

To determine the
technical skills



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As an engineer today, many expertise are necessary for them to move forward in their job. It is a common misconception that an engineer will only enhance his or her technical skills and it is all that is needed to actually go into a job. Based on today's job requirements, having technical skills only is not a good idea when applying for a job. When an engineer steps into a job fresh after graduating, he or she will become a First-Line manager. This will require an engineer to possess Management skills and also soft skills. Having multiple skills of this kind will enable an engineer to actually lead their lower level workers well. An engineer needs to show their employers that they have all the compulsory expertise in order for them to succeed in their role as part of the company's asset.

Objective:

To determine the technical skills and non skills needed for an engineer in the working world today.

Scope:

Our scope is to find out what are the needs that calls for the necessary skills that is called for when an engineer is stepping into the working environment. We will have to find the types of skills that many young engineers in various fields bring into play to assist them.

Engineering Skills:

Engineers have to prepare themselves with a great variety of Engineering Skills. These skills will then help them to go through their working skills easily and without trouble. They will also be able to be a better leader to

their workers and their down line. When talking about engineering skills, we have many skills that can be associated with engineer. But we can categorize this great variety of skills into 2 main categories. Those are Technical Skills and Non-technical skills. When we talk about non- technical skills, it branches out into many other skills.

When we talk about Technical Skills, we will automatically associate it to those professionals whom attend to technical and scientific matters. Engineers are mostly trained to enhance their technical skills before graduating. When they are ready for their working environment, we can safely assume an engineer is capable of dealing with things that require technical skills. When we discuss about technical skills, it can branch out to many other skills under it. Technical skills vary between one engineering field to another. For example a Mechanical engineer may have a totally different technical skill when compared to a Robotics Engineer. A robotics engineer will have more knowledge in electronics and a mechanical engineer will have knowledge in the mechanics of machines. As we can compare them, although both appears to be engineering field, different working environment require different skills.

Non-technical skills are referred to skills that are other than that taught. Usually non-technical skills are attained as an engineer enters the working environment. Non-technical skills are very subjective and are not found in any engineer books but instead learned through experience and people. Non-technical can also refer to many major skills mainly soft skills, interpersonal skills and management skills. Soft skills sometimes may refer to people skills. These skills are not specific to one engineering field but can

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apply widely. Some examples of Soft skills are responsibility, time-management and optimism. Interpersonal Skill is very important to current working environment and to today's employers. What characteristic they look for in engineers is the essence of leadership, communication skills and teamwork.

An engineer must be able to work in a group and give productive work to the company. As many companies interviewed, they have stressed that many engineers have the required technical skills but most lack the necessary soft skills and interpersonal skills. Most engineering graduate today think that as an engineer, all they need is only technical skills but the fact is having only technical skills will never get them far in their working surrounding.

According to T. W. Hissey in his Journal entitled Education and Careers, IEEE, Vol. 88 No. 8, 2000, industry leaders have said that young engineering graduates do not have the extra skills that include written and oral communication aptitude, basic marketing- related knowledge and financial matters either in quality or quantity.

Basic Skills that engineer necessitate:

No.

Basic Skills

Definition:

1.

DESIGN AND PLANING SKILLS

The ability to identify an alternate course of action.

To be able to lay down realistic goal

Carry out a plan effectively

Good time management

Able to predict future trends and pattern

2.

INFORMATION MANAGEMENT SKILLS

To be able to sort data and objects

To Apply information creatively

3.

RESEARCH AND INVESTIGATION SKILLS

The ability to use chic methods to access information

Use variable methods to test the data validity

The ability to identify problem that arises

4.

COMMUNICATION SKILLS

To be able to communicate effectively

Able to speak fluently in the required working environment

Able to facilitate communication using computer programs

5.

INTERPERSONAL SKILLS

The ability to keep employees on target and move together to achieve the aim.

Understands the feeling of others

Willing to teach a skill, concept or principle to others

6.

MANAGEMENT SKILLS

The ability to manage other technicians

Able to organize people in a certain manner.

7.

IT SKILLS

Able to grasp the common knowledge about computers.

Able to access computers to define any problems related to engineering field.

Table 1: Basic Skills

Example of Specific Skills for Engineers in specified fields:

1

AEROSPACE ENGINEERS

-Develop Aeroplanes Skills

-Spacecraft Skills

-Missiles Skills

2

AGRICULTURAL AND BIOLOGICAL ENGINEERS

-Technologies And Biological Sciences To Develop Skills

3

BIOMEDICAL ENGINEERS

-Medicine And Biology Skills

4

INDUSTRIAL ENGINEERS

-Manufacturing Facilities Skills

-Designing Production Processes Skills

5

MARINE AND OCEAN ENGINEERS

-Design Skills

-Build Skills

-Maintain Ships Skills

6

MATERIALS ENGINEERS

-Develop The Material Used To Create Various Products Skills

7

CHEMICAL ENGINEERS

-Combine Engineering Chemistry Principles Skills

8

MINING ENGINEERS

-Focus on Locating Skills

-Extracting And Processing Coal Skills

9

NUCLEAR ENGINEERS

-Determine The Processes Skills

-System Necessary To Tap Into Nuclear Energy and Radiation Skills

10

PETROLEUM ENGINEERS

-Oversee Searches Around The World For New Sources Of Oil And Natural Gas Skills

Table 2: Specified Skills in Respective Engineering field

Online Article:

According to T. W. (Ted) Hisey, IEEE Director Emeritus What separates high-potential engineers, who rapidly rise within their organizations to positions of great prominence and leadership, from those who do not advance? Why are some engineers capable of transforming their technical knowledge and experience into successful entrepreneurial ventures, while others fall short of this financially rewarding accomplishment? Or, as a dedicated individual contributor, what will best prepare you as your organization embarks on the widely dreaded restructuring, downsizing or right-sizing exercise? Highly successful professional engineers are not only technically astute, but also often possess some of the extra or soft skills that many experts believe are necessary for engineers and scientists to increasingly embrace as we move forward in the 21st Century.

Thus, the ideas presented in this article are based on interviews with various industry executives and managers, and industry-savvy government leaders, as well as academic leaders, from both the USA and around the world. The

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consensus results indicate that engineers and scientists should understand the career enhancing value of the soft skills in order to progress in today's global open market economy. The paper discusses the importance of developing these skills through educational and other professional enrichment activities. It is expected that these skills will be required for the members of the global workforce of the 21st Century. This will also be an era in which the responsibility for career development is no longer the duty of the organization but rather that of the individual engineer.

[T. W. (Ted) Hisey (2000) Education and Careers IEEE. 88 (5), 1367-1370]

Enhancing technical and non-Technical Skills:

Technical skills are very easy to be cultured by engineers because basically the whole core about being an engineer is to deal with issues that require the core of engineering. An engineer will have to learn to yield the knowledge and understanding. Engineers in the working field will eventually and specialize knowledge in his or her major. Each engineering major will specialize in different aspects of engineering field. As per knowledge in technical part, once necessary technical skills is accomplished, an engineer will be able to solve problems related to engineering field and design systems though using resourceful and ground-breaking thinking.

Technical skills are usually sharpened during graduating years. This is where Engineers learn their most vital and also basic engineering skills. Some examples of these skills are mathematical, technological and scientific skills and the ability to use with ease the tools related to those skills Engineers are also taught to evaluate and construe statistics to gain data. These are all

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learned in the university or tertiary education level where their basic revolves around.

Next, engineers enhance their skills during their practical training. It is one of the most important periods where engineers are taught the real essence of working. After graduating, engineers are usually trained for 6 months before working or even when acquiring a job, they are sent for 6 to 10 months for competency courses. This is when they actually apply their knowledge and get the hands-on experience of being an engineer. This phase is very important to know the skills of using a very range of gear, apparatus and software and the techniques to use them for their specific field.

When we talk about non-technical skills such as soft skills and interpersonal skills, it can be very subjective. An engineer will not learn these skills in classrooms or from any hard materials. These skills are actually learned and incorporated in an individual over time and years of working experience. A good engineer will have a good command of both skills, technical and non-technical. A good communication skill can be learned when talking with peers or participating in a talk or presentation. They will also be able to communicate well with a good command of language, mostly English as its most used language worldwide. This has to be achieved by a skilful engineer by oral and written method. IT is also important for a good engineer. This can be learned by having a fairly good computer skill. This can be trained easily as everyone is moderately experienced in IT.

Other interpersonal skills include the ability to work together. An engineer has to portray his or her ability to run along a multi-disciplinary team. This is

especially important in engineering field as its very common for engineers to be involved together when working in projects. This skill can be acquired during the year of working and also when involved in projects whether in schools or working environment. Creativity is also important for engineers as they need to find a solution for a problem and creativity and innovation is important for getting an idea. This can never be taught anywhere but is found in each engineer as they progress. Other soft skills include intellectual integrity, self motivation, and enthusiasm that can be achieved through group work and working experience.

Fishbone diagram: Engineering skills for current world

Results and Findings from the survey conducted:

Figure 1- Learning mode that is crucial to become a good engineer

A survey was conducted for 30 engineering students in Multimedia University. Figure 1 above shows the results for learning mode that is crucial to become a good engineer chosen by the student's. There were two particular group's of student, 11 each chose that hands on lab experiences and all the three learning modes is crucial to become a good engineer. Next, 5 students chose only assignment based learning will help them to become a good engineer. Finally, 3 students chose that exam based learning will help them to be a good engineer.

From the results we can conclude that the two particular groups of student had working experience in a company. This is due to most of them which chose these results stated that they went for industrial training after diploma

and degree. Meanwhile, the students which chose exam based learning and assignment based learning had no working experience. Thus, they think with that sufficient knowledge they can work in a company.

Figure 2- Qualities to become a good engineer

Figure 2 above shows the results for qualities to become a good engineer chosen by the same student's. A total of 15 students chose that having the ability to identify and solve old and new problems as it arises is the important quality to be a good engineer. Meanwhile, another 9 students stated that having practical skills on the respective engineering field is the better quality compared to others. Thus, another 6 students chose having broad technical knowledge on the respective engineering field is one of the essential qualities to be a good engineer.

From the outcome we can conclude that majority of the students chose having the ability to identify and solve old and new problems as it arises because they know from their previous working experience that these are the main quality needed to become an engineer where they need to solve all the problems in their daily life. Students which chose having practical skills on the respective engineering field assume that practical field skills will enhance their performance in a company. Finally, fewer students chose broad technical knowledge on the respective engineering field due to the hands on lab experiences they get from their studies.

Figure 3- Important study approach that are used for working experience

Figure 3 above shows the results for important study approach that are used for working experience. 22 students chose lab experience as important study approach that is used for working experience. Next, 5 students chose lecturers and tutorial class and finally, the remaining 3 chose assignments are important study approach that are used for working experience.

In conclusion, majority students that preferred lab experience had previously undergone their industrial training. Which they find lab experiments is something relevant to the working environment they went through. The minority students which preferred lectures, tutorial class and assignment as their options had different kind of approach where they assume it will help them to gain technical knowledge on the respective engineering studies.

Conclusion:

According to the survey and interview conducted with the former engineers and students we have come to a conclusion that in the current working world today young engineers need to possess two essential skills in order to develop their career. Those are technical skills and non technical skills. Usually technical skills learned throughout their studying period and engineers sent for training for the first few months to gain the technical knowledge in a company. Thus, when it comes to non technical skills, soft skills are one of the main concerns in the working world today. According to research, many executives interviewed stressed that many of the soft skills were lacking in most of the graduate engineers today.

Young engineers who desire to progress forward in an organization should put effort to obtain, and then improve, the identified skills and characteristics

to the finest of their abilities. Experienced veterans of the engineering profession should continue to expand and maintain these skills. Furthermore, it is imperative for the engineers to develop extra aptitudes or skills, which will allow them to distinguish themselves among their peers. These skills improve personal and professional image and thus serve to solidify one's position in an organization.

Appendixes:

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Interviewed Person: Teo Mooi Yeow

Previous Post/Position: Engineer in Infineon

Current Post/Position: MMU lecturer

Q&A:

Q: What sorts of work were you involved in your company?

A: I was involved as the First-Line Manager

Q: Does your company find it hard to hire fresh Engineers for their skills?

A: I don't think so. Our Engineers are very skilful in technical factor. During interviews, we have many candidates with excellent skills. We don't find it difficult to hire fresh engineers.

The HR department will automatically assign each candidate to their respective specialty, so the issue of an engineer not meeting our technical requirement will not arise.

Q: What sort of skills lack in fresh Engineers?

A: I find that many engineers lack non-technical skills. Engineers today are mostly equipped with the necessary technical skills but not other relevant skills. What companies today are focused on are the soft skills and interpersonal skills. They play a big part in hiring an engineer. One skill that I think engineers today lack is the practical skills. This refers to their skills that are harnessed during their practical session or industrial training. We learn a lot of theory in class but in the end what matters is that we know how to apply these theories in the problem-solving. In my previous working place, a new engineer will require at least 6 months of training to successfully finish their project.

Q: What do you think about the soft skills in engineers?

A: Quite a few lack these skills. But as far as I've seen, MMU is equipping its students with necessary soft skills. Students are taught how to talk in class, do presentation and while at it, they learn how to enhance their computer skills such as how to do PowerPoint slides. Somehow many engineers still lack these computer skills and I believe it's important to have these form of soft skills as a preparation during working.

Q: So do we use a lot of soft skills such as computer expertise in the working environment?

A: Well, it depends on the working fields. Some engineers need it frequently and others not so much.

Q: What about management Skills?

A: For new engineers, when they come out freshly after graduating, the beginning of their career will revolve around technical skills and very less on management skills. When we say management skills, we can say engineers will use them when dealing with the technicians. It takes a lot of practice and years of experience to actually manage the engineers or the company. For example, through my experience, I had to manage my technicians and decide whether they need overtime, what are their needs? This is when we use our management skills.

Q: What do you think about Interpersonal Skills?

A: As an engineer we might need more interpersonal skills and Technical skills.

Q: As you said earlier, you worked in Infineon. Do they hire foreign engineers from other countries?

A: It's very unlikely. But there are times where they exchange engineers from China.

Q: Why do you think this occurs? Is it because Malaysian Engineers lack vital engineering skills?

A: No, this is because of business rather than to say we lack technical skills or non-technical skills. When we get China's business, for example Infineon,

they can trade specialties and set up a branch in their countries, actually we are actually providing them with the necessary skills.

Q: What improvement would you like to see in our fresh Engineers?

A: I'd like to see improvement in attitude. They need to ask questions and not only blindly take orders.

Do More! What fresh engineers need is to take the extra initiative to accomplish something and go further in the working environment. Never skip jobs and do the job that you feel that you can do and like. In engineering, you will only learn more when you are more involved in the . When you keep switching jobs; you will end up not learning anything.

Q: Which skills do you think is absolutely necessary and definitive for someone to be successful in this engineering field?

A: I think that would be Interpersonal Skills. You need to understand the psychology of your co-workers. You need to read their mind and understand their needs so we can have them work for you voluntarily and at ease. You need to give them a positive influence.

Interviewed Person: IR Ali Askar

Previous Position: TNB Manager

Current Position: Uniten Lecturer

Q&A

Q: Sir, my questions are related to engineering skills for today's working environment. Moving on to the first question, what sort of work were you involved in?

A: Basically I was working for the TNB for the District Power Distribution subdivision. I was the manager for that division.

Q: Do you find it hard to hire fresh engineers?

A: For fresh engineers, we are not that concerned on their technical skills but more on their communication skills, management skills and other soft skills. We also look into their attitude. Technical skills can be taught and learned very fast but soft skills and interpersonal skills must be incorporated in every engineers.

Q: How do you enhance technical skills among fresh engineers in the working environment?

A: Before I came to teaching, I was the Human Resource Development Manager. From the moment engineers come in, they do not enter engineering sector but applied as training executives for 10 months in competency courses. This will develop their technical skills specifically required for their respective jobs.

Q: What kind of skills do you think lack in fresh engineers?

A: I think the most important skills in engineer that they should grasp are mathematical skills. The technical skill depends on the particular engineering field. They need communication skills which is important. What is important is their attitude to learn what is necessary. What we learn in University is certainly insufficient.

Q: Do you think Engineers today have better working skills compared to past engineers?

A: I think what is different is the attitude. In the past, engineers are willing to learn from technicians and lower people. But now, the engineers like things easy. They want to sit in the office and have less involvement.

Interviewed Person: Dave Lim Chot Hunchlim

Previous Post/Position: R&D Engineer

Current Post/Position: MMU Lecturer

Q&A

Q: As you said earlier, you worked in Infineon. Do they hire foreign engineers from other countries?

A: It's very unlikely. But there are times where they exchange engineers from China.

Q: Do you think engineers today have better or worse working skills compared to the past?

A: They are worse compared to the past. This is due to, engineers back then were skillful nowadays skills are not required because machines perform all the tasks. In example, previously mechanical engineers used to create the structure of a machine. But now engineers use AutoCAD to draw a structure. In this modern world everything exists so engineers just modify the previous work.

Q: What improvement would you like to see in young engineers to meet their skills requirement?

A: First of all they need to be independent and perform the jobs by themselves because when fresh graduate enter the working world there will be no one to guide them this will be a whole new experience for them. So if anyone tends to help or share his knowledge with you always thank them. Thus, if your supervisor doesn't recognize what you're doing for the company try not to be depressed work harder.

Q: Which skills do you think is necessary for an engineer to do well in a company?

A: communication or soft skills to be more specified. Usually engineers posse's technical skills in order to present that skill they need soft skills. If an engineer can communicate well this can solve many problems. This will reduce the communication barriers between the subordinate.

Survey forms:

1) SEX: MALE FEMALE

2) PROGRAM YEAR: BETA GAMMA

DELTA EPSILON

3) PROGRAM MAJOR.....

BECOMING A GOOD ENGINEER:

4) TO BE A GOOD ENGINEER, WHICH STUDY MODE DO YOU THINK WORK BETTER?

HANDS ON LAB EXPERIENCES

EXAM BASED LEARNING.

ASSIGNMENTS (PROBLEMS SOLVING) BASED LEARNING

ALL OF THE ABOVE

5) AS AN ENGINEERING STUDENT WHICH OF THESE QUALITIES ARE THE BEST?

HAVING BROAD TECHNICAL KNOWLEDGE ON THE RESPECTIVE ENGINEERING FIELD.

HAVING PRACTICAL SKILLS ON THE RESPECTIVE ENGINEERING FIELD.

. HAVING THE ABILITY TO IDENTIFY AND SOLVE OLD AND NEW PROBLEMS AS IT ARISES.

6) DO YOU HAVE EXPERIENCE WORKING IN AN ENGINEERING FIELD (INCLUDING INDUSTRIAL TRAINING)?

YES NO

7) IF YOU DO BASED ON YOUR WORKING EXPERIENCES WHICH PART OF STUDY MODE IS CRUCIAL?

LAB EXPERIENCE

ASSIGNMENTS

LECTURES AND TUTORIAL CLASS