



The Joy of Teaching

Prof. C. Balaji

Department of Mechanical Engineering

Outline of the talk

- Goals of teaching
- Attributes of a good teacher
- “My” philosophy of teaching
- Role of stress, hard work and research
- 10000 hour rule
- Flow and creativity
- Simple tips and things-to-avoid for effective teaching
- Inspiring quotes

The goals of teaching



Hierarchical set of goals

- Teaching to justify our existence!
- Teaching to impress!
- Teaching to improve learning
- Teaching to improve learnability

Cardinal attributes of a “good teacher”!

1. Mastery over the subject

- Key caveat: The above should never be taken for granted!!
- Most engineering courses, curricula are evolving; hence “Mastery” quickly evaporates, if we do not constantly endeavour to update

Cardinal attributes of a “good teacher”!

2. Good use of examples and illustrations

- It is here that being **active in research** helps.

Cardinal attributes of a “good teacher”!

3. Sense of time

- Coming to and leaving the class on time
- Overshooting the time always makes the students very edgy – avoid it

4. Being fair consistently

- Never put off any student

Cardinal attributes of a “good teacher”!

5. Enthusiasm

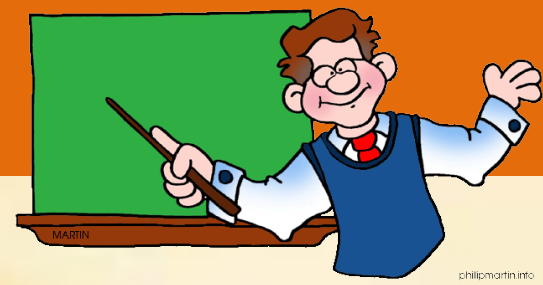
- Enthusiasm about teaching
- Enthusiasm about what is being taught
- **Continue to have this enthusiasm** even after teaching “the same course” again and again.
- Present the material in a way that ,makes students believe that we are also learning along with them.
- **“Infect”** students with this enthusiasm

Cardinal attributes of a “good teacher”!

6. Self evaluation and self criticism

- Never try to defend the indefensible.
 - If a mistake is made in class, so be it!
 - To err is positively human.
- Redo stuff that did not get across in the previous class.
- Be one’s harshest critic.
- Evaluate oneself at the end of every class

My philosophy of teaching



- Teaching is a “**Tapasya**”
 - Needs to be treated with reverence.
- Every class is a like a **concert** for a performing musician.
 - The music should be enjoyed and also understood by the audience.
- Need to **avoid overt display** of virtuosity.
 - Covert display may be OK sometimes.

My philosophy of teaching

- Never feign “modesty”.
 - If there is some arrogance at the start of the career, be aware of it.
- Arrogance has to and will melt away with time!
 - with getting “hit” by anonymous reviewers of our research articles.
- Sending out papers and facing reviews –
 - Prerequisite for puncturing the ego to keep us at ground level.
- Research not only brings in excitement to teaching but also sanity!!

My philosophy of teaching

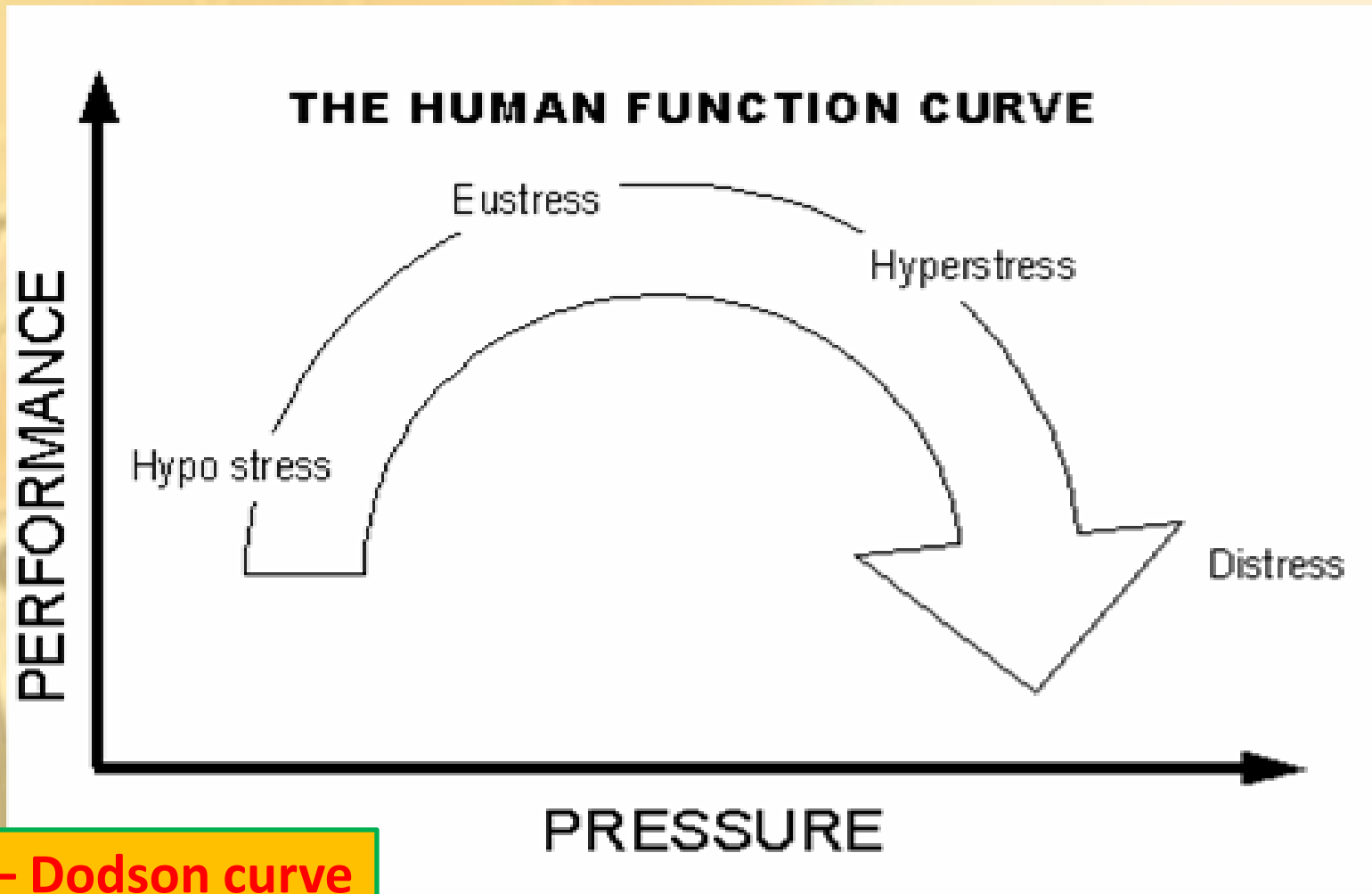
- “Each soul is potentially divine”!
 - Translates to “Each student is potentially capable”
 - The capability may be hidden; the challenge is to bring this out!
- Need to avoid constant bad mouthing of students
- Avoiding sweeping statements that start with ‘Nowadays...’, “those days” ...
- Sometimes the problem may simply be that every generation thinks that it is the best.

Role of stress in teaching

- Discontent with the present is the first step towards progress
- Hence, progress is all about “Optimal disenchantment” and channelizing this disenchantment
- Teaching is all about “Optimal nervousness”.
- “Eustress” is required for bringing out the best in us.
- Stress by itself is not stressful until it becomes distress



Eustress – better the performance ?



Role of hard work

- Oft repeated - **hard work is the key!**
- Even so, this can never be overstated
- New evidence only confirms this more and more

The 10000 hour rule!!

- What is this “10000 hour rule”?
- It takes approximately 10,000 hours of deliberate practice/study to master a skill/area of research

Hours of work/practice per day	Period required, years
3	10
8 (full time employment)	5
10-12	3-4



The 10000 hour rule!!

- Man behind this: **Prof. Anders Ericsson, Florida State University**

Chase and Ericsson, 1982, Psychology of Learning and Motivation (vol.16), Academic Press, New York

- Popularized by Malcolm Gladwell, **Outliers**, 2008, Allen Lane



Mozart
Beatles
Bill Gates
All Chess GMs

Hard Work is the Key in Both Research and Teaching

- Science progresses through hard work, failures and frustrations!
- The human element of these “travails”- Not seen in publications!
- Society attaches way too much importance to success.
- Its importance to hard work is conditional upon some “final” success!
- Takes time for success in research
- Teaching difficult concepts is also iterative and needs to be constantly worked upon and eventually the elusive success knocks at our doors!



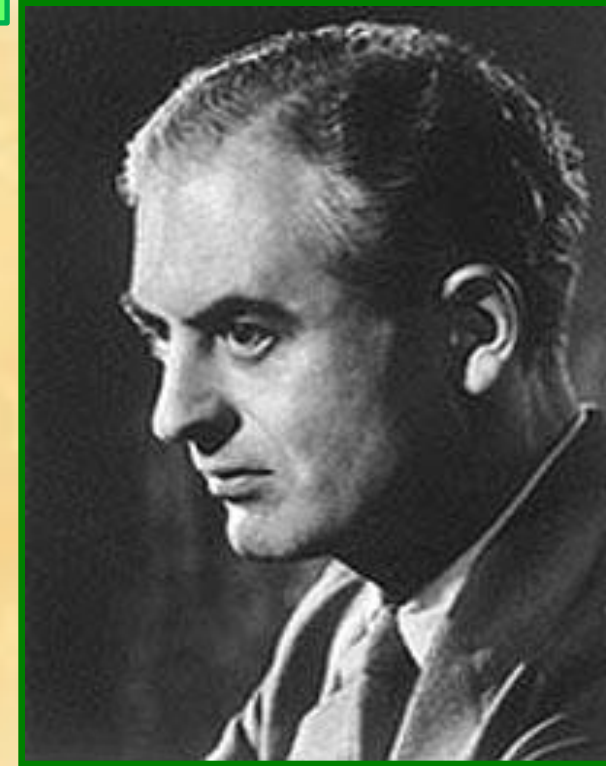
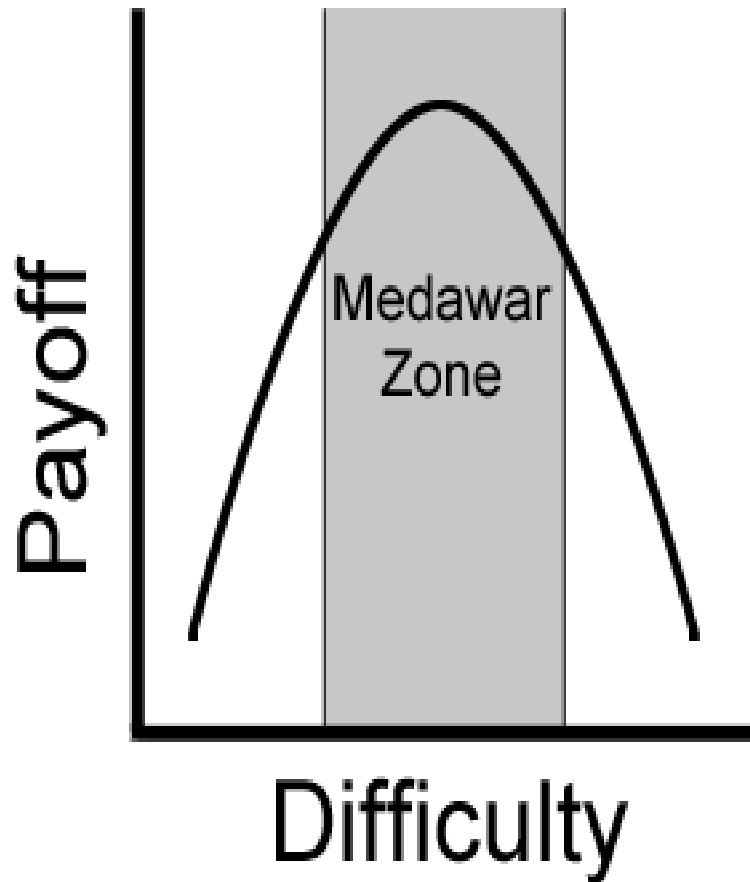
Role of research in teaching

- There is a tangible nexus between teaching and research.
- The intangible nexus
- Global nexus
- “All academics, who were identified as good teachers, save one, were active researchers”
- Active Research Involvement is a necessary but not sufficient condition for good teaching

Neumann, European Journal of Education, 1994, 29, 323-338

Payoff vs. Difficulty in Research Problems

Research – Art of the Soluble

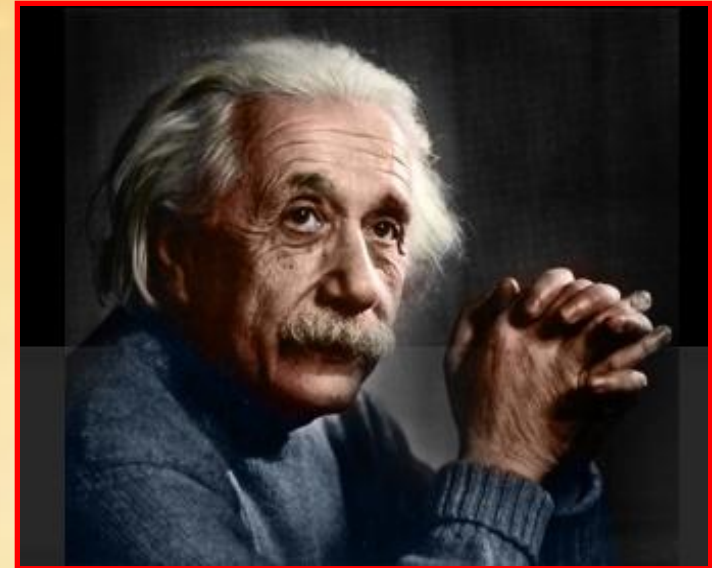


Sir Peter Medawar (1915-1987)
Nobel Prize -1960
(medicine)

First coined by Craig Loehle, *Bioscience*, 40, 123-129

Nobel prize winners and famous scientists

- **Competent Scientists:** Those who were in the right place at the right time.
- **True genius:** Ability to repeatedly develop significant innovative ideas (e.g. Einstein)



Being a good researcher

- **History:** many discoveries made by young scientists during their M.S/PhD or in the few years after their PhD
- A young scientist has all the basic skills (Calculus, Differential equations, Programming, Statistics, Scientific theories) but is **inexperienced** - a **virtue**
- **Familiarity breeds contempt??**
 - When someone has worked or lived in an environment for more than 10 years, he/she tends to be less curious because of familiarity



Continue doing good research

- Change fields once in ten years(?)
- To retain enthusiasm in teaching (taking a cue from what it takes to be a good researcher)
 - change the courses we are offering
 - change the line of investigation
 - Above will herald the birth of new courses
- Active research at the University/ Institute level will set the tone for the path in which research itself needs to go and so we can contribute to the direction in which society is moving.

Flow and creativity in Teaching and Research

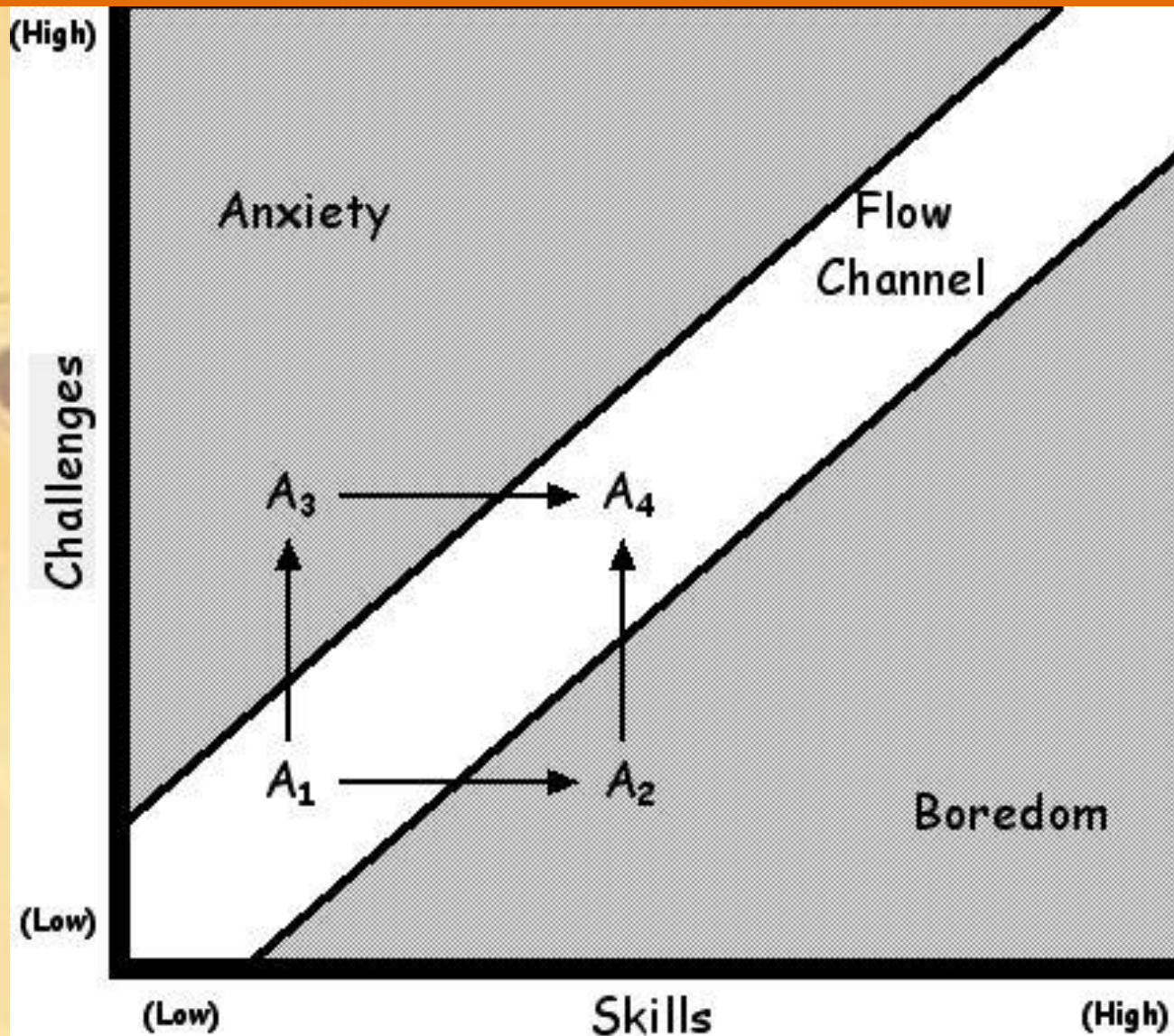
- Flow – a concept in psychology
- First proposed by Mihály Csíkszentmihályi, Professor of Psychology, University of Chicago
- Flow is fully focused motivation
- single-minded focus - represents the ultimate in harnessing the emotions in the service of performing and learning.

Components of flow



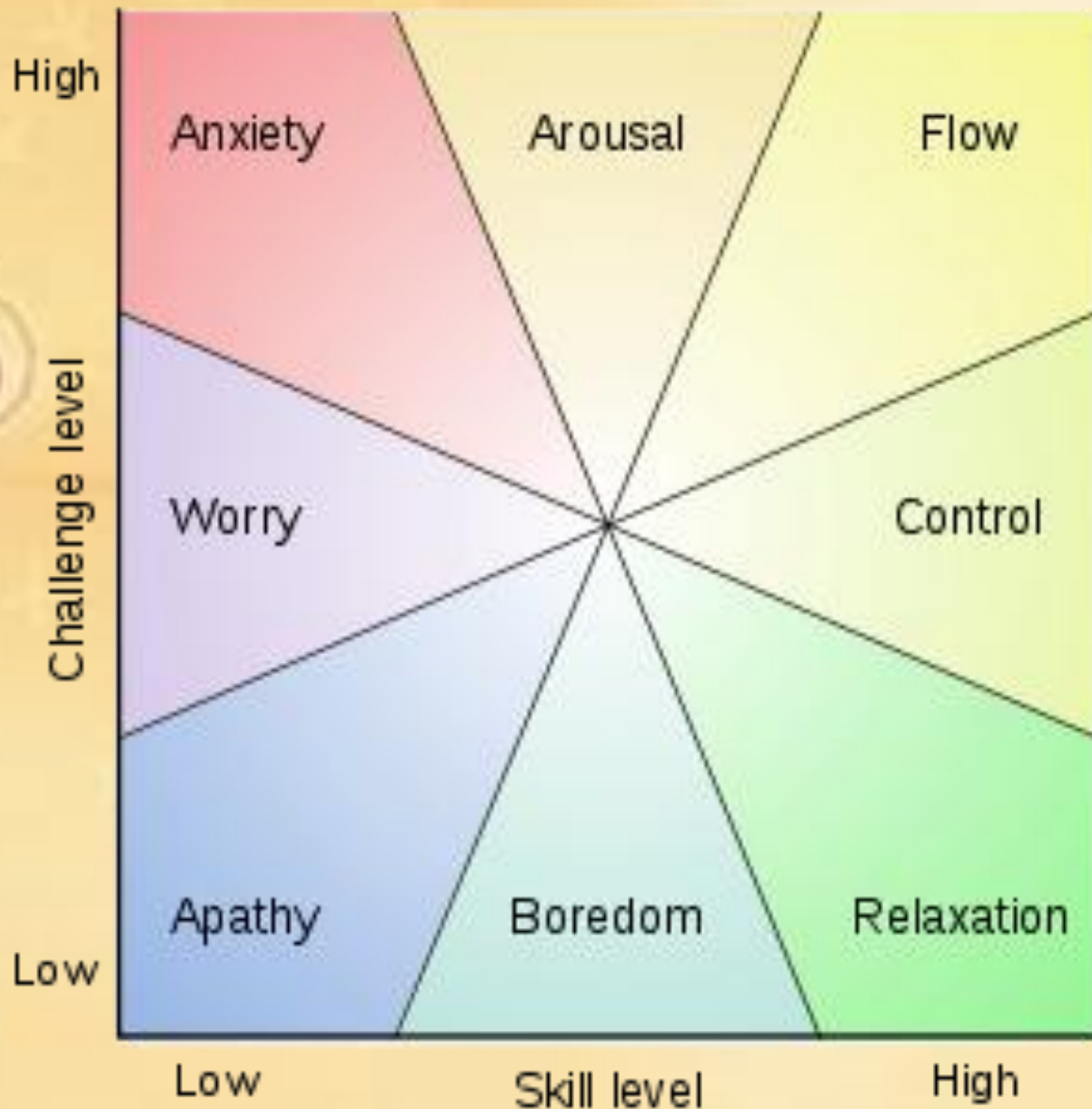
- Clear goals
- High degree of concentration on a limited field of attention
- A loss of the feeling of self-consciousness, lack of awareness of bodily needs - **Timelessness**
- Balance between ability level and challenge
- A sense of personal control over the situation or activity.
- Activity intrinsically rewarding - no worries about prize or reward

Pictorial representation of flow



From Flow: The Psychology of Optimal Experience
by Mihaly Csikszentmihalyi (page 74)

Challenge vs Skill matrix



Role of Humour in teaching

- Makes learning experience **more enjoyable** and memorable
- Helps **retain interest** throughout the class
- **Memory recall – more effective (empirical evidence exists)**
- “Humanizes” the teacher and reduces anxiety and stress
- **Better to attend a fun lecture than a boring one!!**
- Nevertheless, humour should not overshadow lecture content





Effective teaching

Simple tips

- Never under estimate the difficulty of **getting a concept across**.
- Never assume one's own **mastery of the subject**
- Never take for granted one's **enthusiasm for teaching the subject**
- Never assume that one's **ability to communicate** is always beyond question.

Simple things I avoid doing before a class!

- **Opening the Inbox** early in the morning, esp if one has an 8 or 9 AM class, much less responding to an e-mail thread doing the rounds on announce!
- **Arguments with spouse** early in the morning.
 - There is a whole lifetime to “argue and fight”
- **The newspaper** - Before a very important lecture, say derivation of boundary layer equations, if it is an 8 AM class
 - Can always be read in the evening.
- **Long discussions with colleagues before a class (on topics not related to the day’s lecture)**

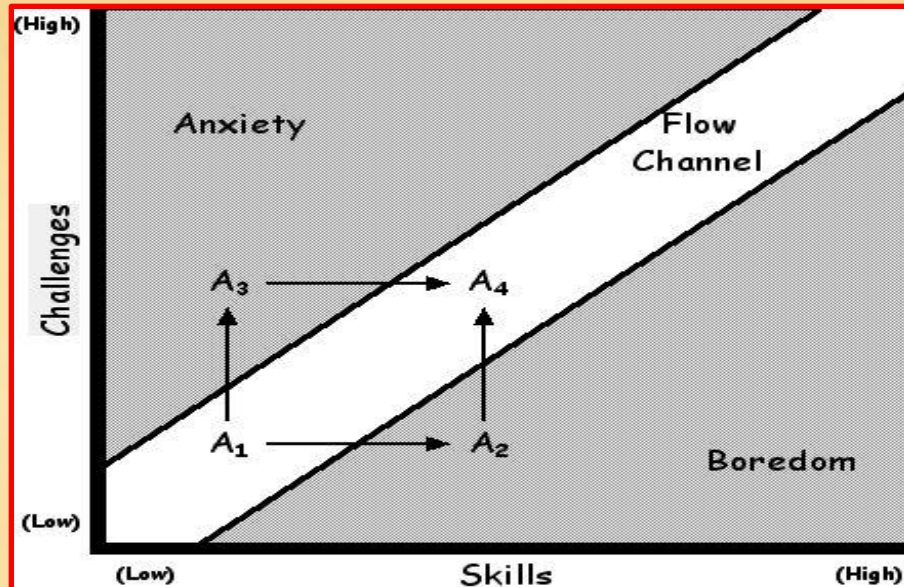
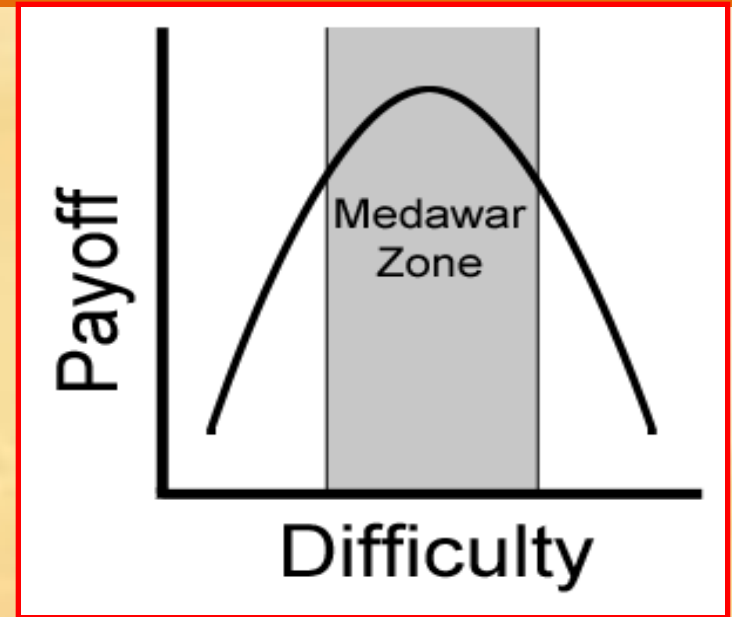
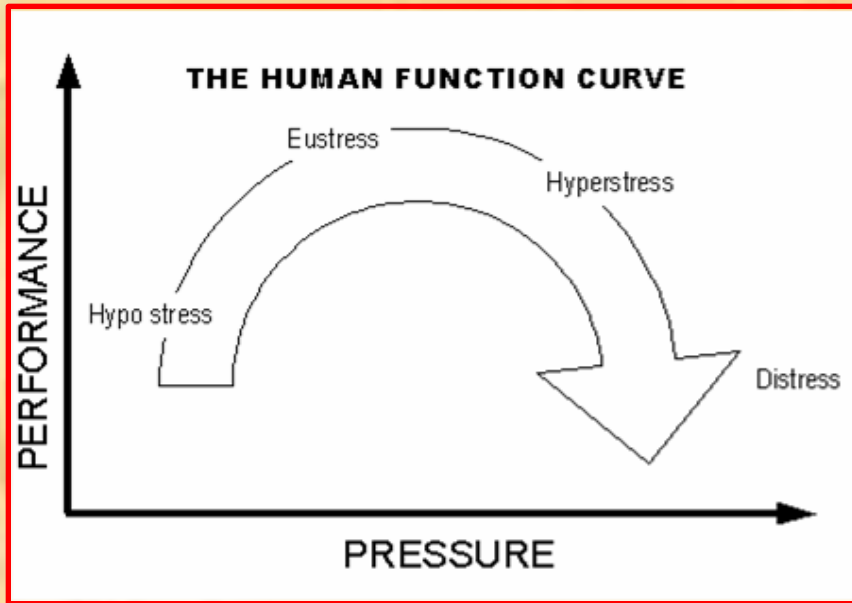


Simple Tips



- Having a **plan B** for every class.
- Students may be restless after a quiz during the quiz week. Need to come up with our own solutions to handle this.
- Late on a Friday afternoon, if students want to go a little early, may be we can be flexible.
- **Sensitivity** may be a very important “soft skill” students expect us to have.
- Follow the **progress of bottomers** in class

The Overall Picture



From *Flow: The Psychology of Optimal Experience*
by Mihaly Csikszentmihalyi (page 74)

Inspiring quotes!!

"Ideal teachers are those who use themselves as bridges over which they invite their students to cross, then having facilitated their crossing, joyfully collapse, encouraging them to create bridges of their own."

-- Nikos Kazantzakis

The mediocre teacher tells.

The good teacher explains.

The superior teacher demonstrates.

The great teacher inspires.

--William Arthur Ward

Who dares to teach must never cease to learn.

--John Cotton Dana

**Behind every successful student lies an
“exhausted” teacher**

Piece de resistance

The test of a good teacher is not how many questions he can ask his pupils that they will answer readily, but how many questions he inspires them to ask him - which he finds hard to answer!!

Alice Wellington Rollins

Thank You!

