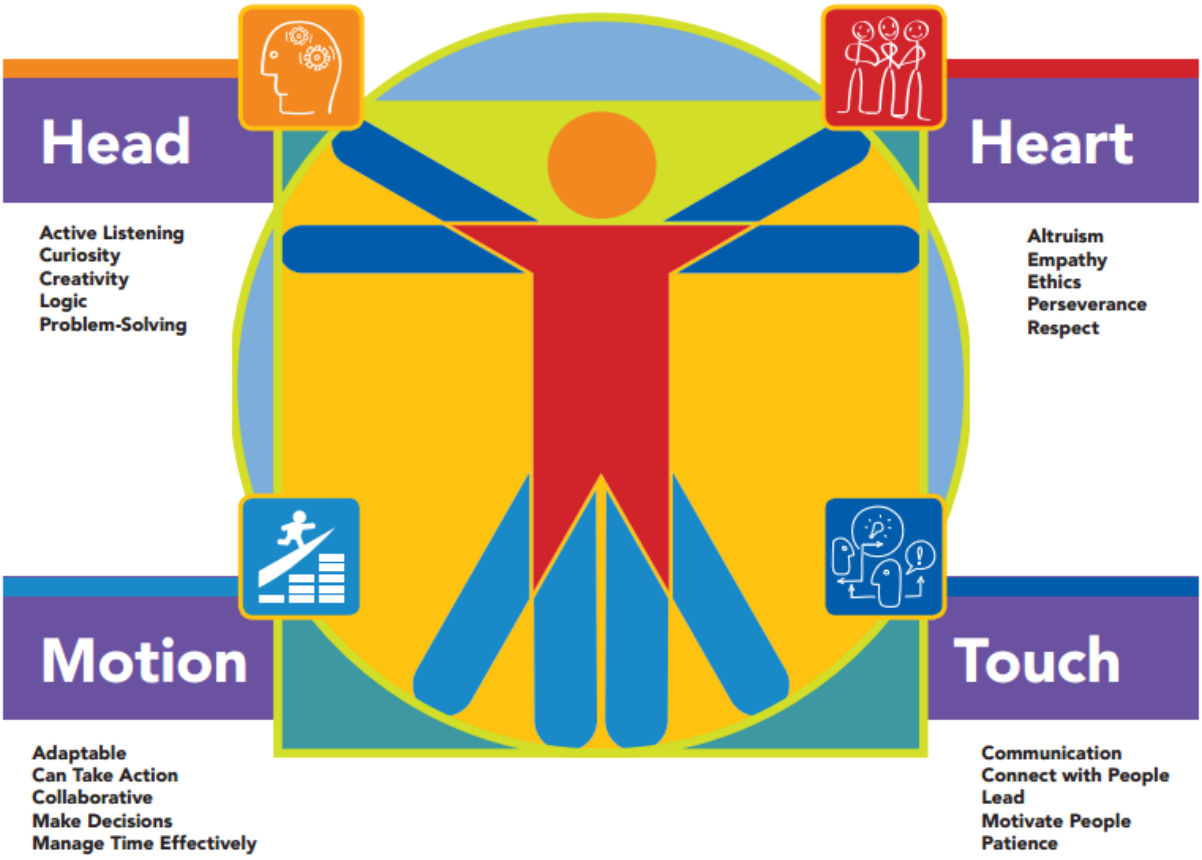
Building an IT Career-Ready Washington: 2015 and Beyond

The Ideal IT Student



Introduction:

- Use five infographics to illuminate the five top points you want to make and want them to understand and remember

This report will outline the skills, knowledge and abilities needed by IT graduates/prospective employees from the perspective of:

- IT employers
- Faculty (who have well-developed IT programs)
- Students (who have succeeded in the transition from

This then lends to a student being better prepared to meet employer job requirements. It will also serve as a resource in creating clearer expectations of what an IT program should be offering its students and what the student in turn should have learned upon graduation.

It will also serve as an instructional guide on what makes an "ideal IT graduate" from the perspective of industry, educators, students, government, and emerging technology trend experts.

Purpose:

- How to align the attributes of the ideal student that industry wants to employ into actionable items and a series of steps.
- Pick the top five occupational pathways and define what new or emerging technical knowledge and skills are in-demand now and projected to be in-demand,
    - Cite how the type of IT employee has changed from someone who was hired say five years ago, and
- Create a list of five major recommendations for IT programs to consider between 2014 and 2015, and moving forward.

What constitutes the ideal IT student?

(Use the notes from the IT advisory board's focus group session)
Compare their notes and look for overlap between Sean Parent's experience and what they detailed.
Use any data collected from the skills gap forum, and look for new information.
Review technical knowledge and skills (the basic "recipe" and the advanced "recipe".
Emphasis on the introduction and integration of soft skills – how important they are, give examples of best practices

Outline the top five occupational pathways in WA State (Western v. Eastern WA) and nationally as a comparison

- Align new developments or areas of growth for each, as well as requisite tech knowledge/skills
- Use EMSI, other research tools

- How has the ideal IT graduate who successfully found employment in 2000 changed or morphed into something different by 2015

Conclusion:

- Five top recommendations for IT programs across the state to consider moving into 2015.

In considering what transforms someone who has even a mild curiosity about pursuing an academic and career pathway in IT, one of the primary questions what are the primary components that can create the **ideal**

- IT student,
- IT graduate,
- IT job candidate, and finally,
- Employed IT enthusiast?

Is there a formula to this composition? What are the different critical elements that might be transformed into a general guideline that informs IT educators and students through an IT Program of Study? Can an actionable plan and steps student, the community and technical college (CTC) system, and IT and IT-enabled professionals and companies could separately and collaboratively build into something concrete. A series of questions were developed to extract from IT professionals a list of ingredients for reflection when IT educators and students start their next academic year.

Then lead into the different components of the questions and the purpose of how it has been constructed as a buffet of options to think about.

May of the images are hyperlinked to the original source for further reading, use as a resource, or for adaption/adoption within the IT educators courses or program, or to share with students for increasing their ability to successfully pursue an IT academic and career pathway.

What constitutes the ideal IT student?

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In considering what transforms someone who has even a mild curiosity about pursuing an academic and then career pathway in IT, one of the primary questions in my mind was who is the ideal IT student, graduate, job candidate, and finally, a job-ready IT enthusiast? Does this ideal even exist? And, what are the different elements that might be factored into a general guideline to making the most of a student's IT academic pathway and then could these elements be transformed into actionable steps that the student, the community and technical college (CTC) system, and IT and IT-enabled professionals and companies could separately and collaboratively build into something concrete.

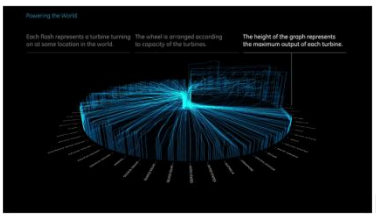
One of the first things to begin this process was to create a questionnaire. Note that surveys, questionnaires, focus groups, one-on-one interviews, and just asking questions are the most underemployed group of tools in formulating a series of considerations when embarking upon a process of analysis, recommendations, and decisions.

The following are a series of the questions and answers were gathered from a group of highly respected, diverse, thoughtful, and engaged IT professionals. Their jobs cover IT occupations in networking, systems design and administration, programming, big data and mining analytics, web design and development, and game development and design.

II. For an IT graduate (irrespective of whether they earned a 2- or 4-year degree), who is about to enter the workforce we asked our IT Professionals

What are the top five IT courses (and subsequent IT concepts/competencies) they should have mastered? (For example, networking, programming, database design/development, etc.)

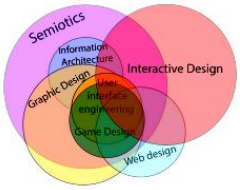
1. IT and Computer Science (CS) Competencies



Database Design/integration: Data is big right now. IT students, whatever the concentration they elect to focus in, need to understand how to build a database, as well as produce database models. Data is driving business decisions and it has become increasingly visual. Data visualization is essentially descriptive statistics which results in a visual representation of data. It's often described as telling a story using data. One of the courses IT professionals consistently recommend is statistics. It can never be overstated how important

statistics is for a student who wants to create an understanding of logic and applied mathematics to build upon for more advanced IT coursework.

IT students are typically introduced to database basics when they are introduced to Microsoft's Excel and Access. Here is a list of the most popular and widely used database software systems, including SQL (one of the most widely used open source database). NoSQL (relational database management system – RDMS) is new to the game of database design and management.



Interactive Design: Is a user-oriented field of study that focuses on meaningful communication of media through cyclical and collaborative processes between people and technology. Successful interactive designs have simple, clearly defined goals, a strong purpose and intuitive screen interface. (Source: Wikipedia)

Mobile Operating Systems (OS) and Platforms: There are a number of operating systems that support mobile devices, smartphones, tablets, etc. The most common OS's are android (Google), Blackberry, iOS (Apple), Windows (Microsoft), and ***all others*** (Ubuntu, Firefox, etc.) Look here for the Mobile Platforms to watch for the second half of 2014. Find out how a non-profit in Queen's New York taught people to create iPhone apps — and their incomes jumped from $15k to $72k.

Networking Fundamentals: "A computer network or data network is a telecommunications network that allows computers to exchange data. In computer networks, networked computing devices pass data to each other along data connections. The connections (network links) between nodes are established using either cable media or wireless media. The best-known computer network is the Internet." (**Source:** Wikipedia)

Operating Systems (OS): In Garner's chart the following percentage increases and decreases could be used to anticipate which languages might be increase/decrease in popularity.

Worldwide Device Shipments by Operating System (Thousands of Units)

Operating System	2012	2013	2014	2015
Android	503,690	877,885	1,102,572	1,254,367
Windows	346,272	327,956	359,855	422,726
iOS/Mac OS	213,690	266,769	344,206	397,234
RIM	34,581	24,019	15,416	10,597
Chrome	185	1,841	4,793	8,000
Others	1,117,905	801,932	647,572	528,755
Total	**2,216,322**	**2,300,402**	**2,474,414**	**2,621,678**

Source: Gartner (December 2013)

Gartner's market forecast data is detailed in "Forecast: PCs, Ultramobiles, and Mobile Phones, Worldwide, 2010-2017, 4Q13 Update" and available on the Gartner web site at http://www.gartner.com/doc/2639615.

Overall, the total device shipments by OS looks to increase by almost 6% between now and 2015, but it's actually a smaller increase than between 2013 and 2014 at 8%.

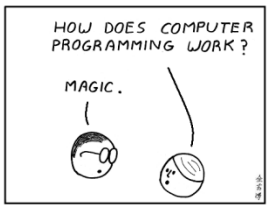
Projected increase/decrease for the six Oss is as follows:

- **Android 4%**
  Android runs the Linux kernel is (similar to the Unix OS) and its user interface works with direct manipulation (for the touchscreen's mobile devices, as well as tablets use). Linux uses free, open source software for its OS software development. Android's programming languages are C, C++, and Java.
- **Windows 17.5%**
  Microsoft's Windows OS did not begin as a full operating system, as it extends MS-DOS. However, it's gone through multiple iterations to become a fully integrated operating system. It's written in Assembly, C, C#, C++. The C programming languages (including, C++) has both open source and proprietary implementations that share an open standard.
- **iOS/Mac OS -14%**
  This is a surprising projected decrease. iOS runs on a Unix-like OS, and uses C languages, Objective C, and Swift. Swift is the Apple-created compiled programming language that's been developed to replace Objective C.
- **RIM -31%**

RIM is Blackberry's operating system. It's a closed source, and written in C++. The decrease isn't surprising given the problems Blackberry's been experiencing over the last few years.

- **Chrome 67%**
  Google's Chrome's OS is similar to Android's in that it runs the Linux kernel. It uses the C and C++ programming languages. It was built using an open source project, Chromium OS. The projected increase is large.
- **Others 8%**

Take Aways: While there is always talk of a language overtaking the C-family of programming languages, looking at the commonality of all these operating systems, it appears the C program language fuels 100% of the OSs listed above (not including "Others" which was not defined by Gartner)



Programming and Scripting: This is for our educators, and it's an important point to consider. There are no shortcuts in teaching someone how to program. It still requires educators to teach students **how** to program, and perseverance on the part of students. Here's why.

> "For the past 50 years, programmers have tried to make it easy for people to learn programming, and for 50 years they've succeeded -- but only at teaching the most basic tasks. Ninety-five percent of the world may be able to figure out if-then-else structures, but that's not the same thing as being a programmer." (**Source:** InfoWorld)

Security: "Data loss", "data breach", "abuse of cloud services"... It all sounds ominous. Network security, specifically ***security for the cloud*** is important. The Cloud Security Alliance listed the "notorious nine" threats. This is a well-organized and succinct overview of the nine security threats to the cloud. You can quickly assess just by reviewing the table of contents. However, as it's only 19 pages, it might be worth reading.

Systems Analysis: The system development life cycle (SDLC) is the traditional system development method that organizations use for large-scale IT Projects. The SDLC is a structured framework that consists of sequential processes by which information system are developed.

1. System Investigation
2. System Analysis
3. System Design
4. Programming and Testing
5. Implementation
6. Operation and Maintenance

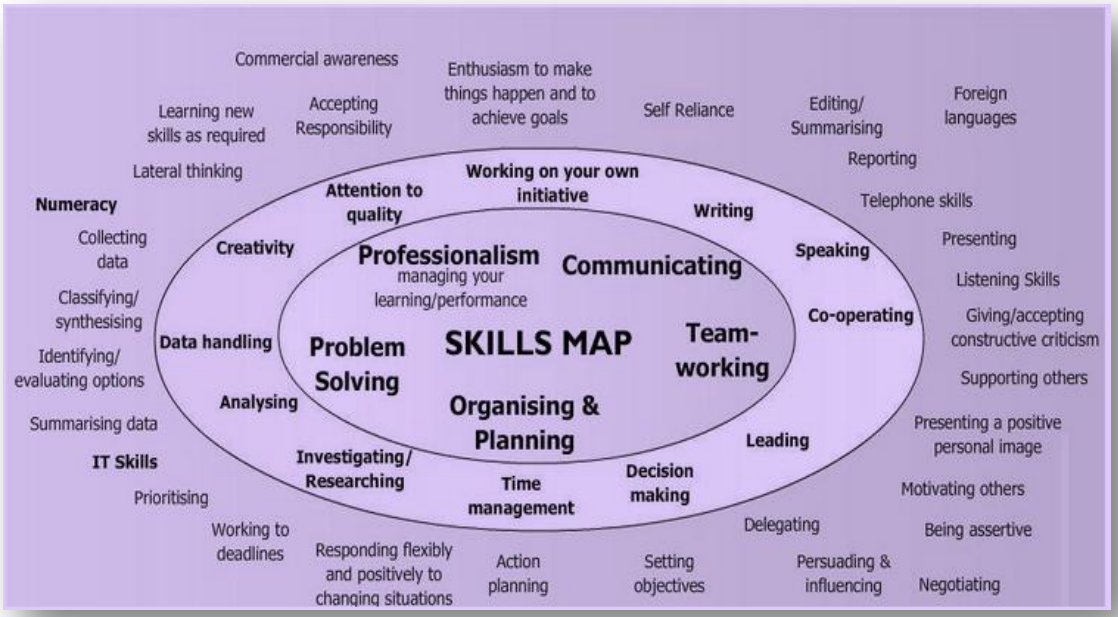
(**Source:** Wikepdia)

Website Design, Development, Maintenance: Five years ago (at the earliest), a college student who was thinking about web design as a possible career pathway might have thought it entailed:

- graphic design,
- learning how to use Adobe products like Illustrator and Photoshop,
- a markup language, HTML, and cascading style sheets (CSS).

Today's reality is far different. "Web Design" now has evolved into the mastery of a large and sophisticated set of technical knowledge and skills, including software development (which means knowledge of a programming language, like the widely used JavaScript, application development, user experience, database design and development, security, and more… Read about the transformation and expanded expectations of how the occupational title "web designer". It is helpful from an academic or professional technical program development perspective. It is also helpful for students to understand how this occupation has both broadened and deepened. For a list of all the ***18 Pivotal Web Design Trends of 2014***, read here.

2. Employability Skills



Courtesy of: The University of Kent

What are employability skills, and why are they so important? "A group of essential abilities that involve the development of a knowledge base, expertise level and mindset that is increasingly necessary for success in the modern workplace. Employability skills are typically considered essential qualifications for many job positions and hence have become necessary for an individual's employment success at just about any level within a business environment." (**Source:** Business Dictionary)

Employability skills are a key factor when an employer looks at a resume, invites you in for an in-person or group interview, in their decision to hire an IT graduate and prospective job seeker. Employers indicate that over 50% of their decision to hire an IT worker is because they have the employability skills the employer is looking for. Even though this Exeter UK chart of employability skills aligns the type of employability skill to secondary activities where evidence and demonstration of that skill can be found in a student's lesson outcome, it is still a good representation of how the skill might be integrated into a course.

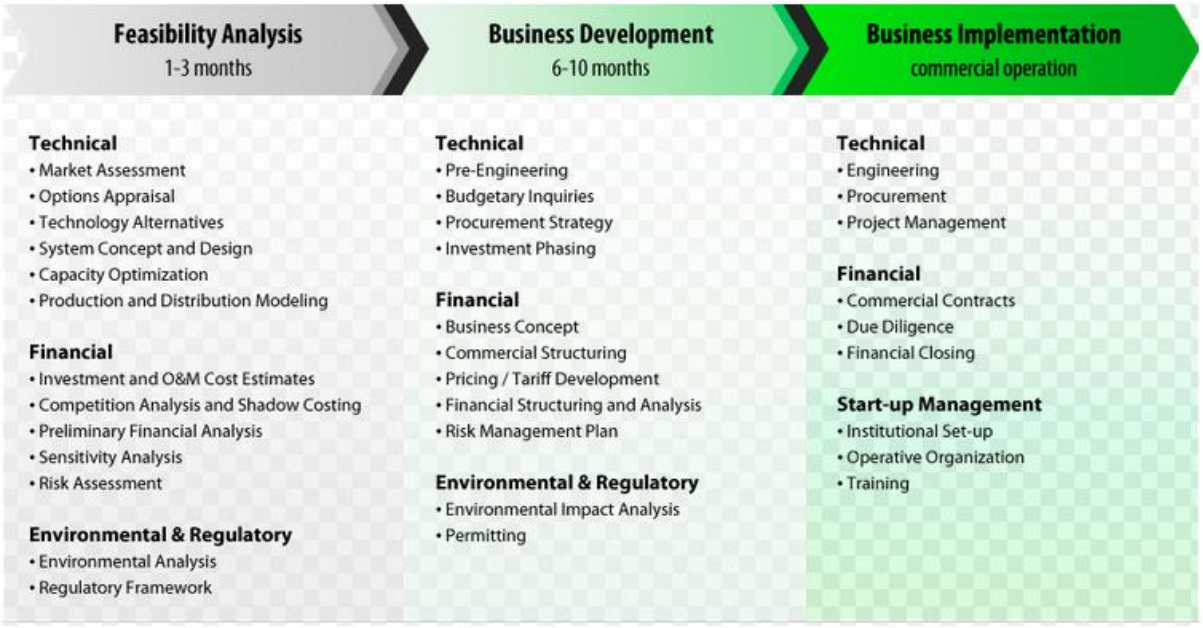
The following were considered to be essential **employability** for an IT student and graduate by our IT industry professional panel:

- **Accounting Fundamentals (how to manage a budget, cost something out, etc.):** While accounting is typically housed in a professional and technical program, or used for business-transfer students, the principles of accounting are highly applicable for IT students. Some of the key components of IT include explaining the return on an

investment. "If we decide to go with this software package systems wide, how much will it cost and will this investment ultimately increase performance, productivity, and save us money?" is a question that may sound like a management-level professional will have to answer, they might ask for opinions from their team. "We have to spec out this project. Can you tell me how many hours it will take you, given your current hourly salary, plus benefits, and factor in a markup of 20%" could be asked in an email an IT worker could receive from a project-lead. Would an IT graduate from your college's IT program be able to answer these questions? One of the employability skills connected to accounting fundamentals is project management. It's another one of those skills employers are looking for.

Covering even a few accounting basics within the IT courses taught, embedding a few principles and then embedding them as learner outcomes in a project could make the difference for an IT student's success in the workplace.

Even looking at this high-level financial process planning the link between IT and financial analysis and project projections have relevant implications for IT graduates and workers.



Career Planning: When you have read the profile of Bryan Stevenson (reference page #/section), you will see that one of the overlooked areas for many IT students is aligning career goals with academic choices. Additionally, students should know how to create opportunities that translate into being seen as a desirable prospective employee. Students need resources as well as guidance with figuring out the different IT jobs out there, what they require in terms of technical knowledge and skills, what the work will actually be like, and, how much will the job pay.

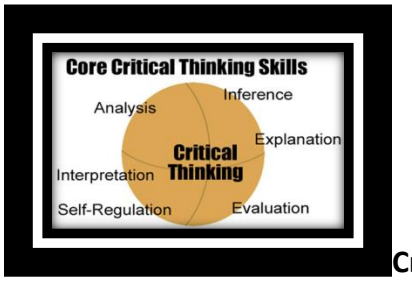
An excellent resource for IT students is the website YourFuturein.IT. It's the ***IT Resource for Students in Washington State*** with academic planning guides, career tips, a search-engine for all the IT degrees/certificates in Washington State, as well as an IT interest quiz, and detailed information about different IT occupations (including duties, pay, etc.)

Communication: Look at any IT job posting and see the following:

- Possess excellent oral and written communication skills, including the ability to interface with senior managers
- This is complemented by outstanding listening skills as well as excellent written and verbal communication skills.
- Strong presentation and communication skills

Communication is included in 1,054, or 47% of all of the IT jobs posted on Dice.com. And, for the 43% of jobs that didn't include it, the employer will still expect it. They are probably assuming a college graduate and now prospective employee would understand how important effective communication skills are.

IT educators can use this resource to weave within the hands-on and applied technology concepts they are teaching the different communication skills that IT employers are looking for.

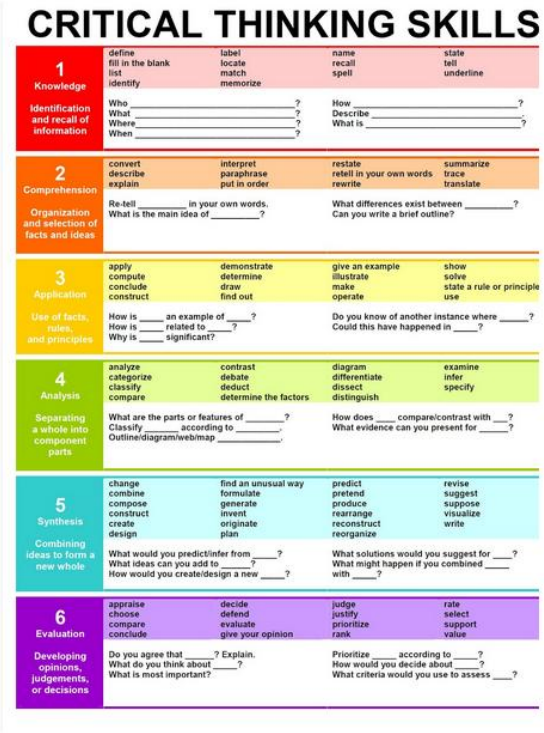


Critical Thinking: Everyone always talks about how important critical thinking skills are. However, there is something vague about this term, as there are a myriad of definitions out there.

What does it really mean? And, can it be taught? This definition seems to capture the essence of critical thinking.

Critical thinking is the ability to think clearly and rationally. It includes the ability to engage in reflective and independent thinking. Someone with critical thinking skills is able to do the following:

- understand the logical connections between ideas
- identify, construct and evaluate arguments
- detect inconsistencies and common mistakes in reasoning
- solve problems systematically
- identify the relevance and importance of ideas
- reflect on the justification of one's own beliefs and values



The following resource and Critical Thinking Planning Guide (below) can be used by both IT educators and students to use in IT courses to build a critical thinking improvement plan. (**Source:** Educational Technology and Mobile Learning)

Flexibility: Think of flexibility as in opposition to the following verb, rigid. In researching "flexibility" and "employability skills" one thing of note is the United Kingdom (UK) has spent sizeable time and effort creating a wide body of employability skills resources. Washington State could benefit from reviewing and implementing the UK's body of research and work in this area.

According to Tony Allesandra, author of ***The Platinum Rule***, "High flexibility is characterized by these five attributes: confidence, tolerance, empathy, positivity, and respect for others." Ms. Allesandra also gives examples of the flip side of flexibility:

- Rigidity—"It's my way or the highway"
- Competition with Others—"I'm smarter, prettier, etc., than you"
- Discontent—"No, I don't like it this way. Why can't we..."
- Unapproachable—"Don't bother me unless it's worth my time and you agree with me"
- Difficulty with Ambiguity—"Let's nail this down right now"

Given how the IT industry's mindset is "rapid change drives innovation", it's important faculty make this common understanding of what it means to work in technology clear to IT students. They need to be prepared to *embrace* flexibility.

Meeting Basics (agenda, lead, why have a meeting? Is it informational or a working meeting, what are the outcomes, etc.): Meetings are an inevitable part of the employee experience. They are also an effective way to create a cohesive vision on how to move things forward. In IT especially meetings happen using a myriad via a number of different platforms: 1on1 or group meetings can take place in-person, on the phone, web(inars). And, the tools to make decisions have now been offloaded through polls, surveys, email, etc.

Some things to consider when either attending or heading a meeting are succinctly summed up by Neal Hartman, MIT, who contributed this piece to Forbes.com's Leadership Forum:

1. Make your objective clear
2. Consider who is invited
3. Stick to your schedule
4. Take no hostages
5. Start on time, end on time
6. Ban technology
7. Follow up

Note: These elements should also be considered from the viewpoint of the meeting attendee. And, while number 6, "Ban technology" sounds counterintuitive, at least consider the rationale.

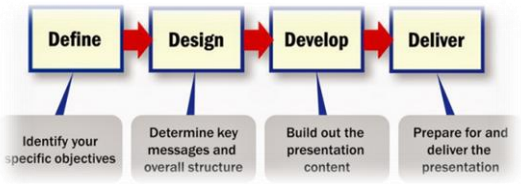
The Modern Workplace Culture: When reading Bryan Stevenson's interview, pay attention to his thoughts on why it's important to pay attention to the culture of the organization when an IT student considers applying for a job. IT students and subsequent graduates need to do their homework and research any and all pertinent information about the company. It's always advisable for students, when doing their research about a prospective employer understand what the company's **vision, mission, and values** are, they can always be found somewhere on the company's website. **Perform searches** (include keyword searches for elements of a work environment that are important and include the company's name and see what pops up). **Use LinkedIn** to see who works at the prospective employer's company to find out if there are any indicators about their satisfaction with company's workplace culture.

Increasingly, one thing for IT students should be aware of is that the IT industry has moved towards to meet employee needs is contract workers. IT students should also read Bryan Stevenson's experience as an IT contract worker.

Something else for IT faculty to impart to their IT students and job seekers is there is stress involved in IT, just like any job. It's a consideration as one of the key attributes our IT professionals identified is IT workers either are comfortable with, or adapt to the sometimes ambiguous nature of technology.

As recent as June 6, 2014, Baseline.Com, reported out on IT workers experience as an IT employee:

- **Fair Trade-Off:** 58% have at least considered taking a new job that would pay less in order to escape their current stress level.
- **Stressful Aspects of Being an IT Pro:** Keeping up with requests/workload: 31%, Keeping up with technology: 28%, Impact on work-life balance: 23%
- **Total Access:** 36% said they're expected to be available 24/7 during a work week, and 23% are expected to provide the same availability while on vacation.
- **Thumbs Up:** 40% of these IT pros said their current work is the most satisfying of their career.
- Professional Pride: 60% said they're proud they chose IT as a career and are also proud of their current role, assignments and responsibilities.
- **Groundhog Day:** 77% of these professionals said that even if they could start over, they'd still choose IT as a career.
  (**Source:** Baseline.com)



Presentations: Presentations have become common place in the IT world. And, IT students need to be prepared. Succinct public speaking and being comfortable with it, both extemporaneously and as part of a formal/informal presentation is requisite for the IT employee. So, encouraging students to start making presentations (whether persuasive, factual, informative, etc.) during their college experience is essential.

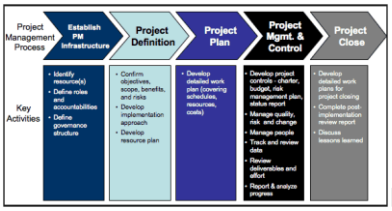
One resource for both faculty and IT students is Ted Talks. Amy Cuddy, a renowned social psychologist, gives an insightful presentation on body language that takes twenty-minutes to watch; it's worthwhile viewing. Watch how she moves around the stage, and realize with most successful presentations, they take time, practice, and require comfort with the subject matter.

Another recommended resource, and this comes from Dan Pink's book, ***To Sell is Human***, (this book is an important one to read to build presentation skills), IT students can improve their PowerPoint (PPT) presentations after they have reviewed, pecha-kucha. It's an international PPT movement that has given new life to the often dreaded PPT presentations. The formula is 20X20 (20 slides X 20 seconds of speaking=6 minutes and 40 seconds).

Professional Networking (LinkedIn.Com): Besides opening a LinkedIn account (LinkedIn is the most widely used professional networking site out there, and has over 150 million users), IT students should consider how networking increases their job prospects. When a student (who must be 18 or over) joins LinkedIn, there is a wide array of groups (like android developers, network security specialists, etc.), they can participate in. These groups can offer insights on job postings and provide opportunities to connect with recruiters. And, internships as well other job openings are posted on LinkedIn.

One thing IT students who are about to look for a job (or, other work-based learning opportunities) is to ensure they are knowledgeable with the latest developments in the tech

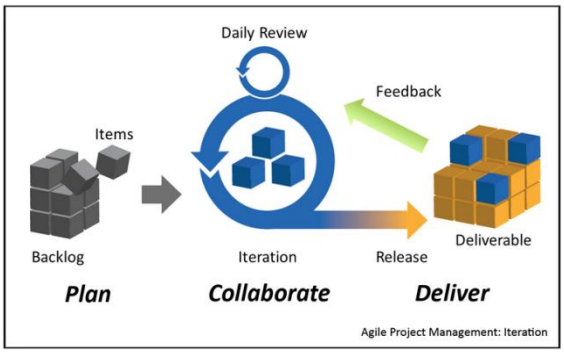
world. Ways to do this include looking through Dice.Com's Tech Blog which has excellent daily reports on a variety of IT topics. ComputerWorld and InfoWorld are also good online resources.

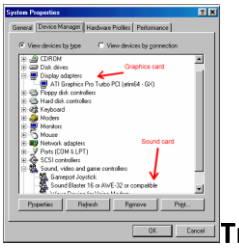


Project Management: There are a variety of IT-specific project management (lifecycle) processes that are used in the IT world. Some common processes and products include products from Oracle, Microsoft, and IBM. Agile and Scrum are two of the most widely used life cycle process products used during an IT project, specifically software development projects.

IT students can quickly assess their understanding of what a project manager is thinking about when they launch a project. Even if they aren't going to be managing a project, viewing the different components of what the expectations are of the project team members is a good starting point. Mind Tools has a project management assessment tool worth investigating, and a robust summary of the different elements of project management.

One of the important considerations for an IT student is when they are either working on project team, or managing the project itself is that there are a number of different moving parts. In some ways it's like trying to put together a moving jigsaw puzzle. IT students should be aware that some of the different elements include: working with team members who have different areas of expertise, working in assorted locations (sometimes even different states or countries), varying work styles, are culturally diverse, and may have different goals.

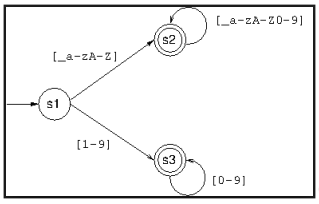




Troubleshooting: Troubleshooting is both a technical skill and an employability skill. Troubleshooting in the IT worlds is typically associated with hardware, networking, software, systems, etc. IT students need to understand that customer service often plays a large role in successful troubleshooting efforts. So, there is not only the technical knowledge needed, but being able to incorporate active listening, proper documentation, patience, and clear communication are all essentials of effective customer service. There are a number of troubleshooting forums and vendor-specific resources online. Here are a simple series of steps to consider when troubleshooting an IT problem.

III. What new technology competencies should the IT graduate be anticipating and searching out to master either in college, a training program, opportunities provided online, or by self-mastery (reading a book, or IT content-specific website)?

Our IT professionals offered a wide array of thoughts on new technology trends and the associated competencies needed to both familiarize and begin the mastery process. Below these insights are enclosed in quotes. The names of the IT professionals are not associated with the quotes, however, all of these professionals serve on the Center of Excellence's IT Industry Professional Advisory Board.



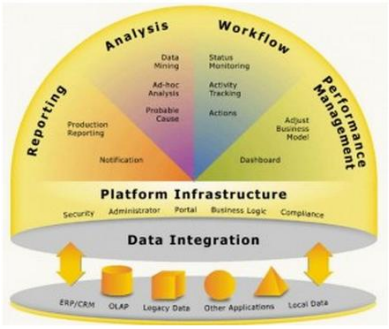
Comparative Programming: "Programmers need to be prepared to use several languages over their careers. Too many programmers are stuck in a belief that one language is superior to all others. The different languages should be viewed as a set of different tools for different jobs.

- *Understanding how to program is key, thus, this is where adaptability can be incorporated into the two-series programming courses most CTC IT programs require in their IT or CS degrees."*

Comparative Programming Language Analysis: Comparative programming language analysis seeks to classify programming languages into different types based on their characteristics;

broad categories of programming languages are often known as programming paradigms. (**Source:** Wikipedia)

It's critical to note that while comparative programming is recommended, this should happen ***after*** an IT student has mastered programming concepts using one language.



"Integration with Outside Technical Systems: The future will be defined by data and interactions flowing in new and unexplored ways between seemingly disparate groups of people." Changes occurring around data integration are moving quickly. A good overview of this is given here, by Datmeer.com. **Data Integration Ecosystem of the Future**, March 25, 2013, provides a comprehensive overview of what it's about and where it's going. This is a preview of Joe Nicholson's analysis of data integration and its exponential growth creating new occupations and technology solutions, "New types of data, rapidly evolving data sources and high volumes of data make traditional data integration obsolete. Big data discovery differs significantly from traditional BI in that it looks to iteratively reveal unknown patterns, relationships and insights across all available data rather than focus on a simple question and answer paradigm."

> **Data integration** involves combining data residing in different sources and providing users with a unified view of these data. This process becomes significant in a variety of situations, which include both commercial (when two similar companies need to merge their databases) and scientific (combining research results from different bioinformatics repositories, for example) domains. Data integration appears with increasing frequency as the volume and the need to share existing data explodes. It has become the focus of extensive theoretical work, and numerous open problems remain unsolved. In management circles, people frequently refer to data integration as "Enterprise Information Integration" (EII). (**Source:** Wikipedia)

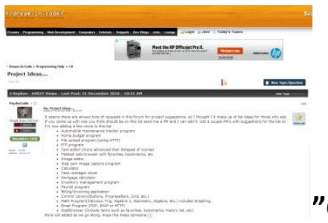
"Too many IT workers are always chasing 'new', which leads them to learn a lot of things that never get used.

- *That time would be better spent getting deeper skills on more widely used and marketable technologies."*

The following were listed as marketable technologies:

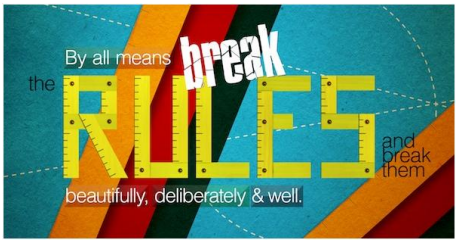
- Big Data (searching, mining)
- Cloud Computing and Models
- Configuration Management (Puppet, Saltstack, Cfengine, Chef, Systems Center)
- Data Analytics & Reporting
- Mobile Computing (Devices and Remote Access)
- Security (Tools and Administration)
- Security + Compliance
- Server Automation/Management (a comprehensive management of hardware, operating systems, and applications to ensure data center management efficiency.)
- Software Tools for Website Applications
- Software Defined Networking (SDN)
- Virtualization (VMware, Hyper-V, XEN)

"Try to learn a series of languages and frameworks through website tutorials, personal projects, internships." IT is often viewed as a commitment to lifelong learning. Every IT professional either asserts, or agrees with this statement.



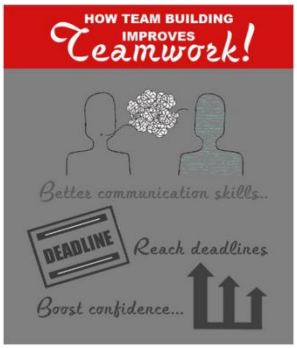
"Get as much real-world experience in things that interest you." Look up ways to create IT projects through everyday experiences, hobbies, or group activities, etc. Just doing a web search, the above image will take an IT student to Dream in Code (Dreamincode.net) where one can find a comprehensive list of coding projects to tackle.

III. Often, IT employers bemoan the lack of innovation and critical thinking in an IT graduate. Why do you think that is? What could the student do to "grow" their own capacity to innovate and think critically?



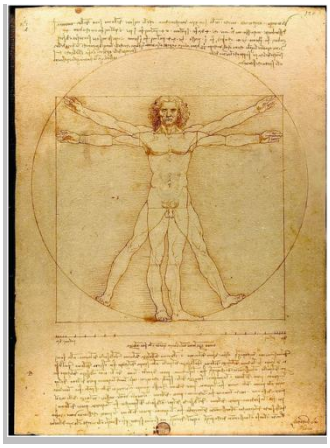
"Programming and related systems are very rule-centric. Spending time only with these leads to limited thinking. Also, people interested in rules-based systems are often not looking to break new boundaries, but instead feel more comfortable with the established order.

Exercises in "breaking the rules" to get people comfortable with the rules, but then finding ways to break them leads to innovations." There are a number of resources out there that interconnect "creative thinking" and "rule breaking". Think about how an IT student can break rules and ways for them to discover what happens when they do. Many business and entrepreneurial experts link "rule breaking" to innovation.



"It is crucial to get IT workers in teams as soon as possible, and keep them there. No programmer will ever get paid to build something on their own without feedback and reviewing requirements from others – Consider referring IT students to :

- the best open source and coding forums **(Try Code.org or review this list of programming forums. The number of forums out there are varied and can be found for any type of concentration for IT students)**
- provide them with examples of how/why it's essential they understand the fundamentals o f team work, and
- guide them on how to work successfully as part of a team."



"Instead of learning how to force data and processes into existing languages and systems, students should learn how to use existing systems as tools for crafting truly appropriate solutions for the people who need to use them." This is essentially the "don't fit the square peg into the round hole" meme. IT students shouldn't use prefabricated, ***easy solution*** technology tools if the specifications require a different outcome, or a unique approach. This relates to the aforementioned "learning to break rules" IT industry professionals' recommendation. Sometimes, what's easy isn't always the best IT solution. While IT has a wide variety of prepackaged solution-based products that are commonly used in the CTC system to teach IT concepts, asking students to stretch boundaries and attempt to create solutions outside the confines of a vendor's safety net, might be worth the risk.

The following are a series of ways for students to think about how they listen, ask questions, and consider linguistics and the actual meaning of both the spoken and written word in the context of academics and the workplace.

- Listening exercises that lead to proper dictation of what the speaker is really saying. The Udemy Academy lists a number of listening exercises that will introduce students into becoming more effective listeners.

Example: "Participants should stand in a line, or a circle. One person begins the game by whispering a sentence to the person after them. This sentence should be prepared beforehand, by someone moderating the game, but it should only be known to the person starting the game. The person who received the messages should then whisper it to the person after them, and so on.

By the time it gets to the final person in the group, they should say the message aloud. The first person will read the sentence they were given, and participants can note how much the two have changed. It's very unlikely, especially in large groups, that the message has not been altered at least a little bit…" (**Source:** Udemy.com)

While Udemy offers tuition-based courses, the exercises can be used in any classroom. You can also view another Ted Talk (7:47 minutes) with Julian Treasure, a sound consultant, who outlines ***5 Ways to Listen Better***. Treasure's most recent Ted Talk presentation, How to Speak So People Want to Listen runs 9:58 minutes.

- How can the IT student learn how to craft questions to get the best answer? What are good follow-up questions? The Conversation Café offers resources as well as meet-ups for students (in Washington State) who want to learn how to ask questions in the course of a general conversation.

Dan Pink's *To Sell is Human* offers two worthwhile exercises:
1. Take Five: Start a conversation with a partner (classmate, friend, casual acquaintance, family-member, etc.), and take five seconds before responding. Pink asks a few questions for the participants to ask themselves. "Is your conversation partner actually finishing their sentences? Is your partner getting their perspective fully on the table without you interrupting? Do they have the time to take a breath before you start yapping?" (**Source: *To Sell is Human***, Dan H. Pink, 2012, pages 199-200)\
2. Start a conversation with a partner and decide to essentially debate an issue with two distinct and different points-of-view. One person starts, and the other person can only respond by asking questions. "These questions must also abide be three rules: 1) You cannot ask yes-no questions. 2) Your questions cannot be veiled opinions. 3) Your partner must answer each question." (**Source: *To Sell is Human***, Dan H. Pink, 2012, page 200)

The general 5 W's are also a good way to think about asking questions: **Who, What, Where, Whey, Why** (**How** is sometimes included). The **5 W's** can also be used to analyze a general business problem, for example here it's used to provide data on who makes game purchases.

- Present IT students with potential interview questions, and also ask them to think about not only how they would answer these questions, but how and why they would ask them of someone they were interviewing.
- IT graduates sometimes struggle to adapt to a world where they are not given very prescriptive direction on a frequent basis. There is not always a "right" answer; instead there is just a "best" answer.

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Innovation: IT employers often talk about the need for innovation in their employees, and the trouble they have finding employees who can actually innovate.

One of the IT professionals responded to this section's question with this, "Mainly because 'innovation' is a buzzword: to innovate, you need creativity, divergent thinking, and the ability to sell ideas."

Again, Ted Talks (**Ideas Worth Spreading**) provide a variety of presentations on innovation. Ted Talks is a valuable resource as it provides snapshots and bite-sized, easily digestible pieces information that get to the point and provide an overview of somewhat complex issues or questions. Nizah Shaer of High Start Group curated the top ten Ted Talks here. Stephen B. Johnson's 17 minute presentation is worth viewing.

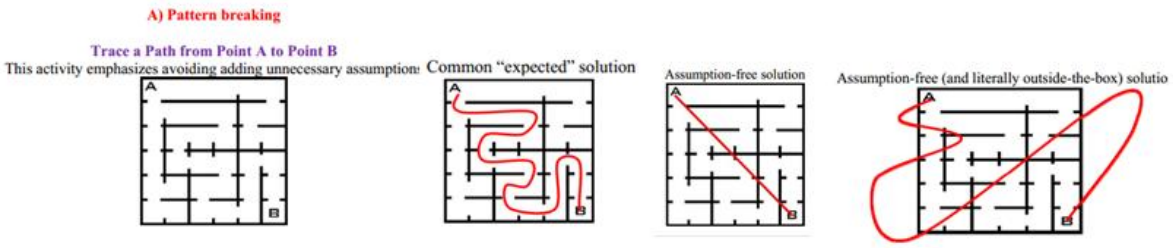
Both IT educators and students can review the third part of a series from **Scott Anthony, author of *The Little Black Book Of Innovation*.**

- Questioning: Asking probing questions that impose or remove constraints. Example: What if we were legally prohibited from selling to our current customer?

- Networking: Interacting with people from different backgrounds who provide access to new ways of thinking.
- Observing: Watching the world around them for surprising stimuli.
- Experimenting: Consciously complicating their lives by trying new things or going to new places.

"To grow explore and engage in exercises that expand **divergent thinking** – public speaking, persuasion, take on puzzles, (examine critiquing skills and experimentation)."

Inspect the following from Dr. Daniel Raviv, Florida Atlantic University, ENCOURAGING DIVERGENT THINKING, for a series of excercises created to encourage divergent thinking, or as Dr. Raviv names it "ideation." (**Source:** ASEE)

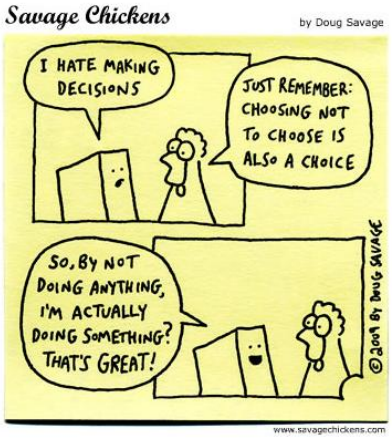


Our IT Professionals Offer the Following Ways IT Students Can Demonstrate IT Competencies:

- Online Portfolios: There are a variety of free online project portfolios out there. However, the majority are geared towards graphic artists, photographers, designers, etc. It doesn't mean that they can't be used to host an IT student's project work. Alternatively, there are online portfolio's that charge a user fee of $8 to $15 per month. Another option is to use LinkedIn, as they have recently added a portfolio option for your profile where links can be added and project files can be uploaded.
- IT Students should seek out IT competitions. Big companies and organizations like Intel, Android, and IEEE Computer Society are worth checking in on as they host annual IT competitions. Below are examples of IT competitions (**Note:** While some of these competitions are over, they are typically held annually so either check back or sign up to receive information on the next competition):
  - Code Chef

    - Coding (Listing a number of competitions)
    - Data (General)
    - Data Mining
    - Imagine Cup (Sponsored by Microsoft)
    - Software Development (Listing a number of competitions)
- Encourage IT students to develop a business plan and/or start their own business, even if it's just for the summer. The Small Business Administration (USA government) has a number of resources to help students figure out what a business plan entails.
- Logic puzzles
- Think about ways IT students can "Understand to be a 'renaissance' person of IT (you need to know that just one thing in IT). You need to a lot of 'things' and know them well."

IV. When you are training and/or mentoring a new IT employee, what three things do you spend the most time on with them to improve their performance?



Decision Making for Individuals and Teams: Team collaboration is something that needs to be emphasized incorporated into the mindset of new IT workers. Students tend to graduate with the mindset, "I get to work in isolation and my decisions related to a work product I created are the only decisions that count."

Here are effective ways to make individual or team decision.

Individual Decisions:
From Skills You Need (SkillsYouNeed), the method they offer consists of seven stages:

1. Listing all possible solutions/options.
2. Setting a time scale and deciding who is responsible for the decision.
3. Information gathering.
4. Weighing up the risks involved.
5. Deciding on values, or in other words what is important.

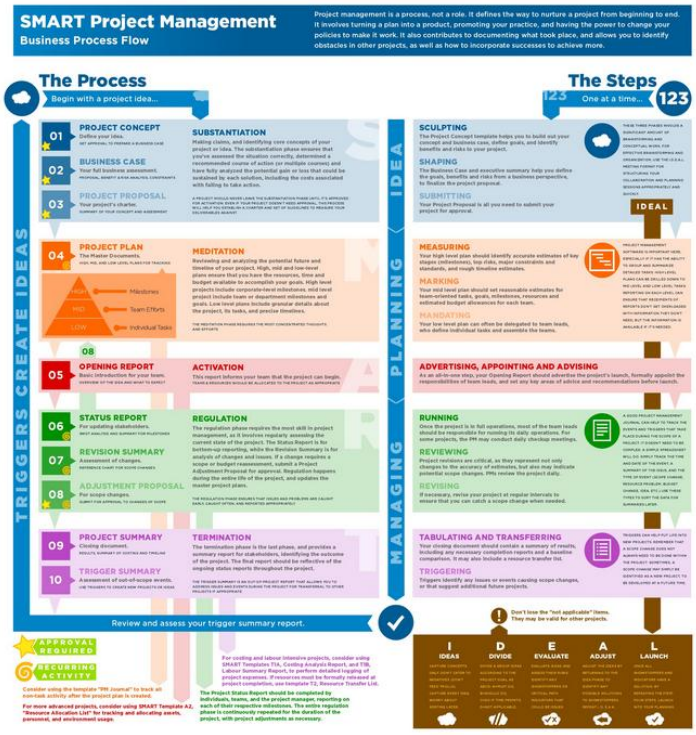
6. Weighing up the pros and cons of each course of action.
7. Making the decision.

There is then an explanation of each of these stages.

Group/Team Decisions:
From Mind Tools, the Stepladder Technique consists of five steps:

- Step 1: Before getting together as a group, present the task or problem to all members. Give everyone sufficient time to think about what needs to be done and to form their own opinions on how to best accomplish the task or solve the problem.
- Step 2: Form a core group of two members. Have them discuss the problem.
- Step 3: Add a third group member to the core group. The third member presents ideas to the first two members BEFORE hearing the ideas that have already been discussed. After all three members have laid out their solutions and ideas, they discuss their options together.
- Step 4: Repeat the same process by adding a fourth member, and so on, to the group. Allow time for discussion after each additional member has presented his or her ideas.
- Step 5: Reach a final decision only after all members have been brought in and presented their ideas.

Mind Tools recommends that productive teams are composed of four to seven members to optimize effectiveness. They also offer a comprehensive overview of team decision making.



Business Processes: "Another area where IT students can improve upon is their understanding of business processes. IT students who enter the workplace must expect that there are steps to follow and take time to know the reasons for the process."

A business process is a collection of related, structured activities or tasks that produce a specific service or product (serve a particular goal) for a particular customer or customers. There are three main types of business processes:

- Management processes, that govern the operation of a system. Typical management processes include corporate governance and strategic management.
- Operational processes, that constitute the core business and create the primary value stream. Typical operational processes are purchasing, manufacturing, marketing, and sales.
- Supporting processes, that support the core processes. Examples include accounting, recruitment, and technical support.

(**Source:** Wikipedia)

Know How to Ask for Help:

IT students, who ultimately enter the workforce, should be able to assess a problem in order to determine it's the right time to ask for guidance. IT educators should help students become aware that during projects there is a critical time when instead of becoming too determined in solving it by themselves, ***they are actually wasting time*** by not asking for help. Here is some advice from an IT professional.

Here are some questions an IT student should consider asking themselves (as both a student and a future IT worker):

1. **Do you understand the problem?**
   First of all, make sure you understand the problem. There are no stupid questions. Do you understand what your client/boss is asking you versus what they need?
2. **Do you know that the problem is unsolvable (within your time/budget constraints)?**
   This will happen. "Build me a bridge by tomorrow". Make sure that you know for a fact that a problem is unsolvable within your constraints. Your client/boss might be flexible on the time/budget and these can be modified to give you more time/budget.
3. **Do you just not know how to solve the problem?**
   If the problem is understandable and the constraints are within reason, and there is technology that can solve the problem, but you just don't know enough...that's what StackOverflow and the Internet is for. Make sure you do your research first. Try to ask explicit questions that have quantifiable answers. Ask your peers. Have a design session. Ultimately, if the above steps don't lead to an answer, let your client/boss know you're stuck. It will help them to adjust the deliverable deadlines before it's too late.
4. **Is your client/boss asking for the impossible?**
   This is a variant of answer number 2. It seems like your client/boss is asking the impossible. Do your research. Never say that the problem is unsolvable, unless you know exactly why and you can clarify.
5. **Is it worth it? (ROI)**
   ROI stands for ***Return on Investment***. This refers to an investment in time. Your Time! Is the problem important enough to solve to warrant the amount of time it will take you to research and solve the problem? Discuss this with your client/boss
6. **Is it a REAL problem?**
   Is it a real problem? Clients, often times, understand what they want, but don't necessarily understand what they need. Try to understand what your Client/Boss actually needs and discuss this with them.

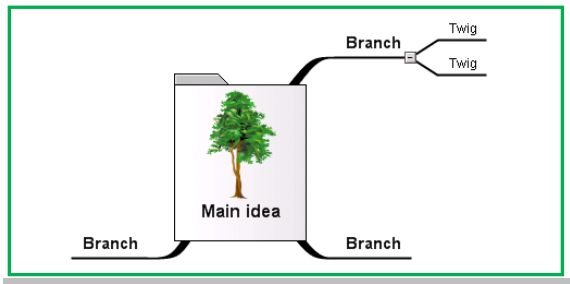
(**Source:** Stack Overflow)

Deadlines and Time Management: Everyone knows what a deadline is. Something (a product, project, etc. with pre-specified elements) someone committed to do is due on a specific date to a specific person. Understanding 1) what a deadline is, 2) different types of deadlines, and 3) what are the responsibilities as the person who has to meet a deadline, or the person who is expecting a deadline to be met with a deliverable, are all important concepts for the IT student and worker. Deadlines are related to time management, and sharing time management tips with IT students will serve them will when they enter the workforce.

The Fail Date: This is considered the "test" deadline. If you fail to meet this type of deadline, you won't be asked back to work on a project for the group, company, contractor, etc. You'll know it's a **fail date deadline** because the timeline seems unrealistic, a need for frequent updates will be part of the project specifications, and you are asked if there is a possibility of completing the project early. If you think you can actually meet the deadline, and then break the task down into multiple parts with hourly deadlines. If you think it's a fail date deadline project then either counter with a realistic deadline for deliverables, or pass on the project.
Firm but Flexible: This is the most common type of deadline. The deadlines are "firm" but there is a chance they won't be met due to unexpected issues that might arise. Find out why there is an aura of ambiguity around some or all of the deadlines. If the project actually knows that some of these deadlines might be missed because of the unexpected issue, what aren't they telling you? Find out. Is it because another part of the project has been farmed out to another person or group and you will have to wait for them to complete their part of the project? This type of deadline is something you can succeed with, it just might take a bit of perseverance and patience on your end.
Stale Date: Stale Date deadlines are attached to a project that isn't really expected to go anywhere. It might be a pet project of someone at the top level of management that produced a lot of initial excitement and then is forgotten about as other projects receive higher priority, or it's a project that doesn't have actual resources attached to it and fades away as time goes

by. Deadlines for these types of projects require acknowledgement of the deadline, keep it on your horizon, but expect that eventually no one will even remember what it was about.
(**Source:** Adapted from Gigoam.com)

Other Resources to Consider:
The Deal on Deadlines and What They Teach US, LinkedIn
10 Time Management Tips that Work, Entrepreneur



A Mind Map is a highly effective way of getting information in and out of your brain - it is a creative and logical means of note-taking and note-making that literally "maps out" your ideas.

The five essential characteristics of a Mind Map:

- The main idea, subject or focus is crystallized in a central image.
- The main themes *radiate* from the central image as 'branches'.
- The branches comprise a key image or key word drawn or printed on its associated line.
- Topics of lesser importance are represented as 'twigs' of the relevant branch.
- The branches form a connected nodal structure.

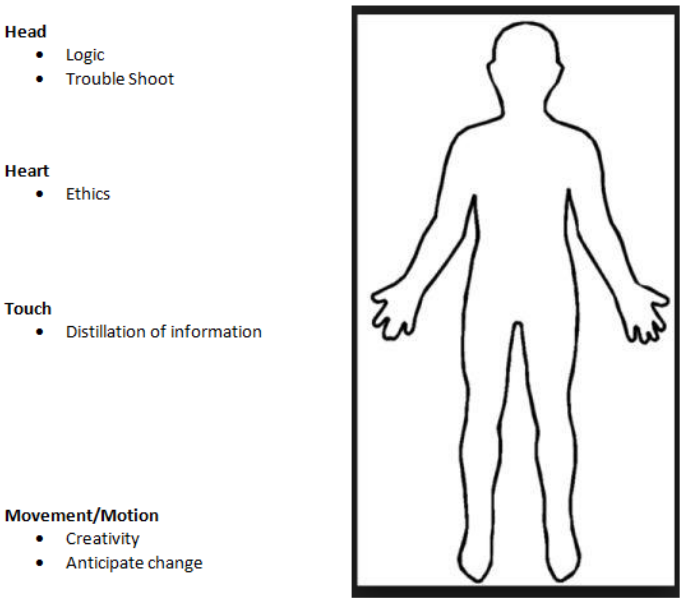
(**Source:** Excerpt from Mind Mapping)

4. What Constitutes the Ideal IT Student?

The IT professionals were asked to take the diagram below and write down the qualities that they thought, based upon their experiences as IT workers, would make up the ideal IT student.

They contributed a group of adjectives, descriptors, specific things that quantify and define this "ideal" under the headings head, heart, touch, movement/motion (skills, knowledge, intangible and concrete qualities, personality traits, characteristic, etc. – a few examples have been given).

They were asked to think about this in the context of their IT expertise/specialization (i.e. web, programming, gaming, etc.):



The Ideal IT student would understand and actualize in the work place the following attributes. These were identified by our group of IT professionals. They used the following four categories and assigned a comprehensive list of attributes:

- Head
- Hear
- Touch
- Movement/Motion

The Ideal IT Student