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What is Quality?

Quality is not merely something we care about when we order a sandwich or get the oil changed in our car. Quality is an academic discipline and a profession. Quality is a vital function in every organization. Construction, manufacturing, banking, and healthcare industries; education; religious and social organizations; the government; and other institutions are all interested in quality. Large or small, product or service related, the supplier or the consumer, everyone is involved with quality.

Careers specifically dealing with quality are growing faster than most other careers. The American Society for Quality (ASQ) has over 80,000 members. Approximately 13,500 individuals sit for an ASQ certification each year. There are numerous quality certifications, e.g., Biomedical Auditor, Manager of Quality, Quality Engineer, Quality Process Analyst, Reliability Engineer, and Six Sigma Black Belt.

Whether the term *quality* is used or not, many job titles and careers focus on quality. Quality managers, engineers, and trainers typically earn over \$75K per year. Quality executives and persons with Master Black Belt certification typically earn over \$100K per year.

Currently, the fastest growing area of quality is the problem solving and improvement technique known as Six Sigma (SS). Using assertive martial arts metaphors, SS has Yellow Belts, Green Belts, Black Belts, and Master Black Belts to define (D) problems and opportunities. Measurement (M) and analysis (A) are then used to improve (I) and control (C) the product, service, or process. The DMAIC process is used in organizations worldwide to improve design, production, customer service, marketing, transportation, and many other functions.

What is Lean Six Sigma (LSS)?

Lean is a set of techniques to improve productivity and efficiency. One could say that *quality* is about doing things right (correctly), i.e., doing things per the plan or per the specifications. *Lean* is about doing the right things, i.e., doing what needs to be done and not doing things that don't need to be done. Obviously, doing correct things correctly helps satisfy customers while fulfilling an organization's mission with minimum cost.

Lean focuses on reducing costs, time, materials, and all sorts of waste, while being safe and adding value to products and services. Similar to quality, job titles and careers related to Lean are increasing. Daycares, contractors, physicians, restaurants, schools, and others want to increase value, quality, and safety while reducing costs, accidents, complaints, and waste.

The Society of Manufacturing Engineers (SME) awards the most highly recognized and valuable certifications in Lean (the Bronze, Silver, and Gold levels). Though focused on industry in general, SME's Lean certifications are applicable to every organization.

In essence, LSS is a partnering of Lean and Six Sigma. LSS principles and techniques are meant to ensure that necessary things (and only necessary things) are being done and being done correctly. Dr. Hayden says that LSS is about *doing right things right*.

Though Lean and quality (including Six Sigma) principles and practices have been historically pioneered and developed by production industries—other sectors, from education to entertainment, can and do use the techniques to be more efficient and do things with high quality.

Quality Courses

Following is a list of courses offered by the Applied Engineering and Technology Management (AETM) Department which specifically focus on quality. Though certain quality courses are required by various programs, many students take a quality course because knowing about quality is good for any career.

Table 1. Quality Courses in the AETM Department.

| Course | Prerequisites ¹ |
|--|---|
| TMGT 361 Quality Systems and Tools – The body of knowledge for the Quality Process Analyst certification. Introductory philosophy, applications, and qualitative and quantitative methods for quality. | Having met Foundational Studies Quantitative Literacy. |
| TMGT 4/561 Lean Six Sigma – The integration of quality (especially the SS DMAIC process) and Lean. Includes a SS project. | Prerequisite: TMGT 361 |
| TMGT 4/563 Six Sigma Green Belt - The body of knowledge for Six Sigma Green Belt certification. Includes a SS project (two projects are necessary for Black Belt Certification). | Prerequisite: TMGT 361 and either MATH 241 - Principles of Statistics or SFTY 341 - Applied Probability and Statistics. |
| TMGT 665 Quality Standards Leadership - Management and leadership activities related to evaluating, creating, and promoting quality standards. | Prerequisite: one graduate level course in quality. |
| TMGT 669 Quality Seminar – Philosophy, current research, and trends in quality. | Prerequisite: two graduate level courses in quality. |
| MET 611 Experimental Design and Analysis - Design and analysis of experiments (DOE) applied to quality. | Prerequisite: TMGT 607 or the equivalent statistics knowledge |
| MET 612 Reliability, Maintainability, and Serviceability – Design and planning to determine and predict the reliability and availability of products, components, and systems. | Prerequisite: TMGT 607 or the equivalent statistics knowledge |

¹ Prerequisites can be met by other course work, experience, or professional certification.

Quality Programs

In addition to taking a course in quality, many students take a program focused on quality.

Majors, minors, certificates, concentrations, and specializations are especially prominent on transcripts and identify specific academic preparation.

Certificate in Lean Six Sigma (LSS). This is a 12 hour (4 course) credit-bearing certificate open to any degree- or non degree-seeking student (at any level, BS through PhD). Technically, the certificate is a type of *degree* because the student receives an official hard-copy certificate (similar to a BS, MS, or PhD diploma). The credits earned in this certificate can be transferred to other programs at ISU and other institutions. The certificate is available at a distance and in a compressed format (i.e., all 4 courses offered in the Fall semester, two at a time, eight weeks each). Some of the courses can be taken as graduate courses if the student qualifies for graduate admission.

BS Minor in Lean Six Sigma. This is a 18 hour minor which can be paired with any major on campus. This minor is available at a distance. The College of Technology has BS majors in engineering technology (Architectural, Automation and Control, Automotive, Civil, Computer, Electronics, Management, Manufacturing, Mechanical and Packaging), construction management; industrial safety, and others. The LSS is also a good complement to many other majors across campus.

MS Concentration in Quality. The MS in Technology Management (MSTM) has a Quality concentration. For the Quality or other concentrations (Automotive, Aviation, Manufacturing, Mechanical & Packaging), one or more elective courses could also be in quality. All MSTM courses are available at a distance.

PhD Specialization in Quality. The PhD in Technology Management (PhD in TM) has a Quality specialization. For the Quality or other specializations (Construction, Digital Communications, Human Resource Development, & Manufacturing), one or more elective courses could also be in quality. The coursework is offered by a consortium of faculty members from the College of Technology and peer institutions. Except for 2 one-week residency visits to ISU, the program is offered completely at a distance.

Certification vs Certificate

Certification (being certified) and having a *certificate* are two different things. A certificate is a sign that points to something and is valued by what it points to. Certification can be represented by a certificate, but a certificate does not automatically grant you certification. Anyone can give you a certificate for anything, e.g., attending a workshop. Some certificates signify more competence than others. The most valuable certificates signify that you have earned a degree and/or you have passed a professional exam. You cannot, for any training or other experience, receive *certification* by merely receiving a *certificate*.

In regards to rigor, oversight, and recognition, to be certified is one step below being licensed, e.g., to practice law or medicine. Professionals are usually certified by professional organizations. The American Society for Quality, the Society of Manufacturing Engineers, the American Medical Association, the American Bar Association, and others certify their members.

ASQ certifies an individual in SS. SME certifies an individual in Lean. To earn a Lean or SS certification, you first have to be qualified (by work experience and education) to apply; next you have to pass a standardized exam. Certification is earned by proving competence via testing, analysis of professional experience, and education.

ASQ does provide a certificate that verifies your certification. ISU does issue a diploma-like certificate to verify your completion of the LSS certificate program. In those instances, the certificate is recognition of something substantial. In the case of ASQ, the certificate is a symbol of having earned certification. In the case of ISU, the certificate is a symbol of having earned a type of academic degree.

Many entities claim to give you a certification in quality or Lean. Without disparaging any of those entities, the most official, most valid, and most widely recognized certifications related to quality are administered by ASQ. Why? ASQ is partnered with ISO, The American National Standards Institute (ANSI), and other government entities and international standards bodies like no other company or institution is. The only substantial certifications related to quality are administered by ASQ.

Table 2. Summary of Quality Program Courses and Scheduling.

| Courses | LSS Certificate | LSS BS Minor | MSTM Quality Concentration ² | PhDTM Quality Specialization ² | Typical Scheduling (check actual schedule) |
|---|-----------------|--------------|---|---|--|
| TMGT 361 Quality Systems and Tools | X | X | | | Summer and Fall via web. Every Spring on campus. |
| TMGT 374 Lean Manufacturing Systems | X | X | | | Fall via web. |
| TMGT 4/571 Production Planning & Control | X | X | | | Fall & Spring. |
| TMGT 4/561 Lean Six Sigma | X | X | | | Every Fall via web. |
| MATH 241 or SFTY 341 | | X | | | Every Fall, Spring & Summer via web and on campus. |
| TMGT 4/563 Six Sigma Greenbelt | | X | X | | Every Spring via web. |
| MET 611 Experimental Design and Analysis | | | X | X | Even year Spring via web. |
| MET 612 Reliability, Maintainability, and Serviceability | | | X | X | Even year Fall via web. |
| TMGT 665 Quality Standards Leadership | | | | X | Odd year Fall via web. |
| TMGT 669 Quality Seminar | | | | X | Odd year Summer via web. |
| QS 7020: Quality Change Culture (BGSU) | | | | X | Every Summer via web. |
| QS 7270 Documentation-based Process Improvement (BGSU) | | | | X | Every Fall via web. |

² Note that the programs also require other courses; only the quality-related courses are listed.

Professionalism

Common characteristics of professionals include the following.

- Possession of specialized knowledge and skills.
- Recognition of expertise by licensure or certification.
- Allegiance to the profession and not merely to yourself, your employer, or your clients.
- Adherence to a code of ethics.
- Participation in your professional organization.
- Assisting the advancement and development of your profession.
- On-going development of expertise.
- Transferring expertise to others.
- Service to others based on professional expertise.

No one can do all of the above and do so perfectly because each bullet can consume all your time. The above bullets are intertwined; an activity may fall under several bullets.

You may take a class in quality for many reasons. But let's face it, professors of quality hope you are taking a course or program in quality because you want to be a quality professional or want to further develop as a quality professional. (Why do you think professor, profession, and professional have the same root?) If you take a course and restrict yourself to *checking that class off the list*, it is possible to learn, retain that learning, and enjoy doing so—that is what the best students do. However, if you take a course for professional reasons, with the attitude and goals of a professional, you will encompass and surpass what a good student does. If you take the course for professional reasons, the course will not be an item to check off but an integrated part of your professional growth. Even if you are taking your first course in quality you can be a novice member of the profession. You are strongly encouraged to take a professional view.

Prescription for Professional Success

If you desire to be a professional and advance in your profession, you will engage in the bullets above. Following is a prescription for professional growth. You will notice that most of the following are reinforced by assignments in various courses.

1. Join ASQ. Students can join for \$28 (even if you are only taking one course and are working full time).
2. Go to professional meetings and participate. Research shows that being active in a professional organization leads to a higher starting salary and faster promotions.
3. Do an internship related to quality. Research shows that doing an internship leads to a higher starting salary and faster promotions. If you are already fully in the workforce, obtain a position related, or more related, to your profession.
4. Take advantage of any opportunity in any course to integrate a course activity with the above bullets and these prescriptions. A course may ask you to collect and analyze data. You should perform that analysis on data related to your job, professional organization, another course, or a project you are working on with a professor or employer. ENG 305T

will have writing assignments; write about something that complements your professional activities. If you take the TMGT 421 R&D class, research and develop something that complements other coursework, the bullets above, and these prescriptions.

5. Form professional relationships; especially, collaborate with faculty members. Get a faculty mentor; maybe, mentor the faculty! Be a colleague and not merely a student. Get involved with professor's research and service activities. If you are a quality professional in industry, have the professor and other students help you with a project. ISU encourages collaboration among students, the faculty, and the community—especially research projects. Such collaboration directly supports professionalism and these prescriptions.
6. Gain more knowledge. Study more on your own. Go to workshops. The most valuable and recognized enhancements to your knowledge base will be college credit-bearing coursework, especially a formal program, e.g., certificate, minor, major, concentration, etc.
7. Obtain an ASQ certification. If you already have an ASQ certification, keep it current and obtain more certifications.

If you want to be a quality professional, take Dr. Hayden's prescription.

Declaring Your Program

A certification, minor, major, concentration, or specialization must be officially declared for it to be stated on the student's transcript. Declaring a minor or certificate should be done before prior to junior standing so that you can schedule course work to graduate on time.

Transfer Course Work

For the LSS Certificate or Minor, one-half of the course work may be transferred from prior institutions or other programs on campus. A transferred course must be substantively the same as the AETM course. Transferred course work must be taken prior to declaring the certification or minor and must be approved by the AETM Department before scheduling your remaining courses so that you can be properly advised.

Advising

Advising has many connotations. Students tend to focus on scheduling. Scheduling is important. Scheduling assistance might be provided by someone other than the advisor. The advisor might provide insights into course sequencing but will focus on developmental advising, e.g., selecting programs and courses in consideration of the student's past coursework, experience, and professional goals. Note that you cannot earn an undergraduate minor at ISU without having a major (but you can earn a certificate without earning a bachelor degree and having a major).

Scheduling Advice

Note that the following is only general advice. Always prepare your program of study with the help and approval of your advisor and/or scheduler. When deciding which courses to take in a given semester, you have to consider factors such as the following.

- How many courses do you want to take, e.g., are you full or part time?
- Does the course have a prerequisite?
- When is the course offered, e.g., the rollout or planned future scheduling?
- By what method is the course taught, e.g., face-to-face or internet?

If you are a new student (to ISU or a quality program) you need to prepare a plan of study with your advisor as soon as possible. An enrolled student should already have a plan of study and a schedule. If not, see your advisor immediately.

For financial aid purposes, *full time* for an undergraduate student is 12 hours or more per fall or spring semester. To graduate in 4 years with the minimum 120 credit hours, you would have to take 15 hours every semester. All of the following and other factors can alter the *15 credits per semester or 120 credits minimum*.

- Prerequisite, remedial, or deficiency courses.
- Previously earned college credit.
- Changing or adding programs.
- Taking summer courses.
- Taking courses that do not meet a requirement.

The last bullet is the most common reason students do not graduate with the minimum 120 credit hours. You could have 200 credit hours of poetry course work and none of those hours would fulfill requirements for a certain major or minor, the foundational studies requirements, the upper division requirements, or other requirements. You can't graduate by merely having earned 120 credits; you have to fulfill all program and university requirements.

If you are in one of the quality programs, you need to take any quality course on your program as soon as it is offered, i.e., don't postpone it. Some courses are only offered once every two years; you need to grab a course when you can. This is especially true of prerequisite courses such as MATH 241 or TMGT 607.

The above advice also applies to graduate students. For graduate programs, full time is 9 hours or more. Following are sample scheduling sequences. Note that these are samples only. Going to school part-time, starting in a different semester and other factors could lead to a different sequence. Only the quality program courses are shown (and not all the required courses in a program).

Sample Course Sequencing

| LSS Certificate | |
|--------------------------------------|--------------------------------------|
| Fall 2018 1 st 8 weeks | Fall 2018 2 nd 8 weeks |
| TMGT 361 TMGT 374 | TMGT 461 TMGT 471 |

| LSS Certificate | | |
|----------------------|-------------|-----------|
| Fall 2017 | Spring 2018 | Fall 2018 |
| TMGT 361 TMGT 374 | TMGT 471 | TMGT 461 |

| LSS Minor | | |
|---|--------------------------------------|-------------|
| Fall 2018 1 st 8 weeks | Fall 2018 2 nd 8 weeks | Spring 2019 |
| TMGT 361 TMGT 374 MATH 241 or SFTY 341 | TMGT 461 TMGT 471 | TMGT 463 |

| LSS Minor | | |
|--|----------------------|----------------------|
| Spring 2018 | Fall 2018 | Spring 2019 |
| TMGT 361 MATH 241 or SFTY 341 | TMGT 374 TMGT 461 | TMGT 463 TMGT 471 |

| MSTM Quality Concentration | | | | |
|----------------------------|---------------------|-------------|-----------------------|-----------------------|
| Spring 2018 | Fall 2018 | Spring 2019 | Su 2019 | Fall 2019 |
| TMGT 607 MET 611 | MET 612 TMGT 561 | TMGT 563 | TMGT 669 ³ | TMGT 665 ⁵ |

| PhD in TM Quality Specialization | | | | | |
|----------------------------------|-------------|--------------------|-------------|----------|-----------|
| Spring 2018 | Summer 2018 | Fall 2018 | Spring 2019 | Su 2019 | Fall 2019 |
| COT 703 MET 611 | QS 7020 | MET 612 QS 7270 | | TMGT 669 | TMGT 665 |

³ As an elective.

Contacts

Dr. Hayden normally teaches most of the quality and statistics courses in the AETM Department, is an officer and Senior member of both ASQ and SME, and holds several ASQ and SME certifications. Contact Dr. Hayden with any questions about the quality courses in this document or questions about certification or membership in ASQ or SME.

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ISU Online Resources

ISU home page: <http://www.indstate.edu/home.php>

Undergraduate Admissions: <http://www.indstate.edu/admissions/>

College of Graduate and Professional Studies: <http://www.indstate.edu/sogs/>

College of Technology: <http://www.indstate.edu/technology/>

Department of Applied Engineering and Technology Management:
<http://www.indstate.edu/technology/aetm>

PhD in Technology Management: <http://www.indstate.edu/technology/consortphd>