Teams: How You Start Drives How You Finish!

When it comes to working with other people, it's tempting at times to give up on trying to get a group to function truly as a team. Creating a team is often much harder than it sounds, but, in today's world of increasing complexity, teams are critical to getting things accomplished. Working on a well-functioning team is also incredibly rewarding in its own right. The purpose of this article is to help you think more critically about groups in which you are a member, so that you can identify and implement ways to help make those groups act more like real teams.

The word *team* is often overused; it's often used to refer to merely any group of people who are given an assignment to work together. As you've no doubt experienced, though, there's much more to creating a team than that. For the purposes of this article, we'll consider a team to be "a group of people gathered together for a common purpose, *able to accomplish much more than the members could do individually*." Think about a great experience you've had in working with other people, whether it was as part of a work assignment, a class project, an organization like Tau Beta Pi, or a social organization like a fraternity or sorority. What made those experiences so worthwhile and so productive? Here are some of the factors that help make a group of people operate as a real team:

- Being open with each other
- Having clear responsibilities, but also the flexibility to share work when needed; for example, some members willingly taking on more work than others because they know that the laggards will make up their share later
- Sharing the successes, the work, the credit, and the shortfalls
- Building on the creativity and skills of the members to create new ideas and abilities that nobody had before
- Truly accomplishing more than any of the members could have done individually.

We hope that some of these sound familiar to you! Now, what makes it so hard to get to this level when working with others? Think about groups you've joined in which you felt the group didn't achieve all it could, or it was clear that people weren't truly committed to accomplishing something together. What made it difficult? Here are some of the problems that people often experience:

- Unclear goals ("What exactly are we trying to accomplish?")
- Lack of leadership, either because there isn't a clear leader for the group or because the leader is inexperienced or is biased towards certain views or group members
- Not knowing and being able to leverage the strengths of each of the members ("I can write better than Kris; why is she taking all the work away from me?")

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- Differing motives or levels of commitment ("I'm OK with a C in this class" vs. "I really need an A here," or "I really want to impress the boss on this project" vs. "I don't care what the boss wants, as long as the customer is satisfied.")
- Lack of basic organization in the group ("Who was supposed to do that?" "When are we supposed to finish this?" "Where's the project plan for that?")

So, how do you help transform a group that is operating with the second set of problems above to one that thinks more like the first set? Much of it has to do with how the group gets started; the first meeting, or two or three, is a critical time for laying the groundwork for how the team is going to operate. Here are guidelines or checkpoints that can help you in your team meetings, in moving a new group quickly toward team status, or in helping a group to accelerate its progress toward acting like a true team:

1. Clarify the team's purpose.
Spend time taking a step back and discussing what the team is supposed to accomplish. (This should be the main topic of the first meeting or two; if you're already on a team that didn't do this, though, do it now—better late than later!) What led to this project being initiated? Who is the key customer for this project? What would it look like if this project were successful? Develop metrics if possible. How could we measure that success? What would each individual in the team like to see happen? What would each individual like to gain from the effort (learn a new skill, be able to know a new customer, or be able to know the team members better, etc.)? Let each member voice his or her views, and encourage as much honesty as possible. Discuss areas of disconnect and how to resolve them.

2. Clarify team processes (roles).
If the team has a major task at hand or the team is more than three-to-four people, take time to determine who is responsible for what. Talk about who is going to act as the project leader and what that person's role will be. Will you expect an agenda for each team meeting? How are you going to

track and follow up on action items? How will you divide responsibilities? How will work get done between formal meetings? If some members commute from a long distance, could you handle more of the work via telecommuting, phone conferences, or Internet meetings?

3. Clarify team philosophy (norms).
Spend some time talking about how to operate as a team. What are people's sensitivities regarding time commitments? For example, do some members need to avoid late meetings because they need to pick up their children by a certain time? Do team members prefer mornings or afternoons for group meetings? What other commitments do members have that will affect their availability for the team's task? How do team members feel about providing feedback to each other? How will you address concerns about performance as they arise (which they are sure to do)?

These discussions may sound simple, but many teams fail or never get off the ground because of basic misunderstandings or disagreements in these areas that were never addressed properly. It's tempting to skip over discussing these issues; members may be overly eager to get to work (without knowing exactly what the work is!), and some of these topics may sound obvious, overly simple, or too controversial to debate. In addition, the leader may be afraid to invite discussion about these basic issues, either because he feels he'll be perceived as weak and soft, or because she knows there are conflicting and potentially controversial views within the group in some of these areas. However, the vast majority of problems in a team's formation and operation result from conflicts in these three key areas: purpose, process, and philosophy. With a clear and consistent understanding of these, the content part of the project will flow much more smoothly, the team will achieve a much better result, and they'll do it in a way that builds and strengthens relationships for even greater results in the future.

Whether you're a team leader or a team member, take the time at the start of a new project to discuss these topics with your group. If you've al-

ready started a project and haven't discussed these openly, step back and spend a meeting to do this. You may be surprised by what you'll learn, and you'll be guaranteed to a better and more effective start as a result! Good luck!

This article is inspired by the teamwork modules from the Tau Beta Pi Engineering Futures Program, particularly Team Chartering and Group Process. If you would like to learn more about the skills and tools necessary for successful teams, call or email Tau Beta Pi Headquarters to set up an Engineering Futures session on your campus!

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2002 Chapter Anniversaries

Training and Thinking

by Allen Klinger, *New York Iota '57*

This article supports *exposure, familiarization*, and *challenge* as essential ingredients in educating engineering professionals. Acquiring knowledge always involves learning the ways of the past. Engineering courses train students while exposing them to the fruits of past thought, often through laboratory experiments and design projects. Yet engineers often react with unease when given new problems outside their experience. Thinking is a difficult task that we tend to avoid.

Engineering curricula provide students:

1. Familiarization with technology, tools, and theories and
2. Facility in the use of mathematics, models, and computation.

But neither familiarization nor facility prepares individuals for work when there is radical change in the underlying technology or our model of nature.

Past Examples

Radar, computer- and satellite- communication, and jet air-transport all resulted from military research and development. Many developers were engineers, but some ideas and innovations were provided by other professionals.

In attaining balance between familiarization/facility and basic knowledge of engineering, practical steps involve challenging work assignments that reflect changes about basic knowledge. Inexpensive active solid-state devices—chips comprised of large numbers of transistors—lessen the need to study passive circuits, resistors, capacitors, and inductors. That subject was fundamentally important; now it is an aspect of engineering.

There are numerous examples of change in established engineering disciplines. Widespread assumptions about calculus and chemistry have stayed the same over time. Engineers still study calculus that enables building models, useful in dynamics and circuits, using second-order ordinary differential equations. Chemistry has been dropped from some engineering curricula, although advances in biology/genetics require engineers who are able to master biomedical engineering, where chemistry is useful.

> *"You can study mathematics all your life and never do a bit of thinking."*
>
> —*Frank Lloyd Wright*

My goal is to identify aspects of engineering that enable and support engaging in different directions of work. We focus on ways to strengthen engineering education that would enhance the development of graduates who possess greater flexibility in dealing with new ideas.

Simple Questions

Consider the following five statements or questions and possible answers.

1. In four births, which is **most probable**?
    a) Two male, two female.
    b) Three of one gender and one of the other.
    c) All four of the same gender.
Fifty-fifty probability, i.e., male births being approximately as frequent as female, leads some to choose the incorrect answer **a**.

The three-answer, multiple-choice format is best when there are correct, incorrect, and possible-but-wrong answers to an initial statement, and it enables examining complex ideas. But some simple questions introduce other ideas. The next question goes beyond grade-school arithmetic.

2. In **adding fractions** which statement is *true*?
    a) 1/3 plus 1/2 is 2/5.
    b) 1/3 plus 1/2 is 5/6.
    c) In physics, elements with values 1/3 and 1/2 can be connected to compose 1/5.
Each statement **a**, **b**, and **c** holds for some real situation. There are valid alternative interpretations for numerical sums of rational fractions; e.g.,
    a) Baseball batting averages [1];
    b) Adding resistors in series [2], pieces of a whole fruit, etc.; and
    c) Adding resistors in parallel [2].

Consider next a variation on fractions that I call **strange cancellation** and then two other puzzles that trouble many students.

3. For a rational fraction composed of two *two-digit* numbers **canceling** a single common numeral:
    a) Can't give the correct value.
    b) Can give the correct value.
    c) Reduces numerator & denominator values modulo the numeral.

4. To **divide** a circular pizza pie into eight exactly equal pieces by three straight-line cuts:
    a) Is impossible.
    b) The division can be done in one, and *only one*, way.
    c) There certainly are three different ways to accomplish this.

5. *Given:* three *fives*, one *one*, and four **arithmetic operations**, plus, minus, times, and divide; *find:* 24; or *given* 5, 5, 5, 1 and + , - , * , /, *find* 24. (Grouping by parentheses permitted.)
    a) I can do this.
    b) There's no way to do it.
    c) The only way to get the result 24 is to not use one *five*.

Questions 1-5 possess non-obvious solutions to seemingly not difficult subjects: what is **most probable; fraction addition; cancellation; division;** and **arithmetic operations.**

All five questions raise issues about training and thinking, including the issue that there may be alternative solutions.

Anyone stumbling over No. 4 can view the following URL (the image includes brief text about alternatives): *www.cs.ucla.edu/~klinger/pizza1.jpg* .

Let's now consider subjects engineers know about that others may not.

Elementary and Fundamental

Some engineering courses train to redress sketchy secondary-school coverage in algebra and trigonometry [3]. The next five questions address secondary-school mathematics. They show the failings in that sketchy coverage and the differences between engineers and non-technical students.

6. When two quantities, a and b, are compared, we write a is greater than b (or a is more than b) as: $a > b$.

Which comparison is true?
  a) $1/10^3 > 1/10^{-3}$
  b) $10^3 > 1/10^{-3}$
  c) $10^3 > 10^{-3}$

7. For the given pair of equations, which is true about the variables x and y?

$$2x + 3y = 2$$
$$6x + y = 12$$

  a) x and y have the same sign.
  b) x and y are whole numbers.
  c) $x > y$.

8. For the equation $x^2 + x - 1$, solution values are:
  a) Odd.
  b) Imaginary.
  c) Irrational.

9. We write the logarithm of a number n to base 10 by "log n." Which equation is true?
  a) $\log (n + m) = (\log n) + (\log m)$
  b) $\log (n * m) = (\log n) * (\log m)$
  c) $\log (n * m) = (\log n) + (\log m)$

10. There are exactly how many ways to arrange five things?
  a) 120
  b) 15
  c) 54

University students not interested in mathematics had difficulty with 6 -10; one asked "Where did you get those questions?" "They were just high-school mathematics" brought the immediate reply "Not in my high school."

Play involves individuals and stimulates thought about quantity [Ref. 4 and 5]. Training, specifically knowledge of terminology (imaginary, irrational) and procedures (elimination of variable in simultaneous linear equations), or the lack of it is what questions like 6-10 measure. *Creativity* is related to thinking—"Real problems don't come in compartmentalized form" [6]. Is training in old approaches a way to dodge or eliminate thinking? Perhaps—consider this quotation: "Students in college mathematics courses are unresponsive. They are afraid to speculate and afraid to reach into themselves for ideas [7, p. 844]."

Gaining Strength
By now I hope you've found a one-eighth slice of pizza, 24, and other solutions like removing sixes in 16/64 or nines in 19/95, yielding the correct answers 1/4 and 1/5, respectively, to the strange cancellation question. [How many fractions under 100 (1,000, ...) can remain unchanged quantities when a single digit is eliminated from numera-

tor and denominator? Anyone who thinks out how to compute the solution(s) for a given level learns the value of not accepting the established rules and could become interested in cancellation-like procedures described in [8].] Technology can stimulate playful but thought-demanding efforts.

Baseball. Batting averages are calculated as total hits divided by total at-bats. This gives yet another way to look at the addition of two fractions. Suppose a batter has one hit in two at-bats on the first day and one hit in three trips on the second day. The common accepted wording "batting two for five" goes along with the decimal fraction .400.

Circuits. Overall resistance (ohms) depends upon the interconnection method: series differs from parallel. Five-sixths results when two resistors of one-half and one-third ohms are in series, the same result as ordinary fraction addition. Parallel connection of the same resistors yields the overall result: one-fifth ohm.

The thinking/training relevance of the above examples could be questioned since they are mostly based on quantitative ideas. But the above ideas are matched by the models and ferment involved in other practical fields. Physics has relativity or Einstein's expansion of Newtonian mechanics, Maxwell's equations, wave-particle duality, the uncertainty principle, the Schrodinger equation, quantum mechanics, quantum electrodynamics, and many other issues where thought—independent of past knowledge or orthodoxy—has prevailed. Philosophy, astronomy, and cosmology ("Big Bang," "continuous creation of matter" theories) also have evolved.

Exercise and Rest
The relationship between training and thinking is that they are of equal importance. Any curriculum should seek a balance with training in methods of the past taking a share of the time, but reserving an equal amount for thinking.

Professional schools, engineering in particular, are training individuals. The ability to function in a field requires special knowledge. This is independent of developing the ability to continue to learn. Reading widely and writing about ideas are basic exercises that support adaptability.

Thinking is necessary and should be

enshrined in the college and university curricula. Undergraduates and graduates who study engineering need the challenge of lucid writing about cultural, historical, and technological issues [9-11].

The vitality of engineering as a profession depends on its responsiveness to real-world issues. Education for engineers should prepare them to function in the world. Success in new areas can grow from appreciating thinking in different cultures [9].

Conclusion
Distinguishing between overview and in-depth presentation is artificial. There is a seamless nature between elementary and fundamental issues. In reality s*imple* things constitute basic knowledge. One needs an overview or introduction that engages and provides some familiarity. Then more exercise is needed. Trying many things initially is the only practical way to stimulate, ultimately gaining facility in some main area.

Every well-educated engineer has training *plus*. That person's thought processes have been stimulated, creating adaptable qualities. In Bronowski's view ". . . discovering an underlying order in matter is man's basic concept for exploring nature" [11, p. 95]. For engineers, that matter could be synthesized, and the order created by design.

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　　— wisdom & words about paths.
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　　— pointers to wisdom files.

Dr. Allen Klinger, *New York Iota '57*, is professor, engineering and computer science, at UCLA and serves as a District 16 Director. He holds a Ph.D. from UC, Berkeley, and an M.S. from the California Institute of Technology. He is the author of numerous publications on data structures and pattern recognition and is a fellow of the IEEE.

AlumNet

Tau Beta Pi's AlumNet Program pairs students with alumni to allow sharing of information about jobs and academe. To get in touch with an alumnus about a certain field, company, or institution, simply register on-line at *www.tbp.org*. Click on the AlumNet link under "For Members" and follow instructions.

$$$ GIG Grants

Your chapter may receive up to $750 to conduct a project involving civic affairs and public policy issues. The cash is available and waiting under Tau Beta Pi's Greater Interest in Government Program to involve students in their communities and the political process. South Dakota Alpha was recognized at the 2001 Convention for its youth-engineering adventure.

　　Send your chapter's 2002 proposal to the national Headquarters. Application guidelines are in Section C-IV of the President's Book on the website. There is no deadline, and joint chapter projects are now encouraged.

LET'S TALK! WEBSITE FEATURES NEW DISCUSSION BOARD

Whether you are a student wondering if anyone out there has a great chapter fundraising idea, a District Director wanting to start a lively discussion about chapter membership, or an alumnus seeking a dialogue from Tau Bates working on the latest advancements in nanotechnology, the ΤΒΠ Discussion Board was created for you!

　　There is a link to the Discussion Board at *www.tbp.org* . Since its activation last month, there have been hundreds of hits, but few people are registering—which you must do to be able to post a message. When you register, your password is immediately emailed to you, so there is no waiting to begin your exchange. Here is an example of another useful benefit of membership in this great Association, so please don't be shy. Let's start talking!

Welcome New Chapters

Four new chapters chartered by the 2001 Convention have been installed with the initiation of their charter members this year. Missouri Delta officially came into being on January 26, 2002, at the University of Missouri-Kansas City with Vice President **Edward J. D'Avignon** as official installing officer.

　　Oregon Gamma was chartered on February 9 at the University of Portland with President **Douglas M. Green** leading the ceremony.

　　New Hampshire Beta was established on February 23 at Dartmouth College with Councillor **Catherine P. Rice** as official installing officer.

　　Texas Mu officially came into existence on March 3 at the University of Texas at San Antonio with Councillor **Jerome A. Atkins** doing the honors.

　　These bring the number of active collegiate chapters of Tau Beta Pi to 225. Stories of the installations and the harboring institutions will appear in the Spring and Summer issues of THE BENT.
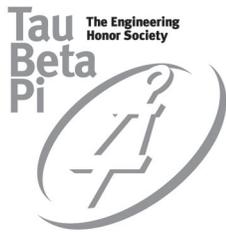
Nominate a 2002 Laureate

Tau Beta Pi inaugurated the Laureate Program in 1981 to honor those student members who have demonstrated exceptional talents outside the field of engineering. Look among your members for an outstanding student. Chapters may nominate one or more members as a Laureate based upon their contributions in arts, athletics, service, or diverse achievements. Laureates each receive a $2,500 cash award, recognition at the Convention, and publicity in THE BENT.

　　A chapter nominating committee, excluding but in consultation with the candidate, should assemble the nomination package and send it to the Secretary-Treasurer by March 15—in triplicate. (Please refer to the President's Book, pp. C-29, *www.tbp.org* .)

2002 District Conferences

The District Program provides a vital link between the national organization and individual chapters. Each year the Directors gather students for regional conferences to provide both retiring and new officers opportunities to discuss chapter operations and to socialize. All chapters are urged to elect new officers before their District conference. New and outgoing officers are urged to attend. The 2002 schedule is:

Dist.	Location	Date
1	Northfield, VT	April 13
2	Ithaca, NY	Feb. 23
3	Newark, DE	Feb. 9
4	Charlottesville, VA	April 13
5	Atlanta, GA	April 13
6	Cookeville, TN	March 16
7	Detroit, MI	April 13
8	Terre Haute, IN	April 6
9	Kansas City, MO	Feb. 23
10	New Orleans, LA	Feb. 16
11	Minneapolis, MN	April 13
12	Casper, WY	March 2
13	Albuquerque, NM	April 6
14	Coeur d'Alene, ID	April 6
15	Reno, NV	April 13
16	Los Angeles, CA	April 13

Important Deadlines

GIG Project Proposal (any time)
- March 1
  Scholarship Application
- March 15
  Laureate Nomination
  Distinguished Alumnus Nomination
- March 21
  Outstanding Advisor Nomination
- April 1
  Constitution Ratification Ballot
- June 1
  Convention Bid for 2005

Monstertrak.com

Tau Beta Pi has entered into a contract to create a special job-listing site for our members. More than 400,000 employers list their position openings with Monstertrak, advertising for entry-level and experienced full-time jobs, as well as internships.

To use the site, email Headquarters at *tbp@tbp.org* to request the password, using monstertrak in the subject. Then visit the site at *www. monstertrak.com* and begin your search. We ask only that you maintain the confidentiality of the password and tell us your success stories. More than 1,000 Tau Bates have requested the password.

Educational Loan Fund

Since 1935, Tau Beta Pi has assisted student members with their financial needs while in school or with payment of their initiation fee through our Student Loan Fund. We are pleased to offer this service for student members in amounts up to $2,500 per member.

Repayment is required after three years, and a simple interest rate of 6% is charged from the day the loan is received.

Interested students can obtain promissory notes and loan applications from their chapter presidents or directly from Secretary-Treasurer Jim Froula at the national Headquarters.