Theory of Constraints

Creative Problem Solving

Umesh Nagarkatte and Nancy Oley

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Foreword

Throughput equals sales minus total variable costs: an appropriate equation if the goal of your organization is to "Make money, now and in the future." But what if your organization's goal is not making money, but money (budget) is a necessary condition of existence? Dr. Eliyahu M. Goldratt's theory of constraints (TOC) spoils its practitioners. They are conditioned to believe that by addressing the system's constraint (steps 1, 2, and 3 of the five focusing steps), the results can only be nothing short of spectacular—anything else would be a "chupchik"—at best, improvements on the margin with a nonconstraint resource.

What if the goal of the system was to enrich its product? How easy is it to define success if the rate of throughput is measured in terms other than dollars? The system is the Mathematics Department at Medgar Evers College (MEC) of the City University of New York. The product is predominantly single, inner city females caught in a struggle to raise their families now or pursue a meaningful career through education in the future. Many of us know of similar situations. The immediacy of the short term overrides the promise of the future in the long term. We know which one wins out in this compromise virtually every time!

I first met with Dr. Umesh Nagarkatte (then professor of mathematics) in the summer of 2001 at the Avraham Y. Goldratt Institute in New Haven, Connecticut. I was the dean of the Avraham Goldratt Institute (AGI) Academy. My role was working with academicians expressing a desire to incorporate TOC into their curriculum. Our experience was that most academicians who become involved with TOC normally do so with the objective of teaching elements of TOC within their existing courses or curriculum, mainly its logistic applications (production drum–buffer–rope, replenishment, Critical Chain Project Management) and to some extent its TOC thinking processes (strategy). After several discussions, this was clearly not the

case with Dr. Nagarkatte. His subject matter for applying the TOC thinking process tools was *improving student retention* and, more specifically, female students interested in mathematics. As their efforts were rewarded with success, the focus was later extended to include female students in science and technology. Given the challenges at hand, the current state was woefully short of achieving the desired end state. We needed a strategy of change and the means to manage it.

What do they change, and why? We're all familiar with the adage "To improve one must change. But is every change an improvement?" Given the current state, what would they require in its place, and why is that justified? (construction phase). What was the sequence of tasks that needed to be accomplished? What resources were required, and were they available? (implementation plan phase). From whom did they need to solicit support—who could support and influence the effort, as well as who could derail the effort? (communication phase). Dr. Nagarkatte and Dr. Oley refer to this phase as "TOC also meaning theory of communication" and "theory of empowerment (TOE)." In total, this was the scope of effort behind improving student retention. The strategy went well beyond the Mathematics Department. Direct support of counseling and administration were also critical elements to success. The principal investigators, Dr. Umesh Nagarkatte, Dr. Darius Movasseghi (department chair), and Dr. Joshua Berenbom, professors of Mathematics, focused TOC on a system-level approach across the college, designed with student performance at the core. In nearly all universities and colleges, students flow through the system with the hope of becoming graduates. Professors add value through an accredited curriculum of study leading to the awarding of a degree. *What if the goal of the system was to enrich its product?* That was the theme behind designing the system with student performance at the core. This was a team of professors with the support of the college president and his cabinet, going above and beyond adding TOC content to a course or curriculum.

I was privileged to facilitate the professors' use of TOC to build a better system and enrich the lives of their students. In all my years of TOC (since 1993), and of all the implementations of TOC, this one holds a special place for me, not because the professors were successful in achieving their goal, but because in so doing, they enriched the lives of their students, empowering them to achieve their full potential. What better gift could students receive from their professors? This team of professors provided meaning behind President Jackson's vision of "Creating success, one student at a time."

Of the difference between smart and wise men, Dr. Eliyahu M. Goldratt said, "A smart man learns from his mistakes; a wise man learns from the mistakes of others." Be wise—and learn from works of Drs. Nagarkatte and Oley to enrich your lives and those of your students.

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Preface

Thinking is fundamental to being human. The theory of constraints (TOC) has thinking process (TP) tools to help people think systematically. Using them, one can learn how to manage real-life constraints. A constraint is something that stands in the way of achieving a goal. TP tools are based on logic. They are simple enough to be used by kindergarten children for modifying their own behavior and sophisticated enough to be used by chief executive officers to bring their corporations out of bankruptcy. In our experience, TOC becomes theory of empowerment (TOE). It also becomes theory of communication.

This text is intended to help creative thinkers and people who are interested in continually improving knowledge and education, or the Process Of OnGoing Improvement (POOGI). It is especially intended for the higher-education community—students, parents, mentors, educators, advisors, counselors, and administrators. It purposely includes all these audiences since they form components of the *student success system*. TOC needs patience on the part of stakeholders. It is designed to teach TOC and its powerful graphical logic-based TP tools. The tools can be used for creative writing, creative projects, conflict resolution, decision making, and problem solving. The authors feel fortunate in having come across TOC and TP tools and have used them for all their creative work in the school setting and in other activities. They have used the tools for systems approach applications and other related activities described in this book, curriculum development, and preparing reports or presentations. They have used them to write several grant proposals, which have brought in close to four million dollars in external funding for helping students and improving instruction. The first author has used the tools to do research in mathematics; publish three math textbooks, three philosophy books and several articles; and give numerous talks on meditation. The second author has used them in a community

setting and to help individuals. Once internalized, most of the time, graphical representations are not necessary. One can see mentally the logical consequences and understand the different sides of an issue, and one can surmise the obstacles and do appropriate project planning without leaving logical gaps. These tools may be applied rigorously to a personal issue, an interpersonal issue, a course content issue, a departmental issue, or an institutional issue. The tools can be used to find win–win solutions for conflicts without compromise or loss for any party. In writing this book, we also hope to encourage open communication between practitioners of TOC around the world.

It is very troubling to see so many young men and women leave school and never fulfill their true potential. We include illustrations in each chapter to show how young men and women, in school or outside in the community, can be empowered to resolve conflicts, make decisions, solve problems, complete school, and succeed. This work is the result of 15 years of research on implementing TOC by two faculty members in an urban undergraduate college who share the common goal (ambitious target) of wanting to stem the tide of student attrition. The authors are aware that this goal cannot be achieved by only one or two people working together, but can be accomplished easily when the entire institution participates in the effort. They feel fortunate that they work in an institution where almost everyone shares this goal. They know that high attrition is due to many factors and is not unique to their college. High attrition is common at many public undergraduate institutions around the country and around the world. It is the authors' belief that their initiative will be replicable in many other institutions that are also struggling to improve retention and graduation rates.

Many educators wonder what to do when their best curriculum developments and well-funded enrichment programs do not greatly improve retention. Their reaction is to give up or to blame the secondary schools for social promotion. They blame distracting TV, the Internet, cell phones, iPhones and iPads, social media, texting, and tweeting. They blame the social structure, or community, or someone else. If their curriculum development programs do succeed, they are local, in the sense that they depend on the personality of the initiator and do not apply globally to the institution. The first thing that we learn in TOC is not to blame anyone, except perhaps *Murphy's law*—what can go wrong, will go wrong—and to provide for it. TOC has a unique way of taking into account not just a student's academic needs, but also his/her personal needs. TOC establishes communication between

various stakeholders so that they can work as a unit to address the problem at hand. In that sense, TOC also stands for theory of communication!

TOC asks three basic questions: (1) What to change? (2) What to change to? (3) How to cause the change? TOC considers the issues of all stakeholders—students, faculty, staff, administration, family, and community. Each stakeholder focuses on his/her area of direct control or influence. This means that the president's issues are different from the student's issues. Regardless of who is addressing the problem, TOC has the same logical TP tools. In other words, the same TP tools can be used to solve institutional—academic or nonacademic—as well as personal problems. Since the tools are logical, they transcend the personalities involved. Anyone considering the same issues, having an intuition about them, and following the TOC roadmap will come up with equivalent solutions. TOC teaches one how to think out of the box and how to go beyond one's familiar assumptions by challenging them. Once mastered, TOC becomes a part of the learner's general approach to resolving any conflict with a win–win solution, solving problems systematically, and making decisions that do not lead to negative consequences in the long run. TOC yields insight into a problem situation. Using TOC and their professional expertise, counselors, faculty, or administrators can resolve the problem in a more systematic and coherent manner instead of wasting resources on individual, isolated, or redundant efforts.

TOC empowers a student to lead a successful life without compromising either his/her personal needs or his/her studies. The TP tools help students to be proactive. TOC can be used by a first-year student program to empower students. In order to give freshmen an opportunity to interact with both faculty in his/her chosen major and his/her academic advisors, a TOC course—see the syllabus at the end of Chapter 5—could be taught by a team of academic advisors and academic instructors in different disciplines using examples of TOC in content areas. Hopefully, this will increase students' motivation to continue on in their chosen major. This book is the only textbook available at present at the college level that can be used for a systematic study of TOC and its application to a student's chosen major or discipline.

The textbook has seven chapters. Chapter 1 is the introduction to TOC and its TP tools and explains the importance of studying TOC. Necessity and sufficiency cause-and-effect thinking is explained here with examples. A few sections show how to help develop student's critical thinking. Chapters 2 and 3 answer the question, "What to change?" using the Branch and Evaporating Cloud tools to resolve various types of conflicts. In Chapter 2, the Negative Branch Reservation (NBR) and Current Reality Tree (CRT)

are introduced to develop a holistic picture of the person's or institution's current situation. In Chapter 3, we begin with Evaporating Clouds that show students how to resolve daily conflicts. If students resolve one conflict every day, they will quickly learn how to create win–win solutions in their lives. Some clouds help resolve chronic conflicts. Some clouds help empower students. We also show how the cloud tool can be used to develop a persuasive essay. With the Evaporating Cloud and the CRT together, one completely develops an answer to the question: "What to change?" Chapter 4 answers the question "What to change to?" What should the future look like? It teaches cause-and-effect relationships through which students can see the likely consequences of their actions. They are introduced to the Future Reality Tree (FRT) and the Transition Tree (TrT). The FRT and NBR answer the question, "What to change to?" completely and show how to avoid negative consequences of the strategies suggested. Chapter 5 introduces the Prerequisite Tree (PrT) to answer the question, "How to cause the change?" It describes how to uncover the often hidden obstacles that are in the way of achieving goals and shows how to prepare project plans. There are several appendices on everything that one needs to know about achieving academic success, critical chain project management of a course, how to study any course, and why and how to study mathematics. This should help students take responsibility and use the college resources to achieve their goals and not settle for anything less. Chapter 6 can be used for solving institutional problems using the five focusing steps of TOC. One major example of an institutional approach is explicated throughout the six chapters to illustrate the systematic logical link among the TOC concepts discussed in each chapter. Sections on TOC-based program review and strategic planning are very relevant to institutions of higher learning. In Chapter 7, we discuss measurable outcomes of TOC implementation. We discuss the TOC initiative at Medgar Evers College and its overall effects. The answer to the question "How to cause the change?" is not complete unless there are measurable outcomes.

The theory of constraints was developed by Eliyahu (Eli) Goldratt around 1980. TOC has an established track record in industry and the school systems of Singapore, Malaysia, and the Philippines. It is also used in Asia, Europe, Africa, and South America for instruction and community work. In Singapore, TOC is used to produce *paradigm change* in prisoners: TOC changes the way that the prisoners think about themselves so that a high percentage live a productive life in society and do not return to prison. At least 15% of the world's businesses currently use TOC for

their operations. TOC is also taught as a required subject in most business schools' M.B.A. programs. But there are several well-known business schools such as Wharton that use TOC or constraint management for all of their operations. The authors' institution, Medgar Evers College (MEC) of the City University of New York, is the first and only liberal arts college where administration, faculty, staff, and students have shown willingness to apply TOC to address the problem of student attrition. It is well on its way to a systemic resolution of the problem. One criticism of TOC is that it has not been applied enough in education as it has been in business and industry. This text tries to show that TOC is as powerful in education as in other fields.

Our experiment with using TOC to address attrition in mathematics courses began in January 2002. Darius Movasseghi, then chair, Joshua Berenbom, and the first author, all faculty in the Department of Mathematics at MEC, participated in formal Jonah training at the Avraham Goldratt Institute (AGI) Academy, New Haven, Connecticut. Tracey Burton-Houle and Steve Simpliciano were the facilitators. The training was funded by an institutional grant for 2001–2004 from the Minority Science Engineering Improvement Program (MSEIP) of the U.S. Department of Education. The attendees used the entire TOC roadmap (described in Chapter 6 of this book) during a two-week intensive workshop to develop a detailed project plan for the Mathematics Department. Their findings were discussed informally by the chair with other faculty in the department, devoting a few minutes of every monthly departmental meeting during the Spring 2002 semester. As the major issues of the department were brought out and discussed in the open, a congenial environment developed that attracted a large number of students to become mathematics majors the following semester. The department developed new curricula and improvements in mathematics tutoring. The faculty developed departmental guidelines that helped all faculty and support personnel work toward student retention. The POOGI of TOC, started in 2002, is so robust that it was still vibrant and expanding at the time of this writing.

TOC analysis addressed the needs of the "whole" student, not just his/her academic needs. The project plan that we developed showed how and where the academic advisors, personal counselors, and the Basic Skills Department could participate with the Department of Mathematics to address the problem of attrition. The facilitator, Steve Simpliciano, made a presentation to the college president, Edison O. Jackson, and his key cabinet members in May 2005, about what the team had learned and offered

the *Departmental Guidelines* as a deliverable. President Jackson approved the guidelines and expressed his desire that everyone in the college should learn TOC, starting with the Basic Skills and Freshman Year Program faculty. Two additional institutional federal grants (MSEIP 2004–2007) and Women's Equity in Education Act (WEEA 2005–2007) facilitated the formal Management Skills Workshop (MSW) training at the Avraham Goldratt Institute of key individuals and more faculty. The grants also provided resources to hold various campus workshops for tutors, academic advisors, counselors, and Basic Skills instructors from 2005 to 2007. In the Spring 2008 semester, President Jackson himself, along with his senior administration, reaffirmed his commitment to address institutional issues using TOC. He laid out a logical plan for administrators and middle management designed to reduce attrition during the first year.* The efforts to improve were continued thanks to four more MSEIP grants†: institutional and cooperative in 2010–2013, institutional in 2012–2015, and institutional in 2013–2016. In 2011–2013 Victor Nwaokwu, an MEC computer science major student, developed a website http://www.tocforcollege.com as an undergraduate research project supported by the New York City Louis Stokes Alliance for Minority Participation (NYCLSAMP) grants.

Among the faculty attending the formal TOC Management Skills Workshop in December 2005–January 2006, was Nancy Oley, the second author. Actually, as early as 1999, she encouraged the first author to apply TOC to the problem of student attrition. After formal training, she has supported all TOC workshops in the college and made several presentations at conferences. Since 2006 she has applied more TOC tools than anyone else in the college—in faculty development workshops, in her Faculty Senate activities, and in her courses in Psychology. Nancy is a leader in implementing TOC within content areas in an academic discipline. She has helped to develop and edit the TOC for College website: http://www.tocforcollege.com. Dr. Oley received Theory of Constraints International Certification Organization Jonah certification after completing the Constraint Management course (EM 526) taught by James Holt at Washington State University at the end of Spring 2008.

* The authors acknowledge the support of colleagues at MEC and Queensborough Community College from the Mathematics Department, Freshman Year Program, Counseling, and SEEK Department.

† Thanks to the reviewers and program officers of US Department of Education.

Acknowledgments

The authors acknowledge the collaboration and support of their colleagues, especially Darius Movasseghi and Joshua Berenbom. Quite a few figures in the textbook are from the joint work of the authors with them at AGI. It was Darius Movasseghi who took the leadership to promote TOC in the department and participated in many international presentations. The authors also received constant encouragement and support from MEC President Edison O. Jackson. They offer their thanks to all at MEC for their support. Many facilitators provided TOC training in a variety of workshops: Howard Meeks of Iowa State University; Kathy Suerken, president of TOC for Education, Inc.; Belinda Small of the Florida School system; Danilo Sirias of Saginaw Valley State University, Michigan; and Janice Cerveny of Florida Atlantic University, Port St. Lucie, Florida. Many advisors, counselors, tutors, and faculty participated in these workshops. We thank them for their support. Alan Barnard of Goldratt Research, South Africa, made an important theoretical presentation at the TOC for Education Inc. 10th International Conference, Florida, in 2007. Some slides from his presentation are included in the book. James Holt from Washington State University, Vancouver, Washington, offered an online Constraint Management course (EM 526) gratis to academics, which triggered a flurry of TOC activity around the college, including presidential retreats to complete the homework of the course. Many slides from the various MEC workshops are included in the textbook with the facilitators' permission. Dr. Holt's critical comments helped us to write Chapter 7—"Epilogue." The authors are indebted to them. Thanks to Eva Chan, director of the Office of Institutional Research, and Janice Cerveny for their help in developing feasible numerical measures for Throughput and Return on Investment in Academia discussed in Chapter 6. These are important logically derived measures, not just the number of graduates. Janice Cerveny also provided some slides related to program review and strategic planning.

Tracey Burton-Houle and Steve Simpliciano were instrumental in covering the TOC roadmap by assigning a lot of homework in the Jonah course in January 2002. Steve Simpliciano introduced TOC free of charge to the first author in 2000 and facilitated the development of a CRT that matched the CRT developed in the Jonah program. Thanks to Tracey and Steve for getting TOC started at MEC. The websites http://www.TOCICO.org and http://www.TOCforEducation.com, international conferences and Tactics newsletter of TOC for Education have been very useful for dissemination and communication of our research worldwide to TOC practitioners in education, in the prison system, and in the wider community. Many educators from the United States and abroad have been encouraging the authors to write a book for professionals in higher education. The authors are grateful to all those and the conference audiences who made these opportunities available. They are especially grateful to Howard Meeks, Philip Ording, and Choi Wonjoon of South Korea, who provided detailed improvements in the text. The contribution of Chuck Gauthier of Vancouver, Washington, toward improving the TP tools discussions was invaluable. We also thank Jordan Pola for suggesting improvements in Chapter 6.

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Authors

Credit: Bruce Gilbert

Dr. Umesh Nagarkatte received his Ph.D. in algebraic number theory from the Graduate Center of the City University of New York (CUNY) in 1976. He underwent dedicated Jonah training at the Avraham Goldratt Institute with two of his colleagues in 2002. The team became pioneers in higher education to implement the theory of constraints and thinking process tools by using the college as the *system*. He has been certified as a Facilitator by TOC for Education, Inc. (TOCfE).

Dr. Nagarkatte, with the assistance of coauthor Nancy Oley as editor and evaluator, received federal grants in 2001–2004, 2004–2007, 2005–2007, 2010–2013, 2012–2015, and 2013–2016 for using the theory of constraints (TOC)/thinking processes (TP) to address the problem of attrition. He has used TOC/TP with his fellow Jonah, Dr. Joshua Berenbom, to develop three textbooks—*Prealgebra*, *Elementary Algebra*, and *Intermediate Algebra*—adapting the Singapore Model Method to the college level. Oley and Nagarkatte started working on the current book on TOC/TP in 2010 to empower students, counselors, educators, and other stakeholders to work as a team to ensure student success.

Dr. Nagarkatte taught at the Borough of Manhattan Community College, CUNY, from 1971 to 1976. He recently retired as Professor of Mathematics from Medgar Evers College, CUNY, where he had taught since 1978. His research interests are in algebraic geometry; number theory; applications of mathematics to chemistry and environmental science, philosophy, and meditation; and applying TOC/TP to all areas of interest.


Credit: Tony Gallego

Dr. Nancy Oley received her Ph.D. in experimental psychology from Columbia University and did postdoctoral work in neurophysiology at Florida State University and in neuropsychology at Teachers College, Columbia University. She studied TOC at the Avraham Goldratt Institute and Washington State University, and is currently certified as a Jonah by the Theory of Constraints International Certification Organization (TOCICO) and as a Facilitator by Theory of Constraints for Education, Inc. (TOCfE).

Dr. Oley has pioneered the incorporation of TOC processes and concepts within the content of her psychology courses, helped to develop TOC curricula for incoming college students, created a short TOC course/workshop for remedial math students, and collaborated with coauthor Dr. Umesh Nagarkatte for over 10 years on numerous federally funded TOC-related grants and projects aimed at optimizing the college system to improve curriculum and instruction in mathematics and to reduce attrition.

Dr. Oley has held positions of leadership in university governance as well as in state and national scientific organizations, and has published in the areas of pain/analgesia, memory, nervous system regeneration, olfaction, and the teaching of psychology. She has engaged undergraduate and graduate students at a variety of institutions, among them Augustana College (Illinois), the University of Hartford, Trinity College (Connecticut), Columbia University, and Medgar Evers College, CUNY, from which she recently retired as professor emerita of psychology.

Chapter 1

Introduction

1.1 Organization of the Book

This book is organized into three major sections, dictated by the three basic questions of the theory of constraints (TOC): what to change, what to change to, and how to cause the change. Within each section, there are practical examples followed by discussion of a specific thinking process (TP) tool used to answer the three basic questions, as it applies to understanding and dealing with simple problems. If the knowledge of stand-alone tools is sufficient, the reader-creative thinker or student can study those specific tools and skip some material as directed. In later chapters, the tools are used formally to solve complex system problems within the broader context of TOC. The last chapter is a review of a systems approach using tools discussed in the earlier chapters and the TOC roadmap, and mainly for department heads and administrators who are sincerely interested in the Process Of OnGoing Improvement (POOGI) and are not just interested in a Strength, Weakness, Opportunity, and Threat (SWOT) analysis of their department or institution for a program review or a strategic plan.

1.2 Reasons for Writing This Book

1.2.1 Student Empowerment

An instructor has accepted two students to do research with her during the summer. One student, Cheryl, is very responsible and hardworking. She does her homework regularly while taking care of her three children,

1, 4, and 7 years old, at home. The second student, Mary, did not respond to numerous e-mails that the instructor sent. Before the actual research began, there were several steps that had to be completed such as obtaining Institutional Review Board Certification and attending a workshop. Cheryl completed them in a timely fashion. Mary, on the other hand, came up with different excuses as to why she was unable to get certified. After talking to people in charge of the research, she was granted a 2-week extension to finish the certification. Luckily, Cheryl and Mary showed up on time at the first research meeting. The instructor warned Mary that if she did not complete the certification during the grace period, she would be out of the program. Cheryl helped Mary to register for the certification, and after 10 days, she completed the requirement.

In the meantime, the instructor met with her two students twice a week. Both came on time. However, Mary did not do her assignments most of the time, and whenever she did some work, it was all wrong. She did not follow any of the instructor's directions. She could not concentrate during their meetings, always yawning or showing disinterest in what was going on. Whenever Mary was told that her work was unsatisfactory, she started crying. When asked if she had other issues at home bothering her, she would just nod. However, sometimes, Mary was engaged and came up with unusually good ideas regarding research. This gave the instructor some hope.

During one meeting, she told Mary that she is intelligent but behaves very irresponsibly. Mary whimpered a little. That day when Mary and Cheryl were working together in the next room, she went to see if they had completed the work. There were a couple of papers and a pen lying on the floor. Cheryl said that they belonged to Mary, but that she had been gone for some time. Cheryl mentioned that Mary had expressed disgust with her life in general and had thrown all of her papers and pen on the floor. But after a few minutes, she picked them up. When Mary returned, the instructor asked her what was really bothering her. Mary started sobbing and told her that she was not crying because of anything that the instructor had said to her.

Mary had major problems at home. Her father had passed away when she was young. Her sister was behaving badly, and her mother was seriously ill. Being the only child around her mother and being very shy, she always got blamed for all the difficulties that the family was having. The family was poor. Mary did not have enough money for public transportation to come to school more often. She did not have a computer at home and had to come to school to have access. After hearing her predicament, the instructor

advised her to go to a counselor, because she herself was not an expert in handling problems of this nature. Before she left, the instructor assigned Mary homework for the next meeting 4 days later. Mary went to a counselor. Three hours later, she returned to the instructor with a happy face and gave three typed pages of the homework four days in advance of the deadline. She confirmed the instructor's gut feeling that Mary was quite intelligent. Her work was almost perfect; only minor changes had to be made. This was the first time that she had done any satisfactory work. When asked what caused the sudden change in her attitude, Mary said that the counselor gave her some immediate steps to take and told her that anytime that she needed help, the counselor would be there. This reassurance really helped her. The instructor also reassured Mary that if she had any problems in her research, she should feel free to contact her by e-mail. She also advised Mary to spend more time in school studying in order to keep her mind off her situation at home and so she could graduate, get a job, and help her mother. Mary also mentioned how patient Cheryl had been, listening to her problems. Cheryl had also taught her how to use Microsoft Word and Excel.

This day started out to be disastrous, but ended on a very positive note. The instructor was looking at a happy young woman who was ready to handle her numerous problems. The instructor and the counselor had both undergone TOC training and had just implemented it to empower Mary.

In short, **teachers should not give up on a student just because the student is not working up to expectations. The student may have nonacademic issues standing in the way of him/her giving the required time to the academic work. TOC has TP tools which can be used to address both academic and nonacademic issues**. The student should be referred to a counselor, and both the teacher and counselor should work together using TOC tools to empower the student. In this way, TOC becomes a Theory of Empowerment (TOE). This does require training in TOC for both teachers and counselors as well as communication.

1.2.2 Who This Book Is Intended For

- This book is written for *students at the high school or college levels* who need to have skill in reading comprehension, summarizing, problem solving, and completing projects. Students have dreams. They also have self-doubt. They can conquer their self-doubt by following their dreams. For this, they need to be proactive. **Being proactive means acting appropriately in anticipation of future problems, needs,**

or changes and not being bogged down by the past or blaming someone. These students must know how to resolve conflicts, write persuasive essays, solve problems—academic and nonacademic—know the consequences of any action, make decisions, prepare projects, make presentations, and manage time. They can learn specific TP tools discussed in this book to cover these areas and be proactive. Starting a TOC students' club and repeatedly working on various issues that arise in students' lives would help students to become proactive and help one another to succeed.

In this book, you will see the word *proactive* used quite often, since once the students acquire this quality, the mission of academia is easily fulfilled. These tools are necessary to live a successful life, and the best time to learn them is when one is studying in school or college.

- This book is written for *creative thinkers* who want to do creative work in any field of research or who are working in the college/university environment and desire to fully understand their environment and to improve it, that is, academics, faculty, counselors, advisors, staff, and administrators. People who have worked with students and who have experienced the issues listed in detail in the next section can also use this book. The sections describing individual tools are also useful for students, parents, community workers, youth counselors, leaders of male/female empowerment initiatives, churches, and even people trying to reform the prison system. One of the most important units of any institution that should learn and implement TOC is administration at the top as well as at the middle level. Since the administrators have power and resources to encourage the units' efforts, they need to work with them and to improve their morale. They must know how to use the power and resources effectively, resolve conflicts, guide, and boost morale of people whom they are serving. If the administrators do not consider consequences of their actions, their institution suffers from litigation and wasted resources.

  A preliminary companion website (http://www.tocforcollege.com) has been launched.
- This book is written for *academics* who are concerned with how to: develop better courses, curricula, or texts; help students resolve their personal conflicts and make good decisions; present material effectively in class; improve processes such as registration; improve morale; and improve the overall functioning of units such as departments and programs. The administration can make or break an institution! "It's

ingenuity that will make the difference between a bleak future and a bright one," says Bill Gates.* TOC with its out-of-the-box TP tools can help creative thinking.

- This book is intended as a *reference* for those seeking to understand and apply TOC and TP in the academic world to activities such as improving thinking skills, time management, project management, presentations, teaching students problem solving, and curriculum development as discussed in Chapter 5. Most TOC texts are designed for management and industrial settings and do not have any direct application to academia. We discuss individual TP tools and show how to apply them in a variety of situations ranging from personal life issues to overcoming departmental and institutional constraints. This is currently the only book based on actual experience written for use of creative thinkers and academia—high school systems and institutions of higher education.

1.2.3 What This Book Is Not Intended For

This book will not be of any use to people who want to make ad hoc decisions and who do not have time to analyze the situation at hand or habitually ignore the consequences of their actions. Studying TOC makes one aware of the consequences of any action. Ad hoc decisions do not necessarily consider consequences, and many result in unintended consequences. This book is useless for people who make systemic decisions to serve their personal interests; these decisions often prove detrimental to the system. If they have no interest in the common good of the system, this book is not intended for them. TOC is ethical and will not harm anyone. If a person is looking for a biased solution, TOC will be useless, since TOC produces win–win, impartial solutions and will not favor one side over the other.

1.2.4 College as a System

A college/university is a complex dynamic system with multiple stakeholders, multiple functional units, and multiple processes focused on a single goal: student success. Each institution is committed to attracting students to its campus, educating the enrolled students, retaining a large number of students in various disciplines so that they progress toward their graduation

* Bill and Melinda Gates Foundation Visitor Center, Seattle, Washington.

in a timely fashion, graduating them with good grades, and placing them in careers or graduate/postdoctoral programs in good schools. Every college wants to have employers and graduate/professional schools recruit their graduates. But does every institution reach its goal?

The multiple units of the system encounter many obstacles that stand in the way of achieving their goals. Each individual unit tries to do its best with the resources that it has available. For example, the Faculty Senate of our college, in a sincere effort to stem our student attrition problem, came up with over 30 concerns of students that needed to be addressed. Collectively, the members found that many students have nonacademic as well as academic issues. To address each issue, they proposed a remedial action and the corresponding agency/department in the college that needed to take appropriate action. But who can oversee such a massive effort? Who can tell the department/agency that something needs to be improved? Is there duplication of effort? Are there enough resources to address all the concerns? Who will assess the improvements made?

The academic departments of a college are not equipped to handle students' nonacademic issues. They put all their resources into creating excellent curriculum in terms of the process and content of instruction. They can form articulation agreements with other academic institutions and industries to recruit or place their students appropriately. But it is the dean of students, counselors, and advisors specialized in their own functions who can address students' nonacademic issues, if the students come to see them. The instructor with knowledge of the college resources can direct students to the right person. If the students are themselves aware of these resources, they can on their own approach the appropriate office/person that can help them with their nonacademic or academic concerns. But most instructors, especially adjuncts, do not know what resources the college has to help their students outside of their own department or school. They have an obligation to finish the course syllabus and do not have the interest, time, or expertise to deal with students' nonacademic issues. Some college and university policies do not require students to attend class or to come on time. The instructor therefore does not have to take attendance and may not be aware of students' absences or, if aware, can complain, but cannot do anything about it. The college experiences a dire economic consequence. If each student pays $5000 in tuition per year and due to academic or nonacademic issues, 100 students do not return to the college the following year, the college loses $500,000 by not graduating these students. At many colleges with large attrition, the actual impact would be more severe. Can any college sustain this type of impact? Of course, no college can. Can anything be done about this typical scenario? Yes, of course, use TOC!

The theory of constraints (TOC), properly implemented, establishes the communication necessary among the stakeholders in the system. Each stakeholder becomes a link in the system, doing his/her part by *thinking globally and acting locally*, and not working in a "silo" and disregarding the consequences to other links of the system. There are academic and nonacademic issues, called undesirable effects (UDEs), pronounced "oo dee," in each system. These UDEs are never isolated. These UDEs are the effects of conflicts. A *conflict* is a situation where we do not know exactly which of two opposing actions we should take. Using TOC, we can find the core conflict underlying myriads of UDEs. We can see how the UDEs are logically connected to the core conflict and thus know what needs to be changed. Details on UDEs are given in Section 1.4. TOC/TP tools show what we should change to, and how we can cause the change, all in a very systematic manner. It is amazing that the same TOC tools can be used to address students' personal issues, and to resolve institutional and curricular issues as well.

A typical college system has a hierarchical organizational chart showing the lines of authority as in Figure 1.1. But the college system is better understood as a chain of activities.

In Figure 1.2, the top row shows the sequential links, the responsibility of each link, and the expectations of the system for that link. The actions/entities in the lower two lines (typical actions and desired actions) are in conflict, indicated by a double-ended arrow. Note that, in the first link, working in a

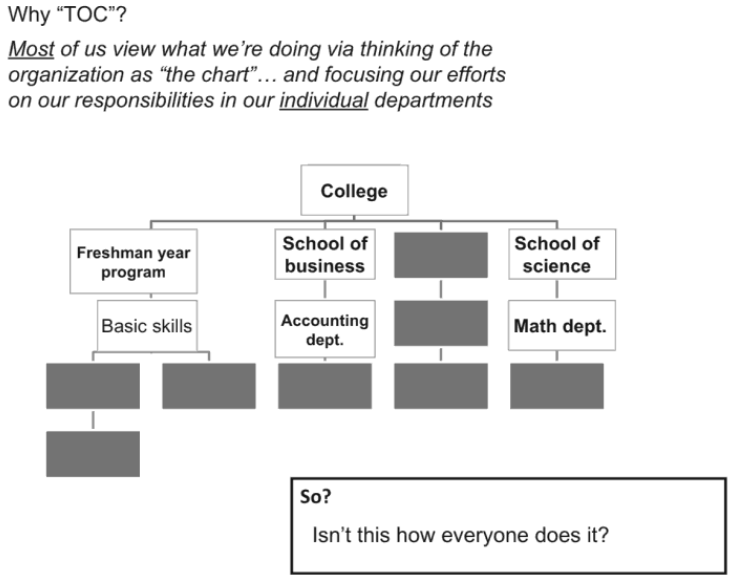

Figure 1.1 Partial organizational chart. (Courtesy of Janice Cerveny, facilitator at several workshops at Medgar Evers College [MEC], New York.)

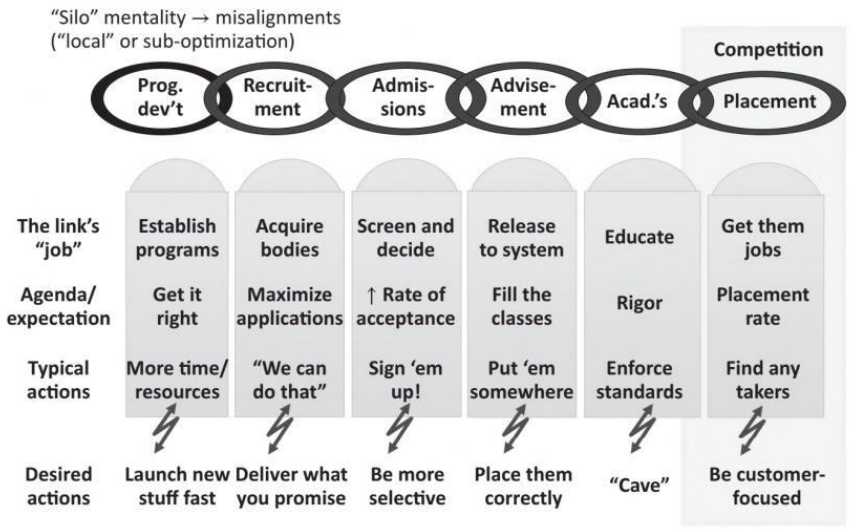

Figure 1.2 Institutional flowchart detailing the functions of each silo.

silo, it takes a considerable amount of time to establish, and many resources to run, a program. But there is also a push from faculty or administrators to launch the program as quickly as possible. Thus, the agendas of the two sets of stakeholders are in conflict. Similarly, actions taken by those working in other silos lead to conflicts. TOC helps to resolve these and other such conflicts by looking at the educational institution as a system.

Figure 1.3 shows a simple linear representation of the university/college system. In this version, the steps in processing students form the system

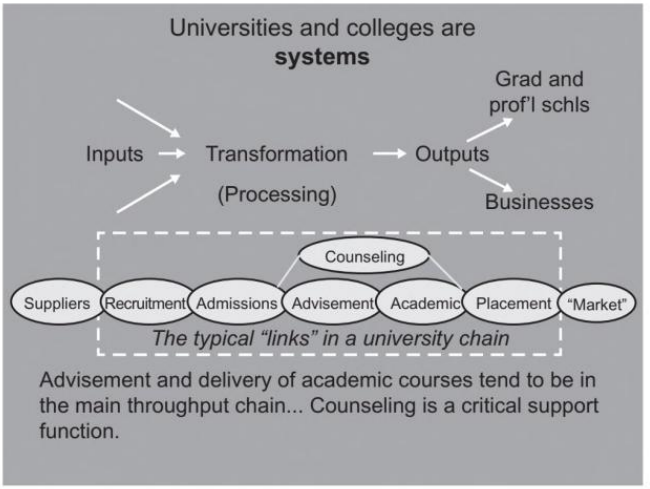

Figure 1.3 Colleges and universities from a system point of view.


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