

# Creating Outstanding Problem Solvers

## Module 0:

### Introduction and overview

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Version 1.12.16



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## Objectives

1. To introduce the course
2. To explain the structure of the course
3. To provide administrative information
4. To provide an overview of the sessions and how they fit together
5. To discuss the two biggest mistakes students make in essay examinations and when doing exercises and how to easily eliminate them

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## Joseph Kasser

- The real world
  - Electronic engineer, London, UK
  - ALSEP, Apollo's 15, 16 & 17, USA
    - Systems engineer
  - TT&C, Comsat
  - LuZ SEGS-1, Israel
  - NASA-GSFC ground support
  - Consultant, coach and mentor (Adelaide)
  - Small business experience
    - Founded three small companies
- Academia
  - GWU, UMUC, USA
  - Associate Professor, Deputy Director, UniSA, Australia
  - Leverhulme Visiting Professor, Cranfield, UK
  - NUS Visiting Associate Professor, Singapore

Teaching online since 1997 or so



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## Topics

- Learning outcomes
- Course assumptions
- How the course is taught
- Course knowledge components
- The sessions
- Course format
- Balanced classroom
- Dealing with the exercises
- The two biggest mistakes students make in essay examinations and when doing exercises and how to easily eliminate them
- Exercise

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## Knowledge

- Lecture
    - Overview
      - and sometimes summary of readings
      - will generally not repeat detailed reading material
  - Reading/Video
    - 0000 Study guide
    - 0002 Introducing knowledge readings,  
<https://www.youtube.com/watch?v=NltGcO2cmJg&t=474s>
    - 0003 Introducing the balanced classroom: Applying systems engineering to systems engineering education, The Voice of the Systems, The Journal of the Israeli Systems Engineers, Issue 18, June 2016
  - Exercises
    - Learn by doing, learn by presenting,
    - Each exercise is sized to take no more than 60-90 minutes
  - File numbering convention [snrn-pn]
    - sn - session number, rn - reading number in session (sn01 = lecture), pn = page number
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## Learning outcomes

1. The ability to deal with open ended problems with no unique solutions
2. The ability to deal with ill-structured and wicked problems
3. The ability to deal with complex problems
4. Improved problem solving, systems and critical thinking abilities
5. The ability to go beyond systems thinking in the analysis of a problem and determination of a solution

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## Course assumptions

- Lectures summarize and point out important points
- Optional readings provide in-depth knowledge
- Practical activities bring knowledge to life and provide experiential anchor points
- Participants
  - Expected to do homework
    - Exercises and readings

Partnership

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## This course is designed to provide

- Education
  - To increase insight and understanding why the task is performed
    - Hammer, M. and Champy, J., Reengineering the Corporation, HarperCollins, New York, 1993, page 71
- Training
  - To improve how a task is performed
    - by increasing skills and competences in performing tasks
- Emulation of workplace environment
  - Requiring reading, doing and communicating

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## How the course is taught

- Uses problem based “active” learning
  - Minimal “Death by PowerPoint” lectures
- Emphasizes **conditional knowledge** not **declarative** and **procedural** knowledge
  - But students are more comfortable with declarative and procedural knowledge 😊

### Notice that you are being shown

1. The context or background – big picture perspective
2. The same issue from more than one perspective – systems thinking



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## Knowledge\*

- **Declarative knowledge** - knowledge that can be declared in some manner.
  - It is “knowing that” something is the case.
- **Procedural knowledge** - “knowing how” to do something and must be demonstrated.
  - Describing a process is declarative knowledge.
  - Performing the process demonstrates procedural knowledge.
- **Conditional knowledge** - “knowing when and why” to apply the declarative and procedural knowledge.

\* A. E. Woolfolk, "Chapter 7 Cognitive views of learning," in *Educational Psychology*, 7th ed. Boston: Allyn and Bacon, 1998, pp. 244-283.

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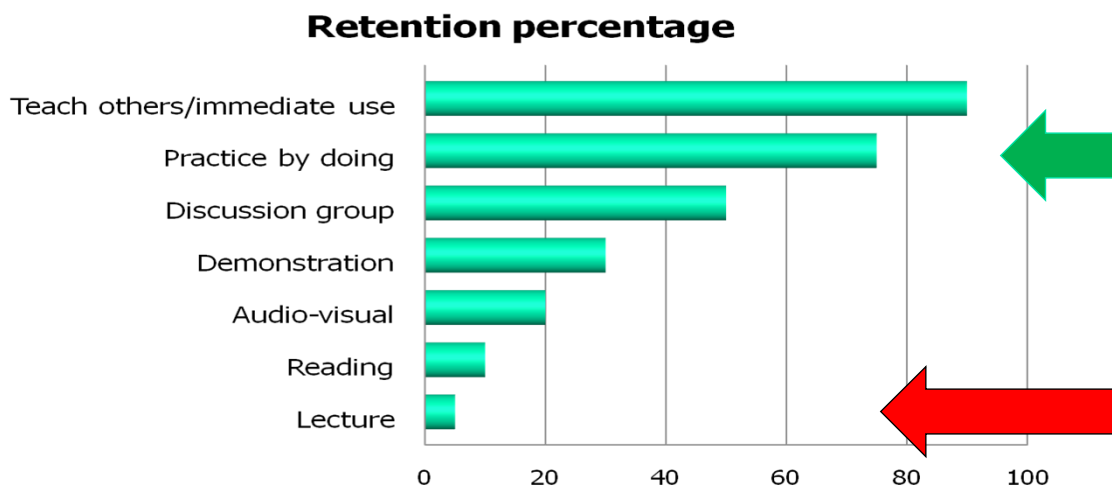
## Course knowledge components

- Lecture-on-demand
  - Audio and visual (some redundancy)
- Supplemental presentation or hidden slides (sometimes)
  - Presentation graphics that need little if any verbal accompaniment
  - Generally self evident
- Readings
  - Additional material from various sources
    - Text books, etc.
- Student prior knowledge
- Exercises
  - Practical and knowledge readings
- External knowledge identified during sessions and contributed by students
- Instructor
  - Mentor and coach for work-related problems

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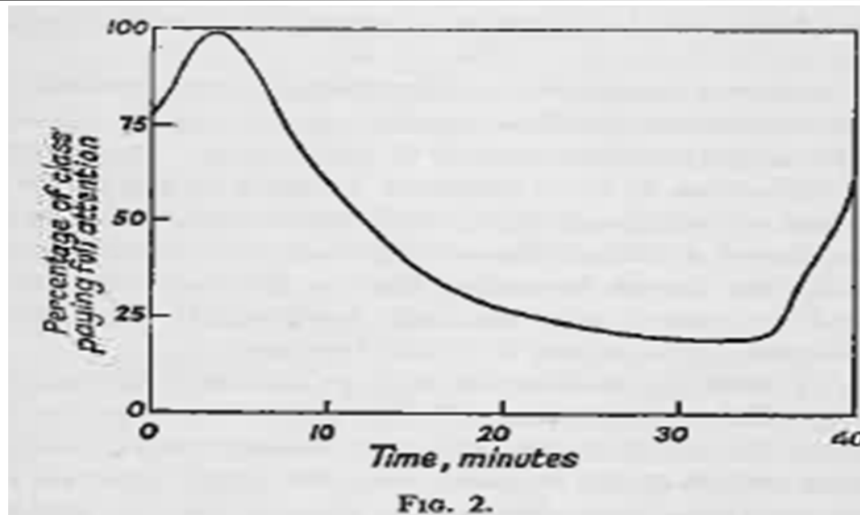
## Retention rate after 2 weeks



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## Attention span\*



\* Mills, H. R., *Techniques of technical training*, Cleaver-Hume Press, London, 1953.

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## The modules

0. Overview and administration
1. Thinking and systems thinking
2. Critical thinking
3. Holistic thinking (systems thinking and beyond)
4. Problem-solving
5. Decisions and decision making
6. Remedying simple and complex problems
7. Tools and applications in project management
8. Tools and applications in systems engineering
9. Tools and applications in risk management
10. Summary, review and wrap up

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## Course format

- Online webinars/lectures
  - Convenient times
  - Live with downloadable recordings
  - Two to three hours a session (with breaks)
- 11 modules
  - One live session per week
  - How many sessions it takes you to work through a module is up to you (Max of 50 for the course)
- Each session
  - Working through problems from previous session – the 'how' (answers)
  - Knowledge reading presentations
  - Discussion of student problems and experiences
- Interactive one-on-one discussions via Skype, Zoom or phone outside classroom
  - By appointment and walk-in (catch me when I am home – my computer is usually on)
  - Via email (discouraged, but if you insist because typing takes up too much time)

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## Schedule

- Weekly Zoom live sessions at convenient times
- You will be asked to voluntarily present your exercises
  - But not in every session unless you insist and there is time
  - Incentive to do the exercise
  - Learn by doing
  - Constructive comments by instructor and participants
- Recordings of each section posted (URLs)
- Asynchronous group for off-line discussions

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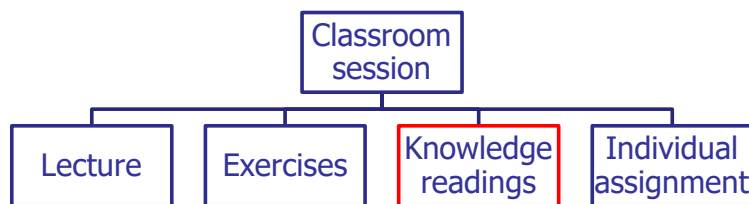
## Dealing with the exercises

- Determine what needs to be done (requirements)
  - Work BACK from the answer!!!!!!!!!!
  - *Systems Thinker's Toolbox* Section 11.8
- Create a compliance matrix
  - *Systems Thinker's Toolbox* Section 9.5.2
- Create a presentation template
  - *Systems Thinker's Toolbox* Section 14.6
- Plan the use of allotted time
  - Figure out how much time to allocate to each part of the exercise
- Think about observations and insights from readings and prior knowledge
- Produce the required presentation
- Incorporate material to show you have looked at the readings or equivalent material
  - Citations in (author, date) format

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## Balanced classroom



|   | Bloom's taxonomy | Lecture  | Exercises | Knowledge readings |
|---|------------------|----------|-----------|--------------------|
| 6 | Creating         |          |           | ✓                  |
| 5 | Evaluating       |          |           | ✓                  |
| 4 | Analyzing        |          |           | ✓                  |
| 3 | Applying         |          | ✓         |                    |
| 2 | Understanding    | Unknown  | ✓         | ✓                  |
| 1 | Remembering      | Listened | ✓         | ✓                  |

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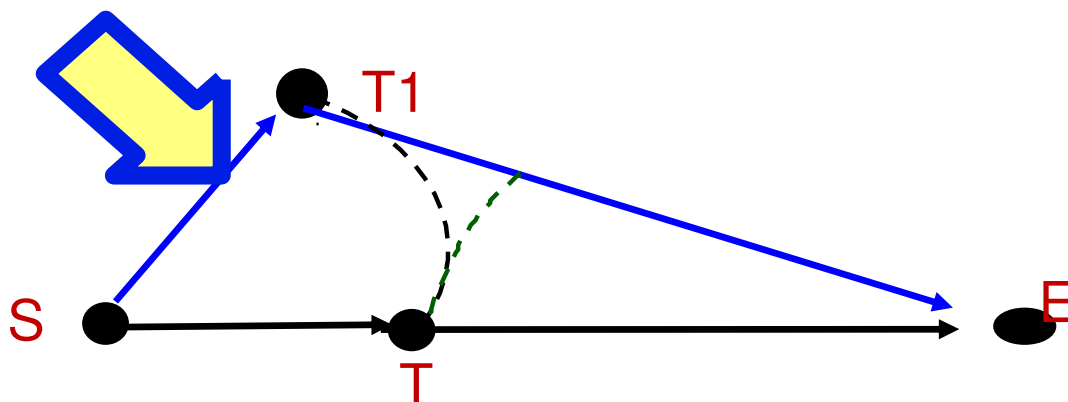
## Knowledge reading exercises (R0002)

- Provide a better learning experience
  - learning for the purposes of presentation is a good way of ensuring retention of the knowledge
- Demonstrate that different people perceive information differently
- Enable the instructor to correct any misinterpretations as they arise
- Provide you with the opportunity to
  - practice presentations skills
  - obtain feedback of content and style



Updated Bloom's taxonomy

## Minimizing misunderstandings



**Bonus**

The two biggest mistakes students make in essay examinations and when doing exercises and how to easily eliminate them

Applies to systems and software engineers and requirements

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## Mistakes and consequences

1. Not answering questions or parts of questions that were asked
  - No points
2. Answering questions or parts of questions that were not asked
  - No points and waste of time
  - Examiner can miss the answer while sieving through the extraneous information which leads to reduced points

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## Writing answers to questions that were and were not asked

- Example
- Question asked you to create a CONOPS for a ... system
  - **Do not** describe what a CONOPS is
    - Waste of your time and examiners
    - You have to know what it is in order to create one
  - **Do** create the CONOPS in a recognized format for the CONOPS if one exists
    - Template sections help you create a complete answer
    - State which template you used and reason for using it as part of introduction
  - You may define a CONOPS with citation to source as an introduction
    - Use (Author, year) not [number]

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## Tools to eliminate mistakes

1. Read the whole question
2. Identify sub-questions
3. Compliance matrix
4. Answer template

| Sub-questions | Answers in Sections | Points |
|---------------|---------------------|--------|
|               |                     |        |
|               |                     |        |
|               |                     |        |
|               |                     |        |
|               |                     |        |
|               |                     |        |
|               |                     |        |

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## Compliance matrix

- A table
- Three columns
  - Parts of question
  - Where answered
  - Points or time value of question/requirement (optional)
- Column 1 parts of question:
  - Inserted when reading the question
  - Exercise in requirements elicitation
- Column 2 data
  - Inserted when creating the answer template
  - Checked just before submitting the exam or exercises
- Column 3 data inserted when reading the question
  - Points to assist you in planning the time to spend on each part

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## Answer template

- Created from compliance matrix
- Makes it easy to see that question was answered
- Minimizes writing answers to questions that were not asked
- Structured response in order of question
- Uses same language as question
  - Question asked for 'benefits'
  - Answer uses word 'benefits' not 'advantages' or other "synonym"
- Logical flow of information
- Easy to grade
  - Especially by teaching assistants looking for buzzwords

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## Typical question

1. Describe three major pitfalls in the engineering of stakeholder requirements and the resulting errors that are frequently made with examples. Discuss possible causes of each error with examples and proposed suitable mitigation strategies with examples.

### Question

- three major pitfalls

### Sub-question 1

- resulting errors

### Sub-question 2

- examples of errors

### Sub-questions 3 and 4

- possible causes of each error
- examples

### Sub-questions 4 and 5

- proposed suitable mitigation strategies
- examples

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## One possible answer template

1. The three major pitfalls in the engineering of stakeholder requirements
  1. First major pitfall with example(s)
  2. Second major pitfall with example(s)
  3. Third major pitfall with example(s)
2. The errors that are frequently made with examples
  - a. List some with examples, each with a different section number
3. Possible causes of each error with examples
  - a. List some with examples, each with a different section number
4. Proposed suitable mitigation strategies with examples
  - a. List some for each error with examples, each with a different section number

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## Second possible answer template

1. First major pitfall
  1. First example
    1. Errors that are frequently made
      1. Different section numbers for each error
    2. Possible causes of each error
      1. Different section numbers for each cause
    3. Proposed suitable mitigation strategies
      1. Different section numbers for each mitigation strategy
  2. Repeat for second and further examples
2. Repeat for second and third pitfalls

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## Questions and comments?

- Which template to use?
  - It depends
- How much time to spend on an answer?
  - Depends on how many points the question is worth

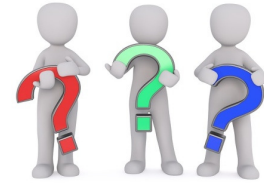


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## Exercise 0-1: Tell us about yourself

- Information you are willing to share
  1. Who you are
  2. Where you are
  3. Why (the reason) you are here
  4. The problem you hope systems thinking will help you overcome
  5. One outcome you'd like to take away with you at the end of the course
- Save as a PowerPoint file as Exercise0-01-abcd.pptx
  - abcd = 4 characters that will identify your postings in this course
- Post/email presentation as, when and where instructed



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## Meeting the objectives

1. Introduced the course
2. Explained the structure of the course
3. Provided administrative information
4. Provided an overview of the sessions and how they fit together
5. Discussed the two biggest mistakes students make when doing class exercises and essay examinations and how to easily eliminate them

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## That's all folks

- Put the Zoom meeting schedule on you calendar and remember to join the meeting a few minutes early
- Download the reading material and review it
- Watch the videos on the knowledge readings and the balanced classroom
- Submit or respond to a request to join the Asynchronous group
- Do exercise 0-1 and submit it as instructed
- Get ready to kickstart your systems thinking

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