etimail

Send ETImail to a friend

EffectiveTraining Inc., Westland MI, 734.728.0909 **Volume 01: Issue 8**

Known as the "Doctor of Dimensioning," Alex Krulikowski is a noted educator, author, and expert on Geometric Dimensioning and Tolerancing (GD&T). A design manager with one of the world's largest manufacturing corporations, he has more than 30 years of industrial experience putting GD&T to practical use on the shop floor.

Web Highlights

mfg.onLine

Musings on Datums
Datum referencing in design and CMM practice is mainly simple, but special cases, and rules for handling them, continue to proliferate and complicate the practice and teaching of GD&T.

Herb Voelcker looks at a different way of thinking about datums in this issue of mfg.onLine.

To read the article, Click here

Back to top

ETImail *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 ETImail, see the archives.*

ETImail is now available in PDF format. To read the PDF file, you will need Adobe Acrobat Reader.

In This Issue

Here are this issue's highlights. Click on any link to jump directly to a feature:

The Tao of Tolerancing
Part IV: How to Lift Your Organization from Tolerancing Hell to Tolerancing Heaven

Alex Krulikowski

This five-part article covers my experiences, thoughts, and beliefs on tolerancing. It is based on observing how many organizations around the world currently handle tolerancing and how I believe tolerancing can be handled in a far more successful way in industry. I believe that using the tolerancing methods discussed in this article can save as much as 30% of part costs.

The first part of this article covered nominal thinking. Part 2 discussed how to specify datums and dimensional relationships for all part features. Part 3 explained how to establish meaningful tolerance values for each dimensional relationship on a part.

In this issue of ETImail, I outline a plan on how to lift your organization from Tolerancing Hell to Tolerancing Heaven. The next issue of ETImail will carry the fifth and final part of this article: a review and summarization of all of the Tao Tolerancing Principles covered in Parts One through Four.

An explanation of the title of this article: Tao (pronounced "dou" or "tou") means "the path" or "the way." Tao is an ancient Chinese religious belief and contains a philosophical aspect that can be applied to how we specify tolerances in industry. A tolerance is simply "the allowable variation for a part feature," so this article is an enlightenment of a philosophical approach to assigning tolerances to part features.

Introduction

In part three of this article, we learned how important it is to have dimensional relationships communicate the functional requirements of a part. In this part, we will see how we can lift our organization from Tolerancing Hell to Tolerancing Heaven. Tolerancing a part (component) is like a religion; it is a result of one's beliefs. Our core beliefs guide our daily decisions.

What is Tolerancing Heaven?

One cannot see Tolerancing Heaven; it is a state of being. When an organization is in Tolerancing Heaven, the following conditions are often present:

- Drawing quality is high and everyone in the organization understands how to read drawings and interpret GD&T correctly.
- The focus of the organization is to produce a product that meets or exceeds the customer needs.
- Manufacturing and engineering are working together towards common goals.
- Product launches run smoothly because all of the problems have been addressed in the design stage.
- Warranty and manufacturing costs are at their record lows.
- Sales and profits are at record highs

Companies can achieve one or two of these conditions for a short period of time. The difference is that, when tolerancing heaven is achieved, most of these conditions can occur simultaneously and for a sustained period. It may sound too good to be true, but it can be done.

Tolerancing heaven for an individual is different than for an organization. For an individual it has three characteristics:

- A high degree of tolerancing skills
- A high degree of confidence in applying those skills
- The kind of high self-esteem that comes from active contribution to product excellence

Why Tolerancing Heaven is difficult to achieve

Tolerancing Heaven is difficult to achieve for an individual because it takes a lot of work. Not many individuals are willing to make the investment. Tolerancing Heaven is even more difficult to achieve for an organization, because the importance of tolerancing to the organization is not well understood. Consequently, proper tolerancing does not receive much encouragement or management support.

There are three critical organizational issues blocking the path to tolerance heaven:

- The relationship of managing part variation to the bottom line is not well comprehended.
- The tolerancing philosophy in most organizations is inconsistent.
- The industrial culture rewards being fast over being correct.

One major issue is that the relationship of managing part variation to the bottom line is not well comprehended. GD&T pundits have failed to document the impact that incorrect tolerancing has on organizations. Without this type of documentation, upper management cannot understand the impact tolerancing has on the business, especially in manufacturing costs, warranty, and engineering changes, so they focus only on processes that they feel have a significant impact on their bottom line.

The tolerancing philosophy in most organizations is inconsistent, because there is a fierce debate between engineering and manufacturing over whether the part tolerances and datum selection should be based on functional requirements or manufacturing practices. When these differences exist, they often result in tolerances that reflect different philosophies on various programs.

The industrial culture rewards getting a job done fast over getting a job done correctly. The employees who can get a job out quickly are rewarded, even though the job is peppered with illegal or inane specifications. Speed is commonly associated with reduced costs and fast-to-market strategies. In some organizations, even when training is provided, the drawings contain many errors. Training can deal with educational gaps, but management is responsible for issues like poor attitude and lack of direction. Rewarding the wrong behavior (or not rewarding the correct behavior) encourages the wrong behavior.

sessions, and includes reproducible handouts to use during the video training.

To read more about it, Click here

Back to top

Video Workbook: Practice GD&T Skills
The video workbook contains diagrams, tips, charts, and key points from the videos. Practice problems and a mini-quiz are also included in each GD&T lesson. The workbook also serves as an excellent reference.

Back to top

GD&T Trainer Makes Learning Fun
ETI's GD&T Trainer is the perfect solution to your training needs. It's an entire interactive GD&T fundamentals course on one handy CD-ROM. It's convenient, portable, and fun.

To read more about it, Click here

To download a demo, Click here

Back to top

Getting to Tolerancing Heaven

The path to Tolerancing Heaven involves hard work, but it is achievable if you are determined. The path is different for the individual than the organization. Let's look at the path for the individual first.

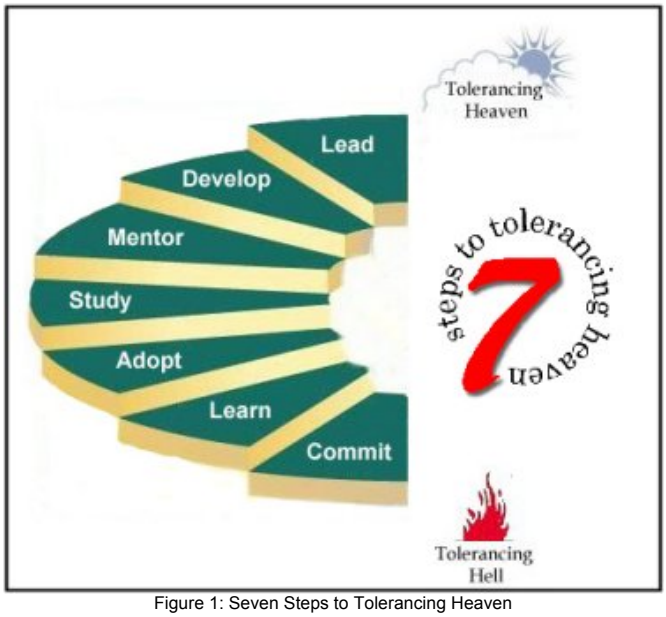


Figure 1: Seven Steps to Tolerancing Heaven

The path to Tolerancing Heaven for the individual involves seven steps. These steps will transform you into a true tolerancing advocate.

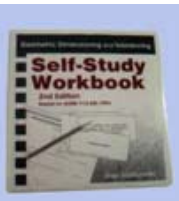
1. **Commit** to becoming a tolerancing advocate.
2. **Learn** tolerancing skills.
3. **Adopt** a set of core beliefs.
4. Continue to **study** and practice with feedback.
5. Seek or become a **mentor**.
6. **Develop** tolerancing business case examples.
7. **Lead** the understanding and application of GD&T in your organization.

Commit to becoming a tolerancing advocate. The commitment involves three parts. First, understand that it will take 2-5 years depending upon how intense your efforts are. Second, recognize that in your journey to becoming an advocate you will encounter many naysayers, charlatans, expediters, and non-believers. Your commitment must be stronger than their influences or you will fail. Third, your commitment should be written and include your plan on how and when you will work on the seven steps.

Learn tolerancing skills. This involves three areas: GD&T, tolerance analysis, and a tolerancing approach (like the system approach to component design). Take several courses on each level of GD&T and tolerance analysis. Learn every aspect of each course. Master the course contents. Repeat a course several times if you find a course to be exceptional (the content is more critical than the instructor). Use tests on the course contents to measure your understanding. Read and reread the Y14.5 Standard until you thoroughly understand its contents. Participate in tolerancing forums. Once you've mastered the concepts, ASME certification is an excellent way to verify your GD&T skills.

Adopt a set of core beliefs. The core beliefs are your value system. The core beliefs should guide your daily decisions regarding tolerancing matters. Every time you make a tolerancing decision, check it against your beliefs. Write a couple of sentences describing each of your beliefs and file them for them future reference. The core beliefs may include several areas: standards, dimensioning philosophy, gaging, design, etc. A few example core beliefs are shown below. They may or may not be right for you.

Standards - I will guide my use of tolerancing from the Y14.5 standard with the following conventions:



Learn GD&T At Your Own Pace

This illustrated, easy-to-use workbook will be valued by everyone who uses drawings in your firm. Experts can brush up on GD&T skills; novices can become proficient quickly.

The workbook has innumerable tips, suggestions, and practical illustrations. You'll find yourself reaching for your GD&T Self-Study Workbook time and again to help you solve problems you encounter in your daily work. It's a resource that will pay dividends for years to come.

To read more about it, Click here

Back to top

Teach GD&T Fundamentals: Convenient digital kit puts course materials on CD-ROM

GD&T Instructor's Kit Goes Digital

ETI launches its new Digital Instructor's Kit--all the course materials an instructor needs to teach an entire GD&T course included on one handy CD-ROM.

To read more about it, Click here

To download a demo, Click here

· I will follow all concepts described in the standard.
· If a tolerancing concept is not explicitly covered by the standard, and does not conflict with the standard, then its use is legal.
· If an item in the standard is vague, I will use one interpretation consistently and recognize that several interpretations may arguably be correct.
· I will not use inane tolerance specifications.

Dimensioning Philosophy - Whenever possible I will dimension parts as they function in their assembly.

Continue to study and practice with feedback. For any skill, practice and feedback are essential to becoming or staying proficient. If you play golf, bowl, or play a musical instrument, you know that to have a high skill level, it takes continued practice with feedback to improve. GD&T is not any different. Your skill level is proportional to your effort.

Seek or become a mentor (learn or teach). You will continue to learn if you associate with those who know more about a topic than you. You will hear ideas, problems, and perspectives that you cannot imagine by yourself. Some suggestions for finding a mentor include:

· Read books on the topic and try to understand the philosophical approach taken by the author.
· Attend standard meetings and listen to the discussions.
· Find a more experienced co-worker who shares the same enthusiasm as you.
· Subscribe to GD&T newsletters like ETImail.
· Sign up for GD&T email discussion lists like ETI's Digital Tolerancing Forum.
· Interact with GD&T students and professionals on boards like ETI's discussion board

You should evaluate the various perspectives and compare them to your core beliefs. They may even influence some of your core beliefs. You may also be able to teach or mentor someone yourself. Teaching is also a learning experience for the teacher. You will sharpen your skills and grow by answering student questions.

Develop GD&T business case examples for proper tolerancing. Document real problems and consequences. Perhaps the biggest mistake tolerancing advocates have made over the years is not documenting the consequences that result from vague or illegal tolerancing specifications. Observing and documenting engineering, manufacturing, or inspection problems that you or others in your organization encounter can accomplish this. Once you start, you will be amazed at how often proper tolerancing (or proper interpretation) is part of the solution to many problems. Documenting GD&T business cases is critical to demonstrating the importance of GD&T to the organization. (This is a large topic and it could be an article on its own.)

Here are a few suggestions to get you thinking about how to gather GD&T business cases:

· Every time a print change is done, there may be a GD&T business case behind the change. For example, if a tolerance is increased, was the original tolerance tighter than it needed to be for function? How much time and expense was used trying to meet the false requirement?
· Every time parts do not assemble in the plant, there may be a GD&T business case associated to the problem. If parts don't assemble, is it a result of tolerances that allow a no-build condition? Or tolerances that are misinterpreted? Or improper gaging? Or proper analysis not done in engineering or manufacturing? All of these are related to the topic of proper tolerancing.
· Every time there is a dispute over part acceptance, there may be a GD&T business case associated to the problem. Is the dispute a result of improper or vague tolerance specifications? Improper interpretation? Improper gaging? All of these are related to the topic of proper tolerancing.

In all three examples, the costs associated with the problem need to be documented. There are many other ways business cases can be built for proper tolerancing. The right business case will gain rapid support for the topic. The important message is that we need to document the examples to demonstrate the importance of GD&T.

Lead the understanding of GD&T in your organization. Before attempting to lead your organization to Tolerancing Heaven, you need to remember to be patient with yourself and with your organization. You will not become proficient in tolerancing in a week or a month, and, for

Back to top

Back to top

many, it will take a year or more. Be committed to your core beliefs and willing to continue to work towards achieving them. You also need to have patience with your organization. You may reach Tolerancing Heaven while your organization is still in Tolerancing Hell. It is easier for one person to make the transition than it is for an entire organization.

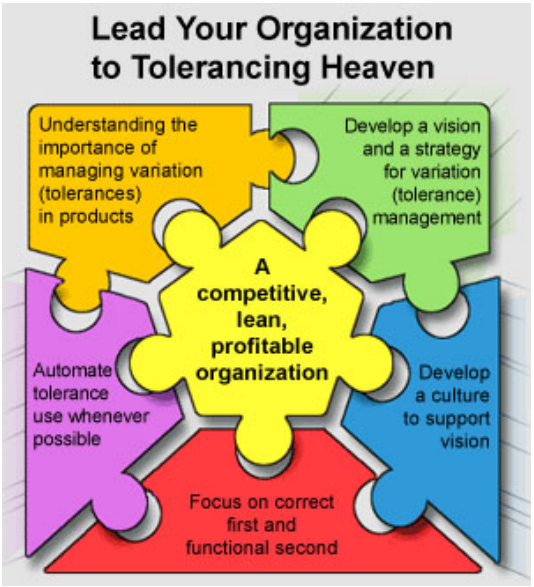


Figure 2: How to Lead Your Organization to Tolerancing Heaven

The path for an organization involves five areas. These areas will transform an organization into a highly competitive, lean, and profitable organization.

1. Understand the importance of managing variation (tolerances) in products.
2. Develop a vision and a strategy for variation (tolerance) management.
3. Develop a culture to support the vision.
4. Focus on correct first and functional second.
5. Automate tolerance use wherever possible.

Understand the importance of managing variation in products. Over the last ten years, oversimplification and the rapid growth of CAD systems have given many leaders the impression that using models to convey design intent is adequate (nominal thinking). In fact, products produced from 3-D solid models are never equivalent to the model. Tolerances control how much the actual part may vary from the model. It is the tolerances that determine:

· If a part will function as intended
· What manufacturing operations are needed
· How the part should be inspected
· A large percentage of the cost to produce the part

Therefore, the company that recognizes the importance of tolerancing will be able to focus on the areas that will reap the most benefit.

Develop a vision and a strategy for variation (tolerance) management. For an organization to make significant progress in tolerance specification and usage, proper tolerancing must become one of the core goals of the entire corporation. A company or corporate vision needs to include the proper use of tolerances in the organization. The supporting strategy should bring attention to the importance of proper tolerancing.

Develop a culture in the organization to support the vision. It is people that implement a plan. The stronger the people, the more successful the plan will be. Developing the culture is much more than training: it is creating the environment that stresses the values of the vision. Training can increase an employee skill set, but management creates the environment. Management—not trainers —are responsible to address performance problems. Managers need to emphasize the skills necessary to support the strategy. In the case of tolerancing, managers should reward employees that possess and apply the desired tolerancing skills, rather the employees who finish jobs quickly, but that are poorly done. When tolerancing skills are encouraged, they will grow.

life industrial situations. Solve tolerance stack problems involving flatness, straightness, tolerance of position, runout, concentricity, and more. The practice stacks are from actual drawings that are provided in the Drawing Package.

To read more about it, Click here

Back to top

Back to top

Focus on correct first and functional second. As much as I believe methods like SACD (System approach to component design) are important to companies, before employees can embrace a dimensioning philosophy, they must have the skills and appreciation for using tolerances properly. In other words, specifying and interpreting tolerances according to standards should be understood and embraced before the dimensioning approach is determined. Understanding how to specify and interpret tolerances properly is the foundation for implementing a dimensioning approach. If the foundation on specifying proper tolerancing is weak, the tolerancing approach (SACD) can not be successful.

Automate tolerancing wherever possible. Even though you are cultivating a higher skill set in your employees, automating the proper specification or interpretation of tolerances is preferred. When you automate the specification of tolerances, it standardizes the specifications, and does it in a more efficient manner. There are several CAD software packages that are working on GD&T checkers to improve the quality of the specifications. The software-based checkers have the potential to reduce poor tolerance specifications. Software is also being developed that can interpret tolerance specifications for analysis, manufacturing, and inspection. These all have the potential to reduce errors and significantly increase throughput. (One word of caution: although there are several packages available today, they are still not accurate enough to rely on). When the software products are complete and accurate, they will be valuable tools to help lift many organizations closer to Tolerancing Heaven.

Conclusion

This is an introduction on how to improve tolerancing skills for an individual or an organization. In such a short article, the concepts can only be introduced. I hope I have given enough information for the ideas to be discussed and developed in various organizations. The organization that can harness the power of proper tolerancing will be the global leader.

Agree or disagree? Please send me your thoughts and experiences.

I will close by summarizing the Tao Tolerancing Principles (TTPs) covered in this part of the article. (TTPs 1-4 are covered in Part I of the article. TTPs 5-9 are in Part 2. TTPs 10-14 are in Part 3.)

TTP #15 - Rewarding the wrong behavior (or not rewarding the correct behavior) encourages the wrong behavior.

TTP # 16 - The core tolerancing beliefs should guide your daily decisions regarding tolerancing matters.

TTP # 17 - For any skill, practice and feedback are essential to becoming or staying proficient.

TTP # 18 - Documenting GD&T business cases is critical to demonstrating the importance of GD&T to the organization.

TTP # 19 -. Before employees can embrace a dimensioning philosophy, they must have the skills and appreciation for using tolerances properly.

TTP #20 - The organization that can harness the power of proper tolerancing will be the global leader.

Next Issue: Part 6 - A review of the TAO Tolerancing Principles

We welcome your feedback. Send comments about this article to ETImailbag. Your opinions will be posted in the next issue.

Back to top

Standards in the News

ETImail's Standards in the News *takes a look at real-life issues involving standards. This month: The need for standards in Web-based applications and services.*

ETI Services

ETI offers convenient, customized, onsite training in fundamentals, advanced concepts and stacks.

Call 734-728-0909 to schedule your next workshop today.

ETI Offers On-Site Training

Effective Training brings the most up-to-date, easiest to understand GD&T instruction in the industry right into your location. Either Alex or one of his personally trained instructors will come to your site to conduct a series of three workshops that add up to a total GD&T education. Workshops can be customized to include your drawings and parts.

To find out more about what ETI has to offer your organization. Click here

Back to top

ETI's Discussion Board: Talk about GD&T issues with other peers and professionals.

vnunet.com UK technology news, reviews and downloads

Excerpts from vnunet.com website.

WEB SERVICES AWAIT STANDARDS

A lack of common standards for security and interoperability for Web services is likely to remain a problem for several years to come, according to some industry commentators. Web services is a term used to describe the linking of information systems and business processes through Web-based protocols.

The lack of standards causes particular problems for integrating legacy applications with Web-based applications and services, according to Mike Gilbert, product director of Cobol tools supplier Micro Focus. Full Story

Excerpt from "Web Services Await Standards" by Martin Banks, from IT Week (itweek.co.uk)

IT WEEK

Back to top

The ETI Mailbag

Alex,
I have a fundamental question. What kind of control would one have on say, a machined circular part with a thru hole and a counterbored hole midway thru the part? Size dimensions are not important, but we are not using any positional tolerancing, just plain sizes given for the different diameters and counterbore hole depth. If there are no location controls given, does that mean that the thru hole can be anywhere on the cylindrical part? I can use some advice here.

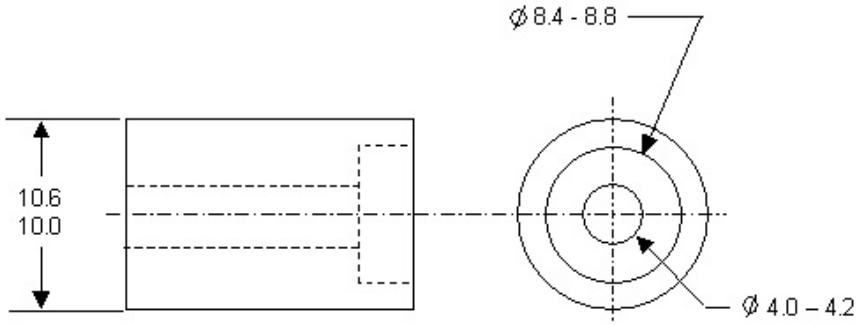
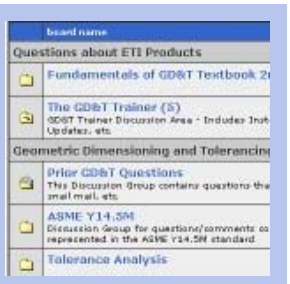


FIGURE 1

Figure 1 shows the part you described. You asked "If there are no location controls given, does that mean that the thru hole can be anywhere on the cylindrical part?" That is correct. With this drawing, there is no specification on how much the hole and counter can be offset from each other or in relation to the outside diameter. The drawing is incomplete. The supplier could produce a part that had any amount of offset between the diameters and it would pass the vague print specifications.

Depending on how the part functions, position control or runout controls could be used



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. Drop by the Interact section of our website and take a look at the Discussion Board. Click on any subject title and you can browse through GD&T topics, where you may find ideas to spark your own questions.

ETI's Discussion Board can provide a place for you to find answers to questions, an exchange of ideas, and a continued discussion of the ever-changing world of GD&T.

To visit the board, click here.

Back to top

ETI's Employment Opportunities Board

ETI provides a free forum that enables job seekers and employers to meet. If you're looking for employment in a GD&T-related industry or you're a company who needs someone with GD&T knowledge, post your needs here. Click here

Back to top

Tech Calendar

to complete the part definition. One possible solution to completing the part tolerancing is shown in figure 2.

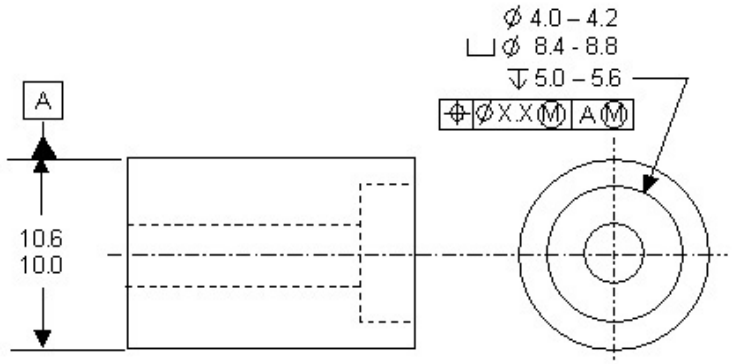


FIGURE 2

I would like to point out the additional controls do not add cost; they complete the part definition. The amount of tolerance that is specified in the geometric tolerances is what determines the costs involved.

Alex

ETI appreciates your questions and comments.
Send your GD&T questions to: ETImailbag.

Back to top

Alex's Tech Tip

From teaching ideas to new products that will assist you in training or on the job, the ETImail Tech Tip will keep you informed about new technology and training trends. This month's Tech Tip: Teaching vs. presenting.

KNOW THE IMPORTANT ELEMENTS OF SUCCESSFUL TRAINING

One of the most important aspects of successful training is finding the right instructor. Too often instructors are merely "presenters" and not qualified teachers. To be assured that students will gain the most knowledge and skills from any course, there are important elements that must be a part of the training and an integral part of the teaching style.

Presenting vs. teaching

When choosing a trainer, you should know the difference between real teaching and its less substantial counterpart: presenting. Real teaching is participant centered. It is a two-way event, not one-sided like a presentation. Teaching is an interactive process. A good instructor involves students in the lecture by encouraging questions and a flow of ideas. Students learn more when they are a part of the process and actively participate in their own training.

Presenters have a more passive approach; they merely quote facts and describe elements of a course without actively involving the students in the process. The lecture may be interesting, but without the active student participation, there is less interest on the student's part, which results in less retention of the topic.

Capable teachers know how to involve students in the learning process. They also know that using adult learning principles maximizes the learning experience. Adult learning principles were developed by Malcolm Knowles, often referred to as the “father of adult Education.” Knowles found that moving students through the phases of the “adult learning

Stay up to date on the latest industry news with the ETI Tech Calendar. Click here

Back to top

Quality Quote

If quality improves, productivity increases. To increase productivity, management must stress quality, not quantity.

--Howard Gitlow and Shelly Gitlow, from *The Deming Guide to Quality and Competitive Positioning* (Englewood Cliffs, N.J.: Prentice Hall, 1987)

Back to top

ETI Staff

President
Alex Krulikowski

Product Development
Jamy Krulikowski

Programming
Cindi Rowe

Sales
Kathy Darfler
Nancy Davis

Website/Internet Svcs.
Brandon Billings

cycle," (experiencing, processing, generalizing and applying) has been proven to bring measurable student success.

Presenters may be skilled in the elements of a successful presention, but real teachers also understand the importance of facilitation skills. According to training expert Bob Pike (author of "Train the Trainer" materials), "facilitation skills bridge the gap between the training content and the learning. These skills include attending, observing, listening, and questioning—all important elements involved in taking the training content and making it successfully understood by the learner."

The chart below highlights the difference between presenting and teaching, so you can remember these important elements when choosing a teacher for your next training project.

Presenting	Teaching
• Is performer centered • Is a one-way event • Is passive • Uses presentation skills	• Is participant centered • Is a two-way event • Is interactive • Uses adult learning principles • Produces measurable results • Uses presentation and facilitation skills

Remember to choose a GD&T trainer who understands the principles of adult learning and is familiar with facilitation skills. The materials used should also be based on these principles and utilize goal-oriented training techniques.

ETI president, Alex Krulikowski, is not only an expert on geometric tolerancing, he also has a degree in industrial vocational education. He understands adult learning principles and has written ETI's courses and materials to reflect his knowledge of these learning techniques. Our courses utilize a series of goals and objectives that reinforce concepts and produce measurable results.

To see ETI's complete catalog of learning materials, click here.

To learn more about our workshops and training, click here.

If you know about a new tech tool or an innovative idea that would aid our readers, please write us: ETImailbag.

Back to top

ETImail Feedback

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

A Common Language:
I feel like a foreigner who just found someone who could speak my language (GD&T)!

Kenneth Gentile
Kearfott Guidance & Navigation Corp.

ETI would like to hear from you. If you have an opinion about any ETImail article or feature, please write to our ETImailbag.

Graphic Artist
Matthew Pride

Network Administrator
Chris Wioskowski

Writer/Editor
Katherine Palmer

Financial Administrator
Tina White

Order Processing
Gary Walls
Lindsay Carlington

www.etinews.com

Back to top

Designers, Drafters, CAD/CAM Professionals...

Send ETImail to a friend

We would appreciate it if you'd keep us in mind when you need GD&T training, consulting, or GD&T products. Feel free to contact us by email or by phone at 734-728-0909 or 800-886-0909.

To subscribe to ETImail, click here.
To contact us with questions, comments, or story ideas, click here.
To unsubscribe from ETImail, click here.

The contents of this newsletter may be reproduced if our Reprint Policy is followed.