Focus

Our stacks textbook stresses applications found in actual industrial situations. Solve tolerance stack problems involving flatness, straightness, tolerance of position, runout, concentricity, and more. Practice stacks are from actual drawings and provided in the Drawing Package.

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Teaching GD&T has never been easier: Digital kits put course materials on CD-ROM

Digital Instructors' Kits from ETI

ETI now offers all of our instructor's materials in a convenient digital format.

certain that he'll use his skills well and that he'll be an excellent addition to his new company.

Alex has developed a complete training program with courses that include GD&T fundamentals, advanced concepts, and tolerance stacks, statistical stacks, and solid model tolerancing. For more information about these onsite workshops, [click here](#).

New in 2005: ETI provides public workshops around the country. The workshops include GD&T fundamentals and stacks, and the new ASME Y14.41 Standard on Solid Model Tolerancing. See the complete list and information about these hands-on workshops [here](#).

We welcome your feedback. Send comments about this article to [ETIemailbag](#). Your opinions will be posted in the next issue.

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Standards in the News

ETI Email's Standards in the News takes a look at real-life issues involving standards. This month: *lack of standards slow up technological advancements.*



InfoWorld LEAD WITH KNOWLEDGE

Excerpt from the infoworld.com website

LACK OF STANDARDS HINDERS ELECTRONIC HEALTH RECORDS

This issue of Standards in the News features an article by Grant Gross about the problems in the development of an electronic health records system.

The health care industry needs to use IT better, but many doctors and hospitals are concerned about implementing technology such as electronic health records without interoperability standards in place, members of a new U.S. government task force focusing on health IT said Monday.

While some large hospitals and medical practices have moved to electronic health records, many other hospitals and doctors fear that electronic health record software they buy now might not work with standards eventually adopted by the health care industry or the government, said Dr. Mark Leavitt, medical director of the Healthcare Information Management Systems Society. Without widespread adoption, the cost of electronic health record technology remains high, and smaller hospitals and practices are hesitant to use the technology until the cost goes down and the industry has interoperability standards, he added.

[Full story](#)

Excerpt is from the article, "Lack of Standards Hinders Electronic Health Records," by Grant Gross, IDG News Service, in the January 10, 2005, issue of [InfoWorld](#) online. Copyright © 2005, IDG Network

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ETI offers convenient, customized, onsite workshops in a variety of GD&T-related topics.



The ETI Mailbag

Alex,

We have been having some discussion at my company about reporting GD&T readings related to profile of a surface. The feature is bilateral, so we understand the concept of an evenly spaced tolerance band across the surface of the part. Readings are being taken in the following scenario: profile of a surface should be .02 (bilateral), so .01 on each side of nominal, readings are taken with varied results from +.008 to -.005. Here is the question: should the results be reported as .016 (doubling the largest reading and keeping the band bilateral), or should it be reported as .013 the maximum range?

JoAnne P.

To check a surface toleranced with profile, I recommend using a measurement plan. One aspect of the measurement plan is to document a set of points to be measured for the profile specification. The number of points will vary based on the area and importance of the surface. This way each inspector (at any location) will be measuring and reporting on the same surface points. The inspection report should document two parameters of the profile specification.

The variation from the true profile for each point should be reported (i.e. Point xx= +.008, Point xx = -.005, etc.) and final designation should be made on part acceptance based on the fact that the maximum variation of any point cannot exceed the profile tolerance zone. Then anyone from engineering, manufacturing, etc. will be able to understand and interpret the data.

Best Regards
Alex Krulikowski



I have a query about inspection of total runout of any shaft.--- [Can you explain] how to inspect total runout on OD of a shaft? Which instrument is to be used? We can use a dial & bench center for circular runout, but [please explain] how to inspect total runout and how to move a dial simultaneously along the shaft. Please guide me.

Walve Nandkumar

First of all, total runout is a very difficult and expensive control to inspect. It should not be specified very often on drawings. With that being said, here are some suggestions on how to inspect total runout.

Often, a special gage is built that has three elements:

1. a set of gage features to hold the part to establish a datum axis
2. a stand to hold a dial indicator (and translate along the part surface)
3. a mechanism to correlate the rotation of the part and the translation of the dial indicator

As far as checking total runout with open inspection tools and methods, I believe it is very difficult (maybe impossible) to do a credible job. A setup could be created with various inspection equipment, but I am not familiar with how this would be accomplished. Perhaps one of the readers of this newsletter has some expertise they can share with us. If so, I will publish the information in a future issue.

I am under the impression that a CMM could be used to inspect total runout, but I am not familiar with the methods used. Again, if a reader has some information, please write to ETI Mailbag and I will publish the techniques in a future issue.



ETI Offers On-Site Training

Effective Training brings hands-on GD&T instruction right to your location. Workshops can be customized to include your drawings and parts.

[ASME Y14.41 - 2003 GD&T Fundamentals](#)
[Fundamentals Overview](#)
[GD&T Advanced Concepts](#)
[Tolerance Stacks](#)
[ASME-ISO Comparison](#)
[Statistical Tolerance Stacks](#)

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New Fundamentals of GD&T Class at the ETI Learning Center.



GD&T Web-Based Training Available

The [ETI Learning Center](#) brings GD&T training to your doorstep. Register now for the [GM Addendum](#).

Coming soon! Fundamentals of GD&T Web-Based Training

This new course will be available in the 2nd quarter, 2005. Call 800-886-0909 today to discuss the benefits that the new GD&T fundamentals web-based training can offer your organization.

To find out more about the ETI Learning Center, [Click here](#)

ETI's Discussion Board: Talk about GD&T issues with

I wish I had more insights to offer, but total runout is not a very common specification, and I have not had a lot of exposure to the inspection methods other seeing dedicated gages built for specific applications.



ETI appreciates your questions and comments.
 Send your GD&T questions to: [ETIemailbag](#).

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Alex's Tech Tip

From teaching ideas to new products that will assist you in training or on the job, the ETI Email Tech Tip will keep you informed about new technology and training trends. This month's Tech Tip: a wealth of resources online.

TAPPING INTO ONLINE RESOURCES

The Internet's potential as a resource for any and all topics is amazing. More and more sites and e-zines pop up every day. This issue of ETI Email takes a look at two valuable sources for industry-related news.



Engineeringtalk.com

The Engineeringtalk email newsletter is a place where Product Design and Automation Engineers can find information from manufacturers and distributors. Based in the U.K., the site adds more news from suppliers all over the world as soon as it's announced. News can be browsed by date, manufacturer, and product category.

According to editor Chris Rand, "At this moment we have 27942 news releases from 3067 suppliers - that's the equivalent content of a huge pile of over 399 magazines. We hope the website will help you find whatever you're looking for!"

Visit [Engineeringtalk.com](#)



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This helpful site is geared towards CAD, CAM, and CAE professionals. The Tenlinks site has organized lots and lots of information into directories that cover products, services, articles, and resources for the technical community. Tenlinks also publishes press releases of current events.

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other peers and professionals.

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Fundamentals of GD&T Textbook 20
The GD&T Trainer (5) 3D&T Trainer Discussion Area - Includes Ink Updates, etc.
Geometric Dimensioning and Tolerancing
Prior GD&T Questions This Discussion Group contains questions the small mail, etc.
ASME Y14.5M Discussion Group for questions/comments on referenced in the ASME Y14.5M standard.
Tolerance Analysis

ETI'S Discussion Board

ETI's website has an interactive forum that's easy to access and may give you a broader knowledge of GD&T-related topics.

To visit the board, [click here](#).

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Quality Quote



Almost all quality improvement comes via simplification of design, manufacturing, layout, processes, and procedures.

— Tom Peters

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many other 3D CAD sites.

[FreeCAD.com](#) - Offers CAD, CAM and CAE programs available for download.

[Upfrontezine.com](#) - Provides information for the computer-aided design industry.

If you know about a new tech tool or an innovative idea that would aid our readers, please write us: [ETIemailbag](#).

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ETIemail Feedback

Have comments about anything you've read in ETIemail? ETI will post your comments here and provide a forum for more discussion about GD&T topics.

ETI Mailbag feedback:

In your last news letter volume 1, issue 12 you responded to Joe Jackson's question in answer 3 by referring to figure 4-11 and 4-13 as examples for a centerline plane. Correct me if I'm wrong, but doesn't figure 4-11 refer to a datum axis, which represents a centerline and its true counterpart is cylindrical instead of two planes.

Thanks!

Art Kietlinski
Industrial Measurement Tech II

Yes, you are correct. Figure 4-11 is a figure involving a diameter and an axis. I should have stated figure 4-13 & figure 4-14.

Thank you for bringing this to my attention. I'm glad to know you read ETIemail very thoroughly!

Alex



Subscriber comments:

The questions posed by readers are very interesting and a great way to be updated and refreshed in the world of GD&T.

— Kenneth R.

Thanks to ETIemail for spreading knowledge of GD&T and opening our eyes.
— Walve Nandkumar

I just receive a course about GD&T with Alex and I was very impressed about the subject. I would like to receive articles about it.
— Antonio Rodriguez

Thanks for your work, GD&T should be required training for all DRE's.
— William Force



ETI would like to hear from you. If you have an opinion about any ETIemail article or feature, please write to our [ETIemailbag](#).

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