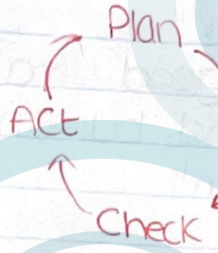
Weekly Notebook

1st Week

Human

First Semester 2022

* Industrial engineers are problem identifiers.



* Every system is designed perfectly to produce what it should be producing.
↓
If the product is problematic, check the system.

* A system is a collection of elements that affect each other.

Stakeholders analysis is the first tool that should be utilized in system thinking.
↓ most important tool for IEs.
⇓
should be followed by Power Interest Analysis.

KPIs ⇒ K: Key important
P: Performance
I: Indicators.

Measurements of performance:
① Effectiveness: is the degree to which something is successful in producing a desired result.
"doing the right thing" "measure of how much you're achieving your goal".

② Efficiency: is the ability to accomplish something with the least amount of wasted time, money, and effort or competency in performance.
"doing it the right way".
"measure of waste" → 7+1 types of waste
↓ tool to get rid of waste.

③ Adaptability: is the ability to adjust to changes in the environment.

Ergonomics: "Rules of work"
→ focuses on creating a good match between job demands and human capacity.
"fitting the task to the man"

Branches of Ergonomics:-
① Physical human factors

② Cognitive human factors
"Mental" "how the brain works"

③ Social Ergonomics
→ interaction of humans with each other.
↓ "organizational factors"

Goals of human factors Engineering:-
① Safety not to get injured because of the way your body moves.
② Optimization of performance.
③ Completiveness.

IISE:- Institute of Industrial and Systems Engineers.
ISO:- International organization for Standardization.

Memory

Short-term Memory → Working memory
→ is a cognitive system with limited capacity that can hold information temporarily.
Capacity: 7 ±2 bits * equivalent to RAM

Long-term Memory (Memory)
→ is where knowledge is held indefinitely.
Learning takes place here.
Capacity: unlimited, however it is said that humans are ~~use~~ using up to 20% of it only.
* equivalent to hard-disk

* Humans are habitual in their nature, and it is said that the week is made up of 7 bits to match the capacity of the working memory.
↳ To not lose track and memorize easily.

* You can reduce huge data into simpler data that can be easily memorized by the process of chunking (grouping).

* You have to organize what you learn to ~~make~~ match it with your capacity.
↙ to make everything easy and achieve the purpose of what you learn.
↓ You have to be able to recall what you learned when needed!

* When you are concerned about one thing, you exploit all the available resources on it, and ignore irrelevant stuff.
↖ selective attention blindness.
our way as humans to be more efficient.

Why do we learn?
→ to make decisions, which are followed by actions.

↓
you make decisions by ~~making~~ comparing between alternatives based on certain criteria.

↓
We are naturally able to optimize small systems.

↓
However, now we are faced with systems that exceed our working memory.

Everything is long-term now, so we need tools to be able to deal with it.

*By natural instinct, we ~~ten~~ value the short-term over the long-term. However, there is a mismatch between us as biological entities and ~~the~~ our lifestyle. ~~we ti~~

⇓
~~thus~~, hence, the need for tools such as chunking.

* Today, what matters the most is how you're going to deal with the situation, not how fast you deal with it.

Right decision, Right time.

Flight or fight response

→ is an automatic physiological reaction to an event that is perceived as stressful or frightening.

this means that the event doesn't necessarily have to be truly stressful or frightening. It depends upon what the person "perceives"

شو الشخص بتصور

① All the senses became sharp & focused on the threat to deal with it.

② ~~The muscles~~ The body prepares to use ~~your~~ the muscles, especially the ones in the extrimities.

↓ Blood ~~is pumped mainly there~~ flow to these parts increases significantly.

الأطراف

③ The body sweats.

i) As a precaution as it is preparing itself to get hot.

ii) could possibly act as a lubricant.

عشان إذا حد بده يمسك فيك يصير الموضوع أصعب

④ Cortisone hormone is secreted.

↙ in case you get injured.

⑤ Adrenaline is secreted.

↗ stress hormone.

The more concentrated the stress hormones in your body are, the more on edge will you be.

There must be physical activity to get rid of the remaining traces of these hormones.

Stress can be caused by either happy or sad occasions!

NIOSH
National Institute for Occupational Health & Safety.

Job stress:
is a set of harmful physical and psycological responses that occur when the requirements of the job do not match the abilities, resources, or needs of the workers.

* Occasional episodes of stress is normal, however the constant exposure to stress is harmful as the body remains in a state of activation.

* This prolonged response results in fatigue or damage to the body.

* The body can no longer repair or defend itself as it normally should, hence increasing the risk of disease and injury.

* The first line of defence in the face of job stress is to design stressful-free conditions.

~~Conditi~~
Potential causes of stress:
① Unrealistic dea
② Lack of control over the working environment.
③ Lack of supervisory support
④ Poorly defined work rules.

* The most direct way to reduce stress is to improve the working conditions.

→ Stress-related conditions can interfere with profitability as stress can result in absenteeism and tardiness of the workers.

~~Potential Stressors:-~~

Stress-prevention strategies:-

① Define workers' roles & responsibilities
② Allow workers to fully utilize their skills.
③ Establish work schedules that are compatible with demands outside of work.
④ Involve workers in decisions that affect their job.
⑤ Reduce uncertainty about future job prospects.

Two job conditions linked to stress complaints:-

① Lack of planning
② ~~Lack~~ Poor communication.

Cognitive Ergonomics

* Information is processed by the brain through electrical pulses.

→ Sensors gather information and this informa is transmitted to the brain by electrical pulses.

Sensory input:- Monitor both external and internal environments.

Integration:- Process the information and often integrate it with stored information.
↖ in order to take a decision.
↙ this electrical pulses will be sent out to do a certain action (either a voluntary or an involuntary o

Motor output:- If necessary, signal is transmitted to effector organs to make an appropriate response.

Stereotype:- is the common understanding of something.
Don't design against the stereotype.
e.g. the stereotype related to traffic lights



Designing a trafficlight opposing to the stereotype could lead to errors.

Correctness of design
→ designing according to what the user will be expecting.

Types of Human Error:

① Perception Errors:-
→ The person making the error did not grasp the needed information.
e.g. you saw a red trafficlight but thought that it is green.

② Decision Errors:-
→ The person did not respond to the signal or information.
e.g. you didn't stop the car eventhough there was a red traffic light. "Making wrong decisions"

③ Action Errors:-
→ The person reacted, but activated the wrong control or activated the correct control improperly.
e.g your intention was to ~~make~~ take the right action however you executed it wrongly.
you decided to stop, but you ~~pressed the~~ instead preased the gas pedal.



Controls:- Equipment features through which users of human machine systems communicate with those systems.
"This is how the human user talks to the machine"

Displays:- Equipment features through which human machine systems communicate with the users of these systems. "This is how the system talks to the user"

* Controls can be either discrete (on/off) or variable.
You have to choose the correct control for the situation.

Display types:-
① Quantitative
Preferred Display: Digital readout or counter.
Advantage:-
- Minimum reading time
- Minimum error potential

② Qualitative
Preferred Display: Moving pointer or graph
Advantage:-
- Position easy to detect
- Trends apparent

The simpler the job, the less stress imposed on the worker.

* Having a lot of controls and displays in one place can be confusing and hard to learn.

* The displays and controls should be designed in such a way that you could easily guess which ~~dis~~ control is for which display.
↳ you could use color, proximity, shapes...

Evaluation Criterion:-

① Learn-ability → easy to learn
② Retention → you don't forget what did you learn
③ Efficiency →
④ Error Probability → should be low
⑤ Recovery → the ability to fix the error if it occurred
⑥ Satisfaction → the user should be ~~designed to~~ satisfied with the design.

Muscoskeletal Anatomy:-

1) Bones:-

* there are around 206 bones in the body.
* they support the framework of the body.
* provide shells to protect vital organs.
* allow the movement of the body.
* the bone marrow, which produces red blood cells, is found in bones.
* store calcium and phospharous.
* bones are very hard, however they inevitably change their structure with time as a result of the loads ~~exerted on them~~ placed upon them.

2) Ligaments:-

* Links bone to bone to hold the joints in place.

LBB → ligament, Bone, Bone.

* Ligaments are very strong.

3) Tendons:-

* Attach muscles to bones.

TMB → tendons, muscles → bones.

* Tendons are very strong and inelastic.
* Blood supply to tendons is low, therefore it's white (or translucent).
* Tendons are very powerful; Some can withstand over 9 tons of pull force.

4) Muscles:-

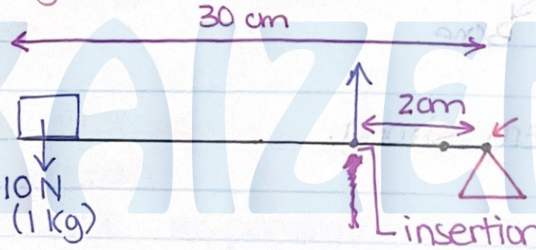
* Muscles only contract.
* Mostly, muscles come in pairs.
e.g. Biceps and triceps.

→ While flexing your arm:-
the Biceps is the prime mover
the Triceps is the antagonist

→ While extending your arm:-
the Triceps is the prime mover.
the bicep is the antagonist.

* Muscles can contract to half their length.
* Longer muscles are stronger.

Lever system:



(Pivot) Fulcrum which is the elbow for this example.

insertion point (point where the muscle is attached to the bone)

$10 \times 30 = 2F$

$F = \frac{300}{2}$

$= 150\,N\ (15\,kg)$

* You need to exert 150 N in order to lift 10 N.
You are at a mechanical disadvantage.

*Humans are lousy machines when it comes to carrying loads

⇓

If carrying loads is a requirement, design a machine that can handle these types of loads.

*The only place that has a mechanical advantage is at the tip of your toes.

⇓

the exerted force to lift your body is less than the weight of the body.

改善 KAIZEN TEAM