Title: Lessons Learned and Observations from a New Method for Teaching and Using TRIZ.

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ABSTRACT

In the previous paper by Malkin & Coates ("An Improved Method for Teaching the Theory of Inventive Problem Solving to Students", Conference Proceedings TRIZCON2007, the Altshuller Institute for TRIZ Studies, Worcester MA, pp.283-303*)*, a new method for communicating a subset of TRIZ was proposed. This paper presents observations and lessons learned from executing this method both in live classrooms and via distance learning formats. It also suggests some improvements to the method for further enhancements to the approach. The paper should be helpful to instructors and educators that are teaching or planning to teach TRIZ. Observations and lessons include class size, instructor interaction, administrative features, examples, homework, tests, and activities required for distance learning to be successful. They also include syllabi content and strategy recommendations for successful communication of the subset of TRIZ being taught. The strategy recommended should help the permanent integration of TRIZ into the student's repertoire of skills. There are also improvements shown for increased productivity of inventive principle utilization.

Introduction

In the paper, "An Improved Method for Teaching the Theory of Inventive Problem Solving to Students" by Malkin & Coates[1] a new method for communicating a subset of TRIZ was proposed. Training, both before and after the introduction of this method, revealed certain observations and lessons that could be valuable to pedagogues of TRIZ.

In the movie Cool Hand Luke, the warden said to the contentious convict Luke, played by Paul Newman, "what we have here is a failure to communicate". This is analogous to the situation that the authors have encountered in their own TRIZ training and observed in training by others. We have not communicated this method effectively enough to convert students to the methodologies used in TRIZ.

Several TRIZ experts and trainers exchanged their experiences[2] regarding the barriers to the communication of TRIZ education last year. Comments by one trainer were: "We have identified three characteristics of the people who continue (to use TRIZ, added). 1) They regularly launch into self-improvement type learning 2) They are persistent problem solvers (They can't help themselves. They take their problem everywhere). 3) They typically set the bar high for themselves. ("I want to blow this problem out of the water"). When you apply this criterion against the general population of engineers, you have whittled down to just a few percent. Another person said: "Yes "TRIZ CAN be used by everyone" but the data clearly indicates that only a few hold on for the long haul", and "It continues to lead us toward the belief that we could greatly expand the appeal of TRIZ within any population, if we can learn how to modify our message, so that it resonates with more people." These are both discouraging and encouraging comments.

Emphasizing the need for better TRIZ communication is the rapid expansion of information. One answer is to use the efficient methodology of TRIZ. Methods like TRIZ are longer lived. They address the organized use of information to solve problems. It seems so obvious and yet unrecognized that we need this training. A recent video on YouTube[3] dramatically portrayed the avalanche of information confronting society, now and in the future, and questioned its preparedness to deal with the information. This video is recommended viewing for teachers. The study Innovate America[4] indicated the importance of innovation and problem solving for our competitiveness. The recent study by the National Science Office of NSF[5] showed that proficiency of 10th and 12th graders in solving complex multi-step word problems was only 4%.

So what is wrong with our delivery and structure of TRIZ? As the movie said, "We Have Failed to Communicate". From the authors' recent experiences, they proffer several Observations, Lessons, and Improvements that may help others communicate TRIZ to their students.

Lessons Learned and Observations

Observations and Lessons include delivery methods, class size, instructor interaction, TRIZ structure, administrative features, examples, homework, tests, and activities required for distance learning to be successful. They also include syllabi content and strategy recommendations for successful communication of a subset of TRIZ being taught. The strategy recommended should help the permanent integration of TRIZ into the student's repertoire of skills. There are also improvements shown for increased productivity of inventive principle utilization.

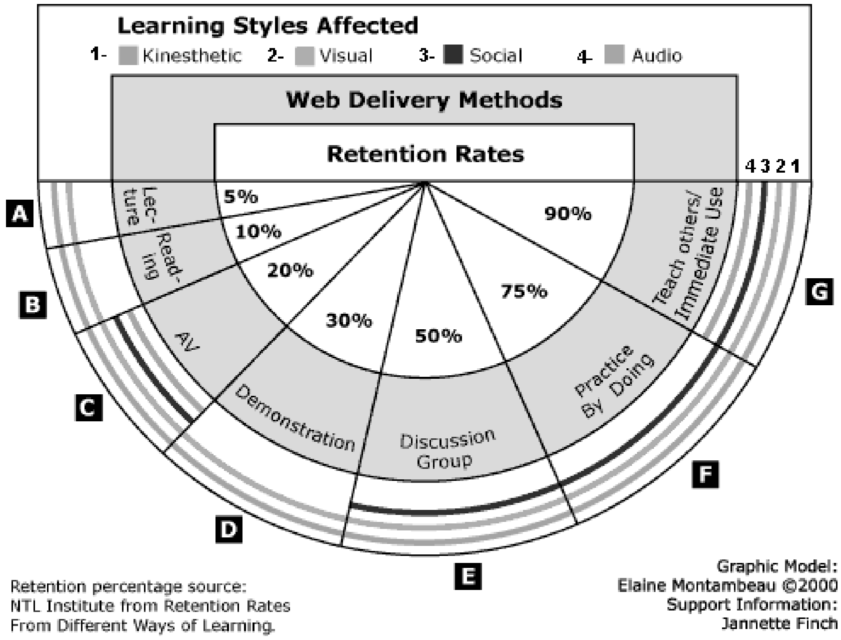
The experiences and learning can be classified in two ways: 1) lessons that need to be habits for future classes and 2) observations that have not yet led to new habits but may become guidelines after they have been interpreted fully.

Lesson 1 - "Lean-in" Pedagogy
Although the authors are experts at problem solving, they are finding that there is much to be learned about effective training. An excellent paper presented on on-line training by Wakefield[6] describes how different on-line training can be made effective. This was identified by Wakefield as "Lean-in Technology", meaning that the student must actively participate in many ways. A web site graphic, shown in Figure 1, by Finch and Montambea at The College of Charleston-SC, Department of Academic Computing's web site[7] and referenced in Wakefield's paper, graphically portrayed the effectiveness of different web delivery methods (a non-inclusive list with some debate. Please read Endnote 7) on retention. The delivery methods are composed of combinations of selected learning styles. They show that "teaching the subject" and "immediate use of training" are believed to be two of the most effective ways to retain instruction. The web delivery methods utilized a combination of learning styles: teaching (the student as an instructor), immediate application after training (e.g. a project), audio (listening), social (interaction), visual (watching it done), and kinesthetic (muscle sensory feedback, e.g., learning to swing a golf club). Less effective learning styles normally used fewer combinations of styles. By <u>improving proactive involvement</u>, the authors have made the lectures more interactive and interesting. Some studies suggest a mouse click for every three screens of material[8]. The authors use comical videos and short quizzes. Links to the web and interactive on-line tests have also helped.

Robert Barr and John Tagg in their groundbreaking paper[9] and later a book by Tagg[10], strongly advocate this style of teaching. He calls it the "learning paradigm" vs. the traditional "lecture paradigm".

It would have been efficient had the authors had the benefit of Wakefield or Tagg's paper. Instead, they learned many of the recommendations from experience. However, these references confirm and give direction to the improvements that the authors are using and that the authors will pursue further. They will elaborate further on these methods in this paper.

Figure 1. Retention Rates for Different Methods of Instruction



Lesson 2 – Communicate Expectations from TRIZ

One misconception the instructors try to clarify for the students is that there is less magic and more work to solving inventive problems. A good example is Thomas Edison, who is quoted as saying: "I haven't failed 10,000 times; I've discovered 10,000 ways that won't work." Inventive problem solvers must be told to behave as artists with a passion and perseverance for their art, and create their own satisfaction by generating inventive solutions. Students are told that if they believe TRIZ will produce magical inventive solutions for them without work, they have a gross misunderstanding. When a TRIZ student creates a long list of inventive ideas, the results will seem satisfying, expected, earned, unsurprising, and not magical.

Lesson 3 - Teaching in the Context of Existing Knowledge

As part of the author's college teaching strategy, TRIZ is discussed in the context of existing innovation methods. This helps the student understand and retain the method since it will integrate into the scheme of what else he has learned and will be applied at the right time.

Many of the methods proposed for problem solving tend to isolate themselves from one another. In the book The Medici Effect by Frans Johansson[11], the author observes a synergy that results from the intersection of many unrelated disciplines, which leads to the creation of many new ideas. He experienced this as he sat in a pub in the town of Madera in the Azores where sailors from around the world stopped for a relaxing moment, camaraderie, and drink. There he saw the explosive birth of many great ideas. However, he gives little credit to the benefit that could be gained from combination with other methods.

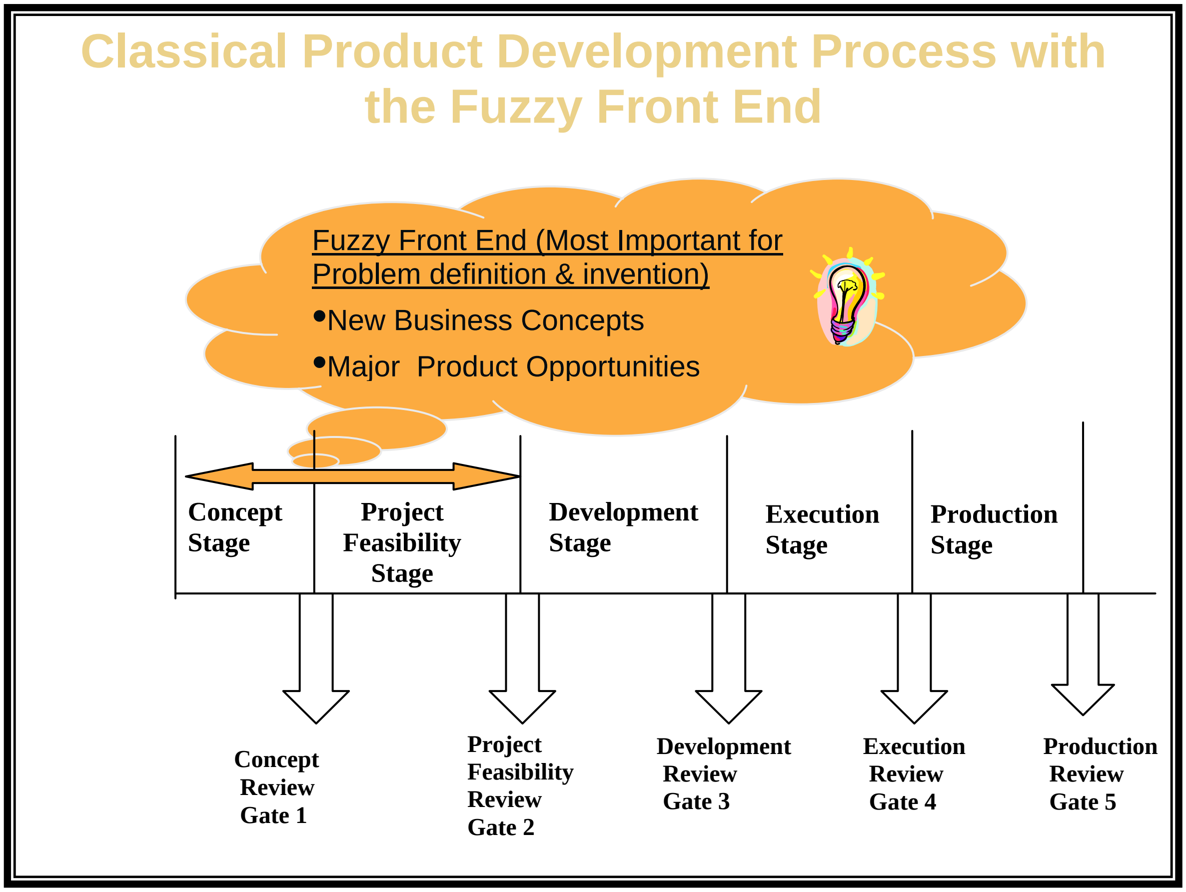
In one of the author's courses[12], TRIZ is presented in the context of existing popular methods for attacking problems and is compared to them. A partial list is given below with comments as TRIZ, as taught by the instructors, could augment them. The strategy, once again, is that TRIZ is introduced in the context of what the student may already know or will learn in the future. He will then be able to associate this tool with others when it comes time to use them.

Table 1. Popular Problem Solving Methods and a Relation to TRIZ

Selected Popular Methods for Problem Solution	**General Benefit According to Authors**	**Benefit of adding TRIZ**
Function Analysis (FA) and Diagramming	Identifies the functions versus the physical item thus stimulating thinking about alternative resources to enable functions.	TRIZ with inventive principles and its other tools complement FA well. Our version of TRIZ include it as part of Structured Brainstorming
Quality Function Deployment	Mediates customer functional requirements and competitive performance between marketing and engineering to create specifications in an objective way.	Some of the compromises between technical spec's and function may be improved through TRIZ.
Brainstorming (Six Hats, Medici, Osborne, etc.)	Creates a list of ideas, through divergent and convergent psychological methods.	TRIZ adds structure to brainstorming beyond psychological methods.
Failure Mode Effects Analysis (FMEA)	Lists functions, their failure mode, cause, total risk, and potential remediation.	TRIZ can assist in the remediation of risks.
Kepner Trego	Structured method to identify causes of failures and potential solutions industrial systems	TRIZ can help generate potential solution ideas
Fishbone Diagrams (Ishikawa Diagrams)	Identifies potential causes of a problem.	TRIZ can help suggest solutions to identified problems
Scientific Method	Classical method for conducting research.	Hypotheses chosen in the scientific method may not attack the correct problem and TRIZ could help identify critical problems and potential solutions.
5 Whys	Can help identify a real cause.	TRIZ can help suggest solutions from the identified causes.

In the same course, the author tries to indicate where TRIZ could be most helpful in a normal product development project. It starts with a general process as shown in Figure 2.

Figure 2. Classical Product Development Process That Indicates Where Most Invention and Problem Solving Occur.

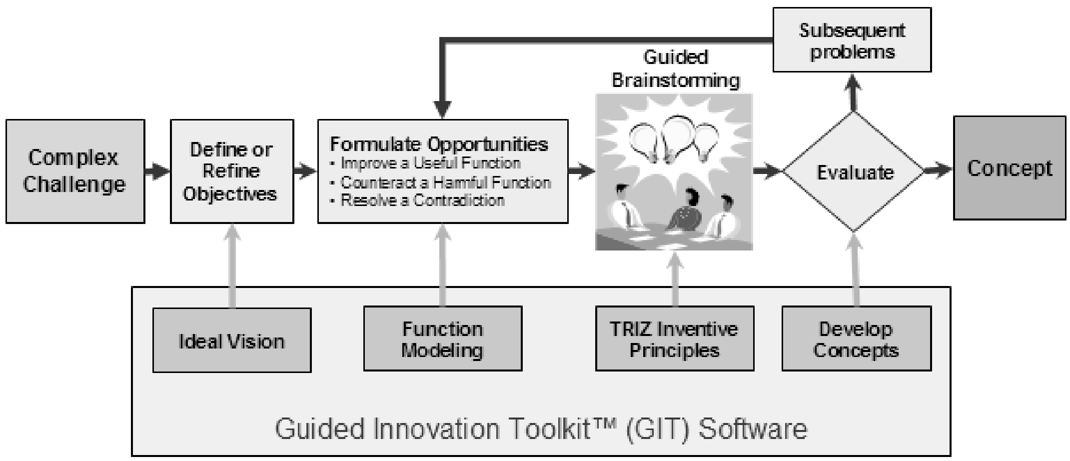


In one Project Management text that one author uses, problem solving is scarcely mentioned[13], however, TRIZ can be taught as an aid to the student when the schedule "comes off the tracks," as when an inventive problem occurs, and then PM receives criticism for not working. Had most PM training included the use of TRIZ for unsolvable problems, TRIZ might be recalled and those involved would be better for it.

Emphasis on TRIZ in the early stages of a project is important. A concept well defined is half solved and with the major issues addressed in the early stages such as by TRIZ, the project may progress smoothly and on schedule to production. Smaller problems do develop in the later stages but they are seldom showstoppers.

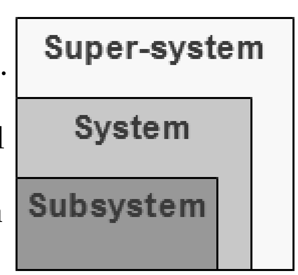
Lesson 4 - A Simplified Process is Used
When a significant challenge/goal is presented, the inventive method of TRIZ promoted by Malkin & Coates[14], that utilizes brainstorming, elements of PM, many other problem solving methods (function modeling, Pugh diagrams, and a new approach for utilizing inventive principles), are placed in a simplified process as follows in Figure 3:

Figure 3. Simplified Process for TRIZ



The process for the student is stated as follows:

1. Challenge/Problem
   Why has the particular situation been selected for improvement? What is the challenge/problem? Why do we consider this an inventive problem?
   1. Define the need
      1. What customer need will be fulfilled when this challenge is met?
      2. How will the customer benefit from solving the challenge?
      3. What will distinguish our deliverable from those already available to the customer?
   2. Define the customer
      1. Is there an internal customer within your organization?
      2. Is there an external customer?
      3. Will multiple customers benefit from the solution?
      4. How will your organization benefit from the solution?
   3. Define the scope of work
      Before we can begin Guided Brainstorming, we must define the system, which contains the problem. A problem can always be defined within a single system but the system may be too broad and general to understand what is causing our problem. In this case, we must look within those sub-systems, which contain the problem.



2. Objectives
   Objectives define the desired end result. Objectives should be measurable. Objectives define what is to be achieved. Objectives do not describe how the result will be achieved.
    1. Construct an ideal system by driving the resources required (size, material, cost…) to zero. This creates an image of ideal system, which is usually not achievable.
    2. Create multiple ideal visions for nearly ideal systems that achieve the useful function of the system considering the restrictions and minimum resources.
    3. Define what cannot be changed in the system. Remember, constraints are necessary but they will limit the novelty of solution. Things to avoid:
        1. Sacred cow constraints
        2. Constraints that prejudge solutions (e.g., we cannot use turbines because they are too expensive)
        3. Political constraints (e.g., we cannot use plastics because the President does not like them).
    4. Selection criteria – Decide how we will choose among several concepts for the best solution. The selection criteria must be measurable.
    5. Formulate Objectives - The performance metrics for the ideal vision.
        1. What will the final result look like?
        2. What measurements will be used to define success?
        3. What is the current level of performance?
        4. What is the minimum acceptable level of performance?

3. Formulate Opportunities
    1. For a well-defined problem, the ideal visions are clear. The functions that contribute to each ideal vision of the system need to be identified.
    2. For a complex system, the functions that contribute to each ideal vision of the system need to be identified in a function model.
    3. Formulate typical opportunity by asking yourself the questions below and using the templates:
        1. What do I want to maximize?
           Find a way to improve <useful function>
        2. What do I want to minimize?
           Find a way to counteract <harmful function>
        3. What contradiction do I have if try to apply known solution?
           Resolve the contradiction: <Contradictory function> should produce <useful function> and should not produce <harmful function>

4. Guided Brainstorming
    1. Select the critical Opportunities (functions) in order to brainstorm ideas. This creates a structured framework for brainstorming sessions.

2. Repetitively brainstorm the different Opportunities to achieve the Objectives via an iterative VFR approach as shown below.

5. Evaluate Ideas, Develop Concepts and address Subsequent Problems
    1. Because Brainstorming generates many different quality ideas, first screening of ideas helps to evaluate and select good ideas.
    2. Combine complimentary ideas into a solution concepts
    3. Any actual concept development produces incomplete Concepts. We compensate the imperfections in Concepts by filling them with new ideas by repeating steps 3, 4 and 5 to addressing the Subsequent Problems.

6. Action Plan
    1. Prioritize the concepts using decision tools such as Pugh diagrams
    2. Evaluate the concepts using tools such as Pugh diagrams and then prototyping the best ones
    3. Implementation plan using project management techniques.

Invention can be thought of as a process of searching through a “space” of possibilities. In contemporary cognitive psychology and artificial intelligence, the metaphor of searching through a space of possibilities has been effectively employed as a powerful way of conceptualizing problem solving and invention. The process of idea generation can be presented as mental or cognitive framework that we can view as a set of activities in which individuals combine, manipulate, and transform symbolic mental images to form ideas. This process employs two concepts:

1. Mental models - dynamic prototypes which the inventor can use to imagine how a system works.
2. Inventive principles - the abstractions that an inventor uses to generate and manipulate mental models.

Students have a clear process to follow for brainstorming. It is called the VFR approach to Structured Brainstorming. It is described in the previous paper[15], but briefly, the Vision Function Resource circle is used repetitively to brainstorm ideas to improve useful functions or counteract harmful functions by changing the outcome of the function, changing the functioning, or utilize different resources that enable the function. The recursive VFR process of developing ideas for achieving the vision of functions in the models is represented by the diagram:

Figure 4. VFR Approach for Brainstorming Ideas

Giving homework on well-defined problems at first gives the students confidence that they can approach problems with confidence to develop new ideas for solutions. Later students learn additional methods for a more complex problem that they tackle in Part 2 of the author's TRIZ course[16].

The number of inventive principles should be minimized and this list kept in front of the students with examples while doing brainstorming on inventive problems. The authors simplified the list of Inventive Principles described in the previous paper[17] to 60 principles by excluding duplications for different opportunities as identified above (48 for useful, a different 8 for change outcome of harmful, and 4 specific for contradictions). It is a list of carefully reviewed, selected and rewritten principles taken from Altshuller's 40 Principles and the 77 Standard Solutions to be applicable to any type of system. For example, some current TRIZ principles could not be used "as-is" for obtaining descriptions that are meaningful to business people because they may not be easily understood in a business environment (e.g. "mechanical vibration", "pneumatics and hydraulics", and "flexible shells and thin films" are excluded from this list).

Table 2. Revised List of Inventive Principles for Improving a Useful Function

Find a way to improve Useful Function						
Change Vision (Outcome)	Change Functioning	Mobilize Resources				
		Space	Time	Energy/Forces	Substances	Information
Intensify	Exclude	Vacant space	Preliminary action	In a system	System elements	Properties
Disposable	Inversion	Another dimension	Synchronization	Dissipated	Raw materials	Output flows
Universality	Partitioning	Nesting	Parallel processing	Flows	Waste	Passing flows
Specialization	Integrate	Passing through	Use pauses	Environmental	Inexpensive	Detection
Dynamism	Mediator	Take out the part	Accelerate	Transformed	Transformed	Additives
Matching	Use model	Localize	Stretch out			
Partial action	Feedback		Post-process time			
Excessive action	Controllability					

Table 3. Revised List of Inventive Principles for Counteracting a Harmful Function

Find a way to counteract Harmful Function.						
Change Vision (Outcome)	Change Functioning	Mobilize Resources				
		Space	Time	Energy/Forces	Substances	Information
Eliminate the cause	Exclude	Vacant space	Preliminary action	In a system	System elements	Properties
Vaccination	Inversion	Another dimension	Synchronization	Dissipated	Raw materials	Output flows
Isolate	Partitioning	Nesting	Parallel processing	Flows	Waste	Passing flows
Counteract	Integrate	Passing through	Use pauses	Environmental	Inexpensive	Detection
Redirect	Mediator	Take out the part	Accelerate	Transformed	Transformed	Additives
Hide	Use model	Localize	Stretch out			
Restoration	Feedback		Post-process time			
Take benefit	Controllability					

Table 4. Revised List of Inventive Principles for Resolving a Contradiction

Resolve the contradiction: contradictory function should produce useful result and should not produce harmful result.						
Separate contradictory requirements				Mobilize Resources		
In structure	On condition	In space	In time	Energy/Forces	Substances	Information
Element and whole	Find condition	Different locations	Preliminary action	In a system	System elements	Properties
Between subsystems	Environmental	Another dimension	Synchronization	Dissipated	Raw materials	Output flows
Integrate	Dynamism	Nesting	Parallel processing	Flows	Waste	Passing flows
Mediator	Excessive action	Passing through	Use pauses	Environmental	Inexpensive	Detection
Use the culprit	Partial action	Take out the part	Accelerate	Transformed	Transformed	Additives
Use a model		Localize	Stretch out	Intensify	Isolate	Controllability
		Redirect	Post-process time	Counteract		Feedback

Lesson 5 - Stepwise Approach to Inventive Principles

Inventive Principles must be explained to the students with patience and clear graphic examples in the context of what they know. A simple step-by-step process allows the instructor to clarify misunderstandings of inventive principles. Thus lasting connections are made and the retention is reported to be better[18]. The process is as follows:

1. Clear examples of an inventive principle
2. Homework where the student must match and explain the inventive principle to a list of solutions by an inventive principle
3. Quizzes that validate the understanding of matching inventive principles.
4. Homework to generate your own examples of inventive principles from your experience.

The students who successfully complete homework show an ability to recognize Inventive Principles and should be able to apply these principles to generate new ideas.

Lesson 6 - A Basic Syllabus
A basis syllabus is broke down into Fundamentals and Application to a Real Problem. The Table of Contents is as follows:

Part I: TRIZ way of thinking

1. Introduction
2. TRIZ Fundamentals
3. Ideality
4. Resources
5. Function Modeling
6. Guided Brainstorming
7. Brainstorm Ideas - Improve Useful Function
8. Brainstorm Ideas - Counteract Harmful Function
9. Brainstorm Ideas - Resolve Contradiction
10. Develop Concepts

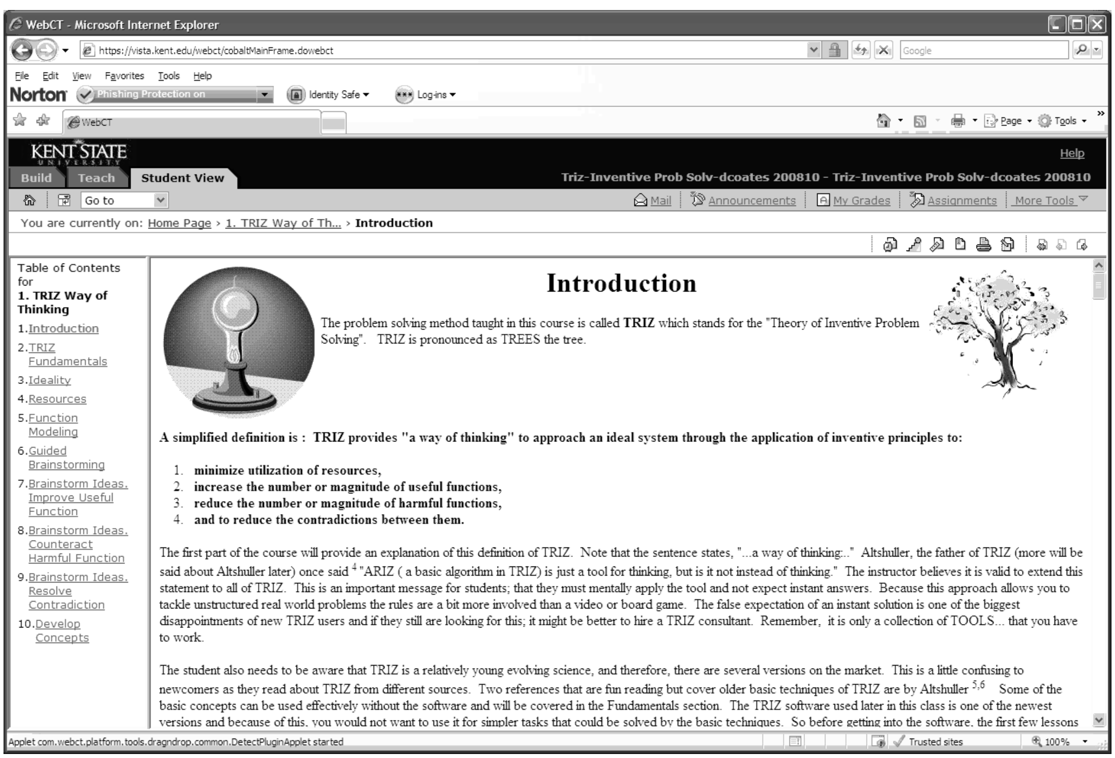
Part II: Project – real problem

1. Structured Innovation Project
2. Situation Assessment
3. Build Function Models
4. Generate Ideas
5. Evaluate Ideas
6. Develop Concepts
7. Action Plan
8. Student Presentation

An example of the Home Page and Part I for this course is shown in Figures 5 & 6 below.

Figure 5. Example of Home Page for On-line Course

Figure 6. Part I Syllabus Example



Lesson 7 – Tailoring the Communications

One approach to tailoring the communications and training is to teach TRIZ to selected groups of students versus the masses. This is both a strategy and a perplexing question. When it comes to physical problems many of today's students lack the experience to solve general problems regarding nature. An increasing number grew up watching TV and playing on the computer while a decreasing number grew up in an agrarian setting, solving mechanical problems as necessity for independent living.

In addition, it seems that the group of students interested in science and math, and/or attend science and technical contests, find more passion and interest in TRIZ. They are augmented by those that are considered early adopters that have developed interests in new things and concepts. Studies on adults[19] show that early adopters are more eager to try a new approach while others will follow once the approach is adopted. It is conceivable that this extends to adolescents as well. One approach to improving communications and the success rate of TRIZ training is to start with these students.

A further tailoring is to understand the metaphor that not all students should go out for football, so maybe not all students should try being Class A problem solvers. Thus, there might be different levels of TRIZ communicated to different levels of interest and skills among students. The expectations should be adjusted for what their anticipated usage will be.

In summary, these observations taken together say the success ratio of communications, usage, and retention could be higher with more tailored audiences and tailored material versus what has been done in the past.

Lesson 8 - Improving Long Term Involvement and Goal Transfer

Another way to improve the cognitive learning of the students is to make the class goal a personal goal. A course goal can relate to a project that is of interest to the student such as a project at work, a personal goal, or to a contest goal. An example is the use of the TRIZ methodology in a First Lego League or Pinewood Derby contest where it can create a high level of interest since it transfers the training goal of the instructor to the contestant's goal as a means to win a contest. The students become mentally proactive and think about the outcomes versus trying to memorize something for a test. Project activities have become more important in our training. This is why the projects represent half the grade for the course.

A further method is to extend involvement, which should improve the retention of the material. This is done by making the goals of the course longer term than the course itself. Work projects can seldom be completed during the semester so the student extends his involvement with the material. Users groups, contests, symposiums, and consortiums also perpetuate the longevity of use and therefore improve the retention and skill level.

Lesson 9 - Function Modeling Simplifies TRIZ

The use of function modeling in conjunction with Structured Brainstorming allows the dissection of a large problem into smaller problems. The user can see the overall problem objectively with little prejudice and psychological inertia. It creates visibility on key problems and avoids insignificant problems. The student can develop ideas from solving various smaller problems, which can be combined into complete concepts for solutions. This is a simpler alternative to Standard Solutions and Substance Field Analysis since their methods are less familiar to many students (e.g., block diagramming, flow charting, organizations charts all create some familiarity with function diagramming).

Lesson 10 – Importance of the Ideal System and Ideal Visions

The ideal system concept and ideal vision concept are in a sense starting from the ultimate solution. These are important concepts for the student to understand from the beginning of the training. The authors say this is starting from the solution and working backwards. This is a concept promoted by one well-known researcher[20]. In a sense, this is an inversion approach, which is an inventive principle, and which provides an insight into a functional way to achieve a solution. For instance, if putting more air into water in a pond than can be achieved by bubbling is a challenge, visualize the result where there are lots of bubbles in the water. How would you remove the bubbles? One idea is to allow the water to settle. The inverse of that is to create bubbles by agitating the water. A list of ways to agitate water, such as waterfalls, ultrasonics, fast action, etc. come to mind.

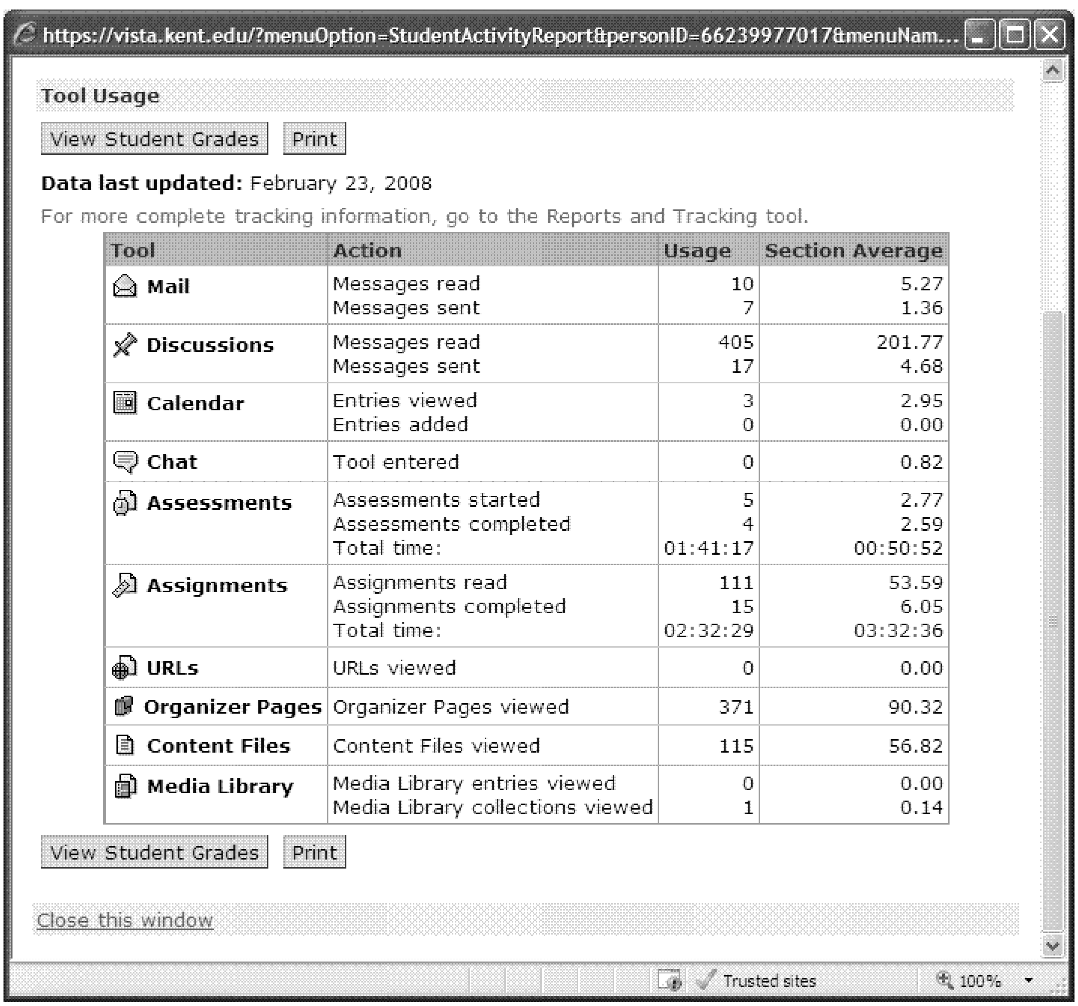
Lesson 11 - Distance Learning (DL) via the Internet Can Be Very Efficient

Offering DL classes via the internet may be a more successful for communicating TRIZ than lecture based delivery, when structured with the following capabilities:

1. The class size should be kept relatively small (under 15). With the current format the authors are using, DL allows instruction to be more individual but this requires more time. When students have a question, a timely response is needed so they can maintain their continuity of thought and momentum. If the instructor is not available, they get general help from each other from on line discussions, which a reinforcement for the students giving the help. Although this is not as instantaneous as a live class, it is adequate and sometimes offers dialogue that is more individual with the students than in a live class. Live classes do not allow as much individual attention due to the shortness of time during class, embarrassment, or the difficulty of making special appointments. In addition, distance learning makes use of unused time that better fits the instructor’s and student’s schedules.
2. The ability to service students from distant places efficiently is a great benefit of DL[21]. With the cost of energy rising and people needing retraining, a DL class can accommodate a wide range of needs. It can also allow the students to practice the methods by doing real problems instead of commuting to a lecture.

3. A computer based teaching engine is a valuable tool to make DL productive for the instructor and viable (such as Blackboard/Vista). Use of self scoring tests, automatic grade posting, logging of student activity vs. a course average, course e-mail, homework submissions, containment of all course material in one place (and not commingled with other e-mails), student discussion sites, paperless approach, etc., are many of the advantages that are available with a teaching engine. It is easy to underestimate the importance of this tool. As mentioned, student discussion groups are important ways for them to teach each other, which is one of the better ways to improve retention. In addition, the program can monitor individual student activity to help the instructor interpret student problems. The instructor can be proactive and encourage the student who is not studying the material to be more industrious so that a communication problem is avoided. Figure 7 shows the level of detail that can be available for each student. It is obvious from the report that this student is studying more than the average. In this case, his grades also show better performance.

Figure 7. Individual Student Activity Report


https://vista.kent.edu/?menuOption=StudentActivityReport&personID=66239977017&menuNam...

Tool Usage

View Student Grades | Print

Data last updated: February 23, 2008

For more complete tracking information, go to the Reports and Tracking tool.

Tool	Action	Usage	Section Average
Mail	Messages read Messages sent	10 7	5.27 1.36
Discussions	Messages read Messages sent	405 17	201.77 4.68
Calendar	Entries viewed Entries added	3 0	2.95 0.00
Chat	Tool entered	0	0.82
Assessments	Assessments started Assessments completed Total time:	5 4 01:41:17	2.77 2.59 00:50:52
Assignments	Assignments read Assignments completed Total time:	111 15 02:32:29	53.59 6.05 03:32:36
URLs	URLs viewed	0	0.00
Organizer Pages	Organizer Pages viewed	371	90.32
Content Files	Content Files viewed	115	56.82
Media Library	Media Library entries viewed Media Library collections viewed	0 1	0.00 0.14

View Student Grades | Print

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4. Demonstrations via video and stellar graphics on the web are possible and are the media “du jour” for our young people today vs. difficult live presentations. Even pod casts can be provided for the mobile society.
5. Students can see problems very differently than the instructor, and the course material can be surgically honed as problems are discovered to assure that the concepts are understood.

Lesson 12 - Use a TRIZ Computer Software Program in Training

This is probably one of the more debatable lessons, but the plethora of versions of TRIZ on the market makes it confusing and there is a lot to remember with TRIZ. By providing a computer-based program, terminology is more consistent and the methodology is more rigorous and consistent. Use of hyperlinks and a glossary in the program are helpful.

Observation – Method and Feedback Versus Best Answer

Providing good feedback and reinforcement versus getting a grade is more important for learning and it reduces the fear of participation. Grades are very important to students and grades tend to emphasize getting the right answer versus learning. The author believes that the student demonstrating the method is more important for the grade versus an exact answer. Through this and coaching, we encourage the right behavior.

SUMMARY AND CONCLUSIONS

In summary, we need to move from a lecture driven paradigm to a learning paradigm for better TRIZ communication and retention. The heuristic methods of pedagogy, discovered by experience and supported by the literature, are believed to improve the communication, utilization, and retention of TRIZ. The methods that are listed in this paper are: active involvement, short and long-term goal transfer using personal real problems, training others, tailoring the communication to the audience, and connecting the method to existing knowledge. These methods are coupled to a new simplified computer based approach to TRIZ that are taught with a distance learning teaching engine. The syllabus for the course is constructed with increasing levels of difficulty. It is hoped that the TRIZ community finds these suggestion helpful to improve their communication of TRIZ.

END NOTES

[1] Malkin Sergey, Coates Donald, Malkin, Galina. "An Improved Method for Teaching the Theory of Inventive Problem Solving to Students", Conference Proceedings TRIZCON2007, Louisville, *KY*

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Real Player is required to view this. This presentation/lecture is also available at http://www.stanford.edu/group/Zarelab/ <accessed 2-11-2008>

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Biographies

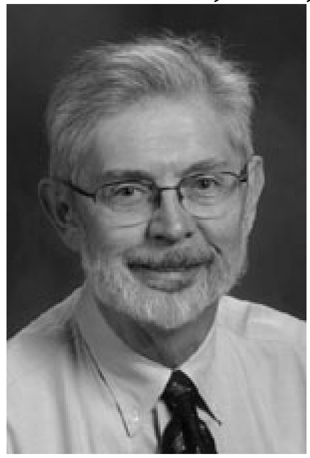
Sergey Malkin

Sergey Malkin VP-Technology, Pretium Consulting Services, LLC is a well-know TRIZ Expert, trained by the method's founder, Genrich Altshuller and has more than 23 years experience of TRIZ application. He has held positions of Director of Software Development, Ideation International Inc.; CEO, Private Enterprise Eurotecton; VP TRIZ&VE, Foton Corp. Sergey holds a MSEE from Sevastopol University and an MBA from Simferopol Business School.

Galina Malkin

Galina V. Malkin TRIZ Specialist, Pretium Consulting Services, LLC has been working with TRIZ for more than 20 years. Mrs. Malkin has taught TRIZ to students of different ages, including engineers, college students and schoolchildren. She had also taught the adapted elements of TRIZ to preschool children. Based on her experience working with younger children, she developed an educational program to teach TRIZ to elementary school students in Lithuania. Mrs. Malkin has also worked as a TRIZ specialist on numerous industrial projects. In 2006, she began her collaboration with Pretium Consulting Services. Mrs. Malkin's subject matter expertise is in biological research. She has worked in various industrial and academic labs and for the last 5 years, she worked at Wayne State University. Galina holds an MS degree in biology from Simferopol State University.

Prof. Donald Coates, Ph.D., P.E.



Professor Coates teaches courses on innovation, energy power and industrial controls at Kent State University's College of Technology. Previously he was Vice President of Engineering at the Speed Queen Division of Raytheon, Director of Corporate Primary Development and Director of Dishwasher Engineering at the Frigidaire Company of AB Electrolux, Director of Research for the Hoover Company of the Maytag Corporation and Manager of Whirlpool Automatic Washers at the Whirlpool Corporation. He received a Ph.D. and MSME for Purdue University and a BSME from the State University of New York at Buffalo. He also received the Distinguished Engineering Alumnus and Outstanding Mechanical Engineer awards from Purdue University. He holds 16 patents, eight pending, and has authored eight papers. He is member of the American Society of Quality and the National Society of Professional Engineers.