Developing an effective course outcomes

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Universiti Teknologi Malaysia

13th Jan 2007

In 2 minutes please comment on the statements below

After this presentation, the participants shall:

1) **have better understanding of OBE concept.**
2) **be more aware of EAC's OBE requirements.**
3) **be more aware his/her roles and contributions in the OBE business.**
4) **be able to identify and improve any weaknesses**

2

In 3 minutes.. please share with your friends..

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At the end of this workshop, the participants are able to

- describe orally the importance of developing an effective course outcomes
- link between the course learning outcomes and the programme outcomes
- write effective learning outcomes for different taxonomy level of the cognitive, psychomotor and affective domains based on 3 components

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Course Outline

- Reflections
- What is learning outcome
- Mapping course learning outcomes with the programme outcomes
- Learning outcomes considering 3 domains of educational goals and taxonomy level
- How to write an effective learning outcomes

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Five Guiding Principles - Revisited

1. People learn best when they understand what they're supposed to know and why they need to know it

The message

- Write clear learning outcomes for all critical knowledge and skills
- Establish real-world context for all new course materials (eg PBL)

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Five Guiding Principles - Revisited

2. All knowledge and skills defined in program outcomes are best learned through intergration in engineering class

The message

- Put both technical and non-technical skills (communication, ethics, contemporary issues) in required engineering courses, not just general education and electives

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Five Guiding Principles - Revisited

3. People learn by doing and reflecting, not watching and listerning

The message

- Use active learning in addition to lecturing

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Five Guiding Principles - Revisited

4. Repetition throughout the curriculum leads to mastery by graduation

The message

- Spread experimental work, design work, teamwork, presentation etc through entire curriculum

9

Five Guiding Principles - Revisited

5. The assessment drives learning

The message

- If it's important, assess it and make sure it counts

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Definitions of Learning Outcomes

i. Learning outcomes are statements of what students know and can do as a result of their respective courses of study

Councils for Higher Education Accredition Board of Directors, USA 2002

ii. A learning outcome is a statement of what a learner is expected to know, understand or be able to do as a result of a learning process.

Centre for the Advancement of Teaching and Learning, The Universty of Western Australia, 2004.

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What are Learning Outcomes?

- Demonstrations, or performance reflects
  - What the student knows.
  - What the student can actually do with what they know.
  - The student's confidence and motivation in demonstrating what they know.

They have implications for qualifications, curriculum design, teaching, learning and assessment, as well as quality assurance.

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Outcomes Based Education?

Outcomes Based Education focuses on student learning by:

- **Using learning outcome statements to make explicit what the student is expected to be able to know, understand or do;**
- **Providing learning activities which will help the student to reach these outcomes;**
- **Assessing the extent to which the student meets these outcomes through the use of explicit assessment criteria.**

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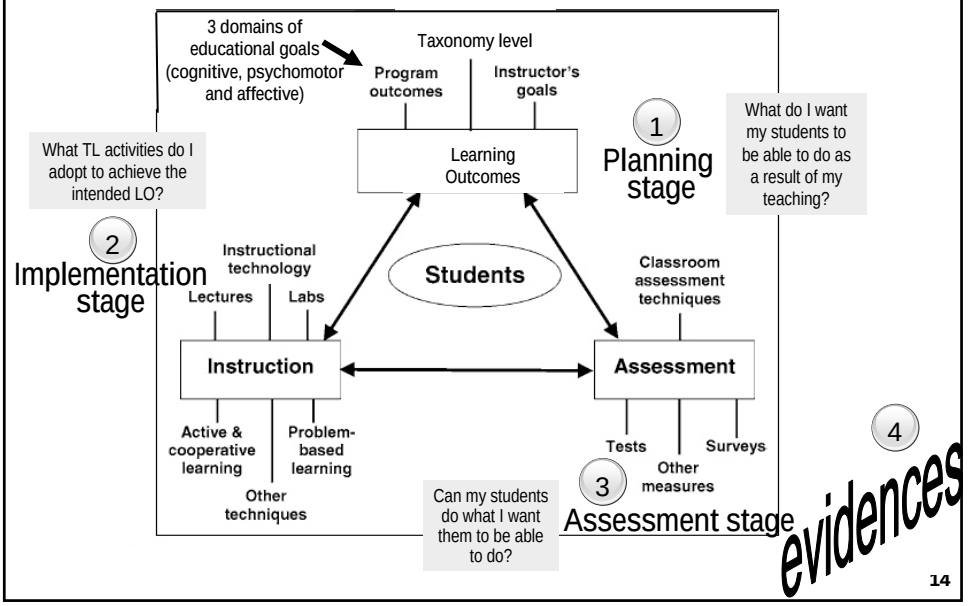
The three main stages in the Teaching and Learning processes



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Why are learning outcomes important?

Learning outcomes are the most important section of your.
They are essential because they:

- define the type and depth of learning students are expected to achieve
- provide an objective benchmark for formative, summative, and prior learning assessment
- clearly communicate expectations to learners
- clearly communicate graduates' skills to the stakeholders
- define coherent units of learning that can be further subdivided or modularized for classroom or for other delivery modes.
- guide and organize the instructor and the learner.

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1 **QA/MQF**

Malaysian Qualification Agency
Ministry of Higher Education

and the

Engineering Accreditation Coucil,
Board of Engineers → Washington Accord

2

The Need for an Outcomes Approach
for
Continual Programme Improvement

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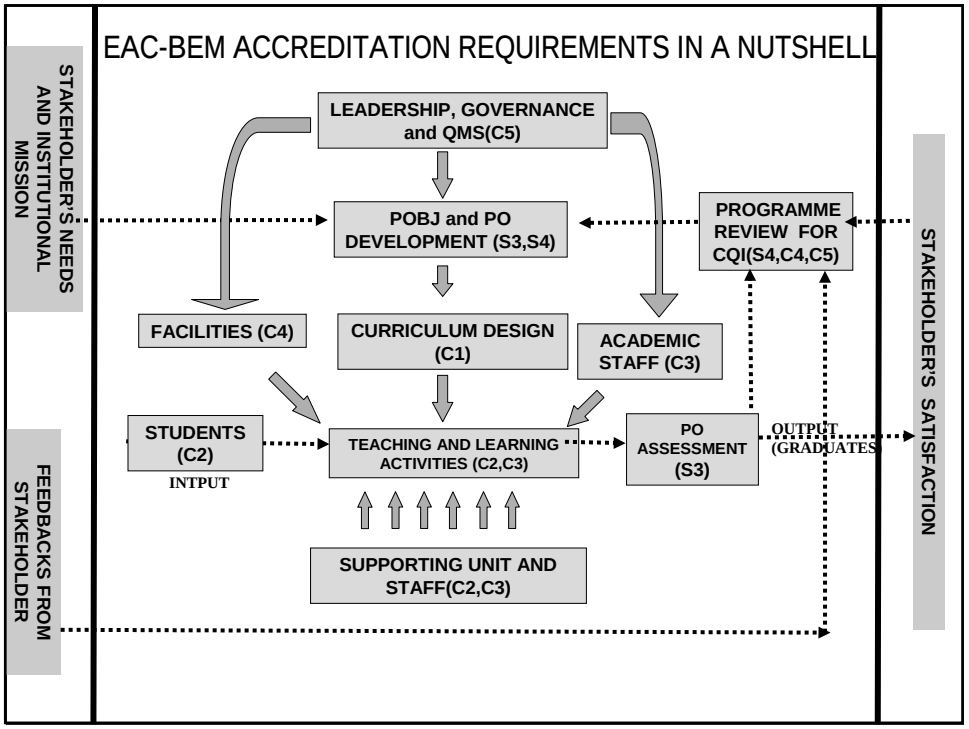
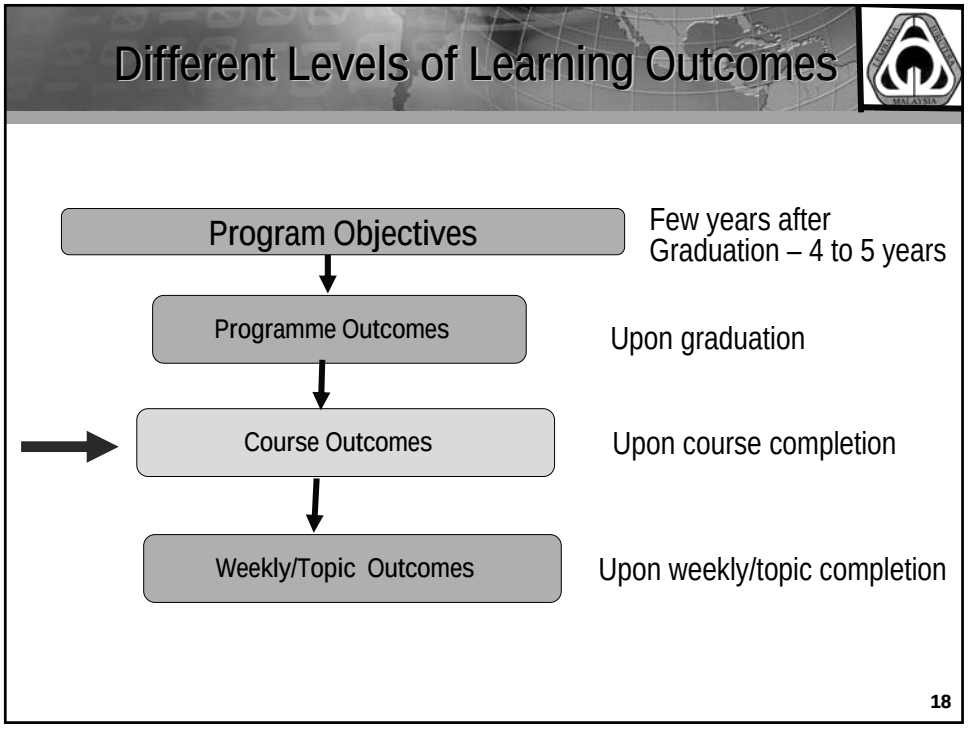

EAC-BEM ACCREDITATION REQUIREMENTS IN A NUTSHELL
STAKEHOLDER'S NEEDS AND INSTITUTIONAL MISSION
FEEDBACKS FROM STAKEHOLDER
STAKEHOLDER'S SATISFACTION
LEADERSHIP, GOVERNANCE and QMS(C5)
POBJ and PO DEVELOPMENT (S3,S4)
PROGRAMME REVIEW FOR CQI(S4,C4,C5)
FACILITIES (C4)
CURRICULUM DESIGN (C1)
ACADEMIC STAFF (C3)
STUDENTS (C2)
INTPUT
TEACHING AND LEARNING ACTIVITIES (C2,C3)
PO ASSESSMENT (S3)
OUTPUT (GRADUATES)
SUPPORTING UNIT AND STAFF(C2,C3)


Different Levels of Learning Outcomes
Program Objectives
Few years after Graduation – 4 to 5 years
Programme Outcomes
Upon graduation
Course Outcomes
Upon course completion
Weekly/Topic Outcomes
Upon weekly/topic completion
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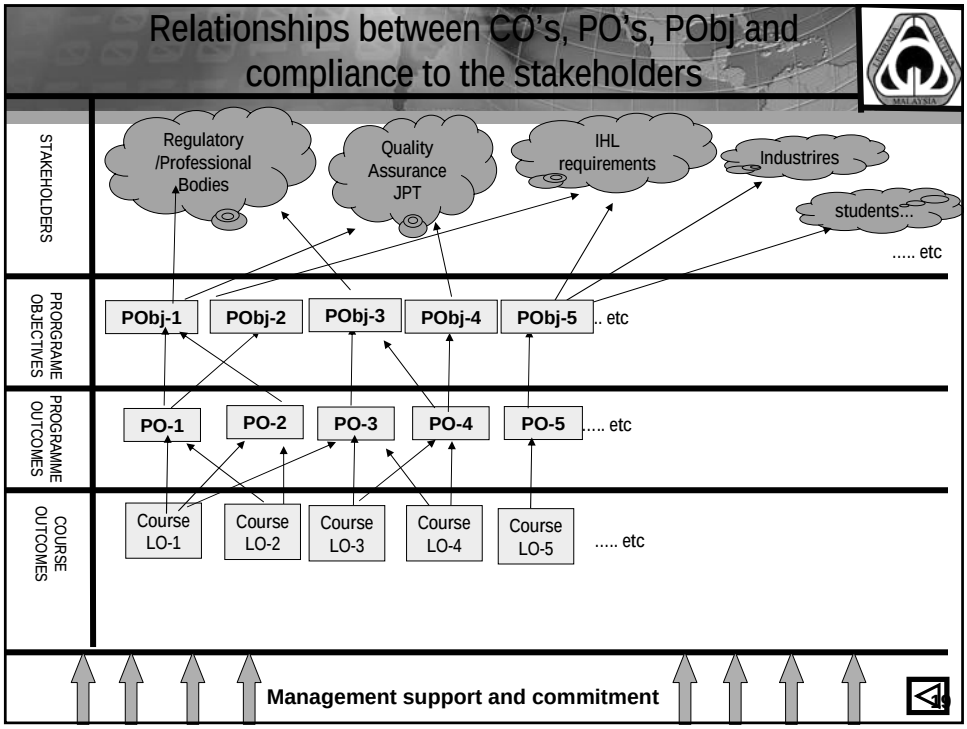
Relationships between CO's, PO's, PObj and compliance to the stakeholders



PROGRAM OUTCOMES
B.Eng (Civil Engineering)

	PROGRAM OUTCOMES
PO1	Ability to acquire knowledge of science and civil engineering principles
PO2	Ability to use the techniques, skills and modern civil engineering tools
PO3	Ability to analyse, interpret, develop and conduct experiments; and design components, systems, or processes
PO4	Ability to identify, formulate and solve civil engineering related problems
PO5	Ability to communicate effectively and with confidence
PO6	Ability to respond and adapt to changing situations and priorities
PO7	Ability to function effectively as an individual and/or in a team to achieve common goals
PO8	Ability to perpetually seek and acquire contemporary knowledge
PO9	Ability to think positively and possess self-esteem
PO10	Ability to apply high ethical standards in professional practice and social interactions for sustainable development

Mapping Course Outcomes to Programme Outcomes

Code	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010
SAB 1011	Engineering Survey – Fieldwork	1	2	2	2	2	-	2	-	2	2
SAB 1023	Engineering Survey	1	2	3	2	2	-	-	-	-	2
SAB 1031	Survey Camp	1	1	3	2	1	-	1	-	2	2
SAB 1042	Civil Engineering Laboratory I	1	1	2	2	1	-	2	2	2	2
SAB 1213	Applied Mechanics	1	1	1	2	2	2	2	2	-	2
SAB 1413	Computer Programming	1	1	1	2	2	-	-	-	2	2
SAB 1423	Civil Engineering Drawing	1	1	1	2	2	-	-	2	-	2
SAB 1513	Fluid Mechanics	1	1	1	2	2	2	2	-	2	2
SAB 1713	Soil Mechanics	1	2	1	2	2	2	2	2	2	2
SAB 2012	Civil Engineering Laboratory II	1	1	1	2	1	-	2	2	2	2
SAB 2032	Mechanical & Electrical System	1	2	1	2	2	2	-	2	2	2
SAB 2112	Civil Engineering Materials	1	2	1	2	2	2	2	2	2	2

Technical competencies

Generic Skill competencies

Key:
Technical Skills : 1 = major contribution to outcome; 2 = moderate contribution to outcome; 3 = minor contribution to outcome

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MATRIX OF COURSE OUTCOMES - SUBJECT : SAM 4324 (DESIGN OF STEEL AND TIMBER STRUCTURES)

No	Course Outcomes (CO)	Programme Outcomes (PLO)										Delivery	Assessment	Key Performance Indicators/Index
		Acquire Knowledge	Use of Technique	Analyse, interpret, develop design and conduct esp work	Problem Solving	Communication	Adaptability	Team Work	Life Long Learning	Self Esteem	Ethics and Integrity			
		1	2	3	4	5	6	7	8	9	10			
1.	Able to describe the concept and philosophy of steel and timber design based on the relevant code of practice	1										Lectures, CL, design practices, tutorials	Tests, Final Exam	Students are able to analyse, design and evaluate the member capacity of the structural element based on the standard codes of practice. 80% achieving Grade C and above.
2.	Able to estimate the design loadings and to analyse structural elements correctly	1	1	1	1							Lectures, CL, design practices, tutorials	Tests, Final Exam, Project Submission	
3.	Able to use the code of practise to design structural steel and timber elements.	1	1	1	1		2		3			Lectures, CL, design practices, tutorials	Tests, Final Exam, Project Submission	
4.	Able to prepare structural design report, drawing plan and structural element detailing before week 15	1	1	1		1					3	Project work, CL	Project Submission	Reports are clear, correct and well presented. Drawings according to standards specifications. 100% passes.
5.	Able to work effectively in a team producing a design report within a stipulated timeframe					1		1			3	CL	Peer Assessment, Observation	No complaints from team members. 80% students achieved 80%.
6.	Able to apply professional practice and ethics within a given time frame									3	1	Project work, CL	Peer Assessment, Observation	No students barred from final exams. 80% coursework delivered on time. 90% attendance during each lectures.

Key:
Technical Skills : 1 = major contribution to outcome; 2 = moderate contribution to outcome; 3 = minor contribution to outcome

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Outcome-related learning objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7
- in one or two sentences, explain in clear jargon-free language *specific gravity, purge stream, vapor pressure, dew point,...*					2		
- perform PVT calculations using ideal gas and real gas equations of state	2						
- perform bubble-point, dew-point, and vapor-liquid equilibrium calculations using Raoult's law	2						
- given a liquid mixture of two species, use tabulated physical properties to identify feasible separation processes	3		1				
- determine the absorption capacities of different solvents for a gaseous pollutant from tabulated Henry's law constants, and explain what else must be known to choose the best solvent	3			1			
- calculate internal energy and enthalpy changes for specified species undergoing specified state changes	2						
- given a process description, draw & label a flowchart, do degree-of-freedom analysis, outline material and energy balance solution procedures, and solve for required quantities	3						
- define the four stages of team functioning and the responsibilities of a team coordinator, recorder, checker, and process monitor						2	
- describe and implement effective teamwork practices and strategies for dealing with non-cooperative team members					2	3	

1 = objective addresses outcome slightly, 2 = moderately, 3 = substantively

Outcome 1: Ability to apply mathematical, scientific, and engineering principles to the identification, formulation, and solution of engineering problems

Outcome 2: Ability to design and conduct experiments & to analyze and interpret data using modern

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At the end of this workshop, the participants are able to

- describe orally the importance of developing an effective course outcomes
- link between the course learning outcomes and the programme outcomes
- write effective learning outcomes for different taxonomy level of the cognitive, psychomotor and affective domains based on 3 components

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3 components of a course outcome

1) Action verb

By the end of this course/semester, students should be able to:

- describe the principles used in designing X.
- evaluate the strengths and weakness of …

Well-written verbs must be (SMART)	Avoid these words
- Specific - Measurable - Achievable - Realistic - Time frame - Observable	- understand - appreciate - know - learn - aware - familiar

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3 components of a course outcome

2) Condition (context under which the behaviour is to occur)

- describe the principles used in designing X.(V)
- orally describe the principles used in designing X. (V&C)

- design a beam. (V)
- design a beam using Microsoft Excel design template . (V&C)

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3 components of a course outcome

3) Standard (criteria of acceptable level of performance)

- describe the principles used in designing X.(V)
- orally describe the principles used in designing X. (V&C)
- orally describe the five principles used in designing X. (V&C&S)

- design a beam. (V)
- design a beam using Microsoft Excel design template . (V&C)
- design a beam using Microsoft Excel design template based on BS 5950:Part 1. (V&C&S)

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Course Outcomes: An example

Identify the a) verb b) condition c) standard.

- From the first principles, calculate the beam deflection at the centre to within one decimal point.

Identify the a) verb b) condition c) standard.

- write an effective course outcomes that include lower and higher order cognitive skills for a one-semester course.

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Course outcomes for this component of the workshop

By the end of the workshop, participants should be able to:

1) Write an effective learning outcomes that include lower and higher order cognitive skills for a one-semester course.
2) develop learning outcomes that show the incorporation of affective and psychomotor skills through the content area of the course.
3) analyse and evaluate learning outcomes, and make suggestions for improvement.

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Common weaknesses in writing CO

- Non-observable/Non-measurable CO
- Vague CO or CO that are too broad or general

At the end of the course, the students are able to:

1. understand the theory of X.
2. know how to write an effective learning outcomes
3. appreciate the importance of keeping the environment clean.

By the end of the course, students should be able to:

1. use the computer.
2. make presentations.
3. comment on designs.
4. design research

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Improve on the following learning outcomes by adding a condition and standard

Poor

- Students should be able to design research.

Better

- Students should be able to independently design and carry out experimental and correlational research.

Best

- Students should be able to independently design and carry out experimental and correlational research that yields valid results.

Source: Bergen, R. 2000. A Program Guideline for Outcomes Assessment at Geneva College

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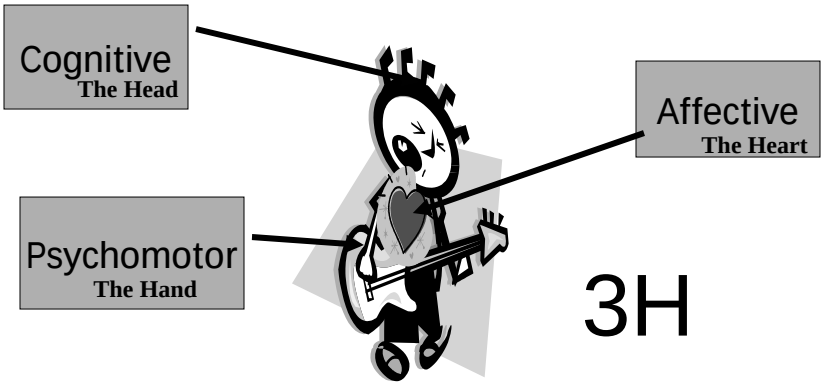
The 3 Domains of Educational Goals



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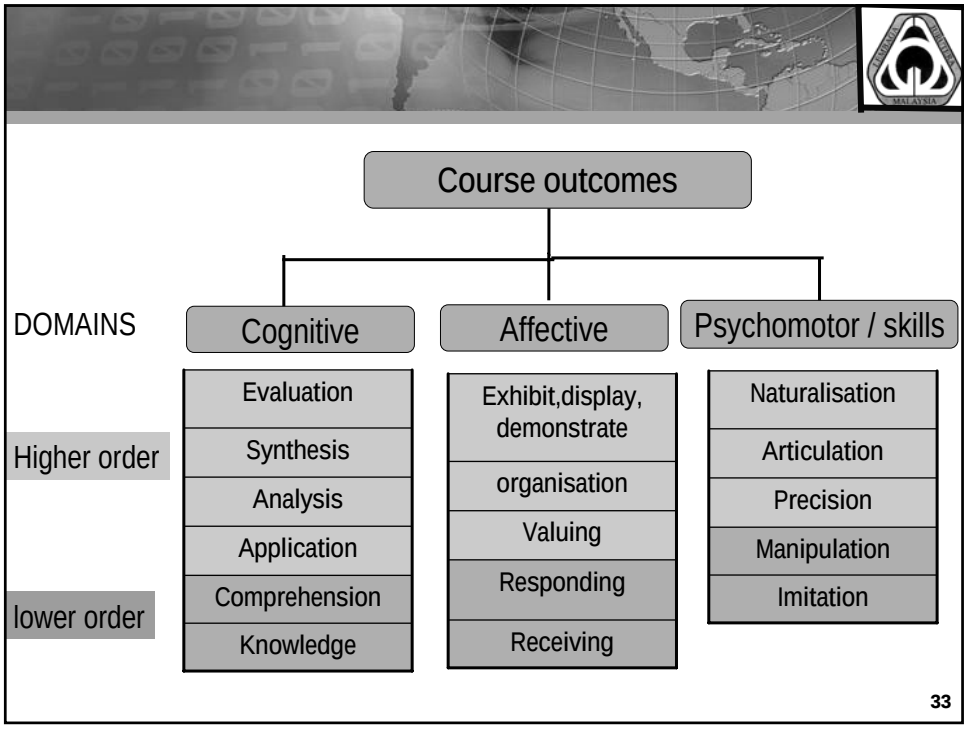
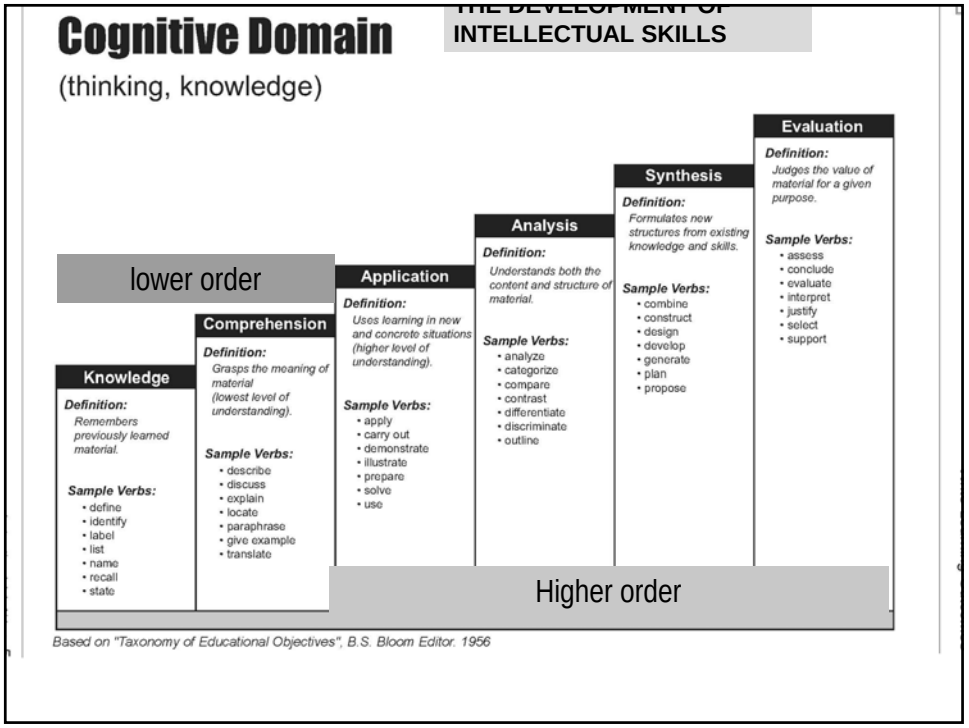

Course outcomes
DOMAINS
Cognitive
Affective
Psychomotor / skills
Higher order
lower order
Evaluation
Synthesis
Analysis
Application
Comprehension
Knowledge
Exhibit,display, demonstrate
organisation
Valuing
Responding
Receiving
Naturalisation
Articulation
Precision
Manipulation
Imitation
33


Cognitive Domain
(thinking, knowledge)
INTELLECTUAL SKILLS
lower order
Higher order
Knowledge
Definition:
Remembers previously learned material.
Sample Verbs:
• define
• identify
• label
• list
• name
• recall
• state
Comprehension
Definition:
Grasps the meaning of material (lowest level of understanding).
Sample Verbs:
• describe
• discuss
• explain
• locate
• paraphrase
• give example
• translate
Application
Definition:
Uses learning in new and concrete situations (higher level of understanding).
Sample Verbs:
• apply
• carry out
• demonstrate
• illustrate
• prepare
• solve
• use
Analysis
Definition:
Understands both the content and structure of material.
Sample Verbs:
• analyze
• categorize
• compare
• contrast
• differentiate
• discriminate
• outline
Synthesis
Definition:
Formulates new structures from existing knowledge and skills.
Sample Verbs:
• combine
• construct
• design
• develop
• generate
• plan
• propose
Evaluation
Definition:
Judges the value of material for a given purpose.
Sample Verbs:
• assess
• conclude
• evaluate
• interpret
• justify
• select
• support
Based on "Taxonomy of Educational Objectives", B.S. Bloom Editor. 1956

Bloom's Taxonomy

Categories in the Cognitive Domain (Taxonomy of Educational Objectives, Bloom, 1956)	
Level 1 – Knowledge The remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required is the bringing to mind of the appropriate information. Knowledge represents the lowest level of learning outcomes in the cognitive domain.	Defines, describes, identifies, labels, lists, matches, names, outlines, reproduces, selects, states. Eg. ▪ List the six levels in the cognitive domain of Bloom's taxonomy. ▪ Define… ▪ State the main principles of Theory X.
Level 2 – Comprehension The ability to grasp the meaning of material. This may be shown by translating material from one form to another, by interpreting material (explaining or summarising), and by estimating future trends (predicting consequences or effects). These learning outcomes go one step beyond the simple remembering of material, and represent the lowest level of understanding.	Converts, defends, distinguishes, estimates, explains, extends, generalises, gives examples, infers, paraphrases, predicts, rewrites, summarises. Eg. ▪ Describe three main features of … ▪ Explain the 3 main components of a learning outcome. ▪ Summarise the main causes of the American war in Iraq.

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Bloom's Taxonomy

Level 3 – Application The ability to use learned material in new and concrete situations. This may include the application of such things as rules, methods, concepts, principles, laws and theories. Learning outcomes in this area require a higher level of understanding than those under 'Comprehension'.	Changes, computes, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses. E.g.: ▪Construct measurable learning outcomes that include lower and higher order cognitive skills for a one-semester course.
Level 4 – Analysis The ability to break down material into its component parts so that its organisational structure may be understood. This may include the identification of the parts, analysis of the relationships between parts, and recognition of the organisational principles involved. Learning outcomes here represent a higher intellectual level than 'Comprehension' and 'Application' because they require an understanding of both the content and the structural form of the material.	Breaks down, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, points out, relates, selects, separates, subdivides e.g.: ▪Analyse authentic data from various sources and prepare…

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Bloom's Taxonomy

Level 5 – Synthesis The ability to put parts together to form a new whole. This may involve the production of a unique communication (theme or speech), a plan of operations (research proposal), or a set of abstract relations (scheme for classifying information). Learning outcomes in this area stress creative behaviours, with major emphasis on the formulation of *new* patterns or structures.	Categorises, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organises, plans, rearranges, revises, rewrites, summarises, tells, writes. e.g.: ▪Analyse authentic data from various sources and prepare a recommendation report for a specified audience.
Level 6 – Evaluation The ability to judge the value of material. The judgements are to be based on definite criteria. These may be internal criteria (organisational) or external criteria (relevance to the purpose) and the student may determine the criteria or be given them. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all the other categories, plus conscious value judgements based on clearly defined criteria.	Appraises, compares, concludes, contrasts, criticises, describes, discriminates, explains, justifies, interprets, relates, summarises, supports. e.g ▪Evaluate the strengths and weaknesses of the cognitive domain of Bloom's taxonomy in relation to the National Educational Philosophy.

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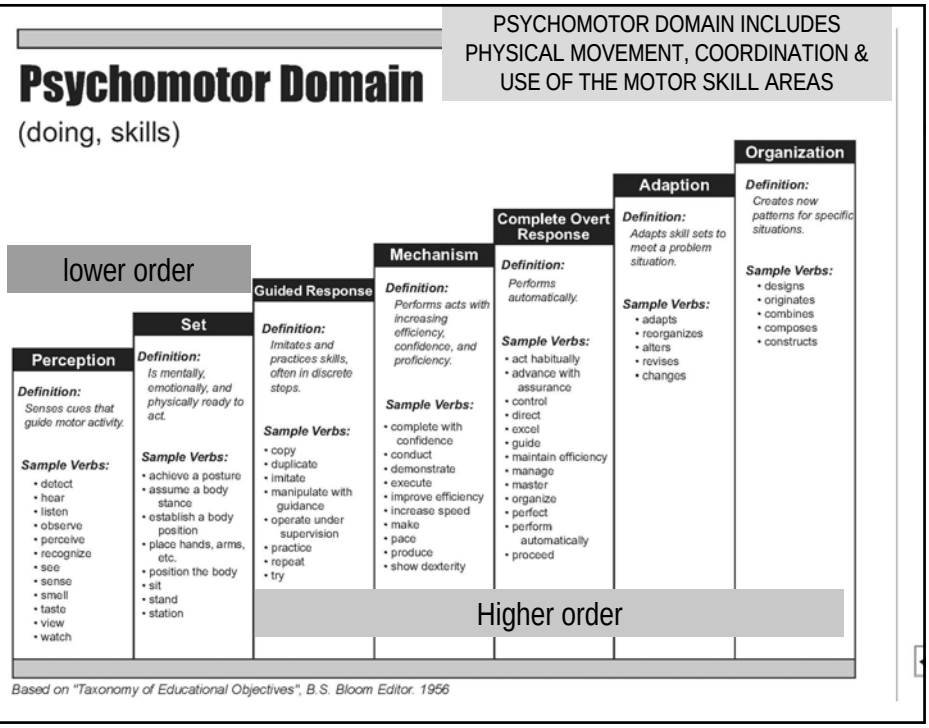
PSYCHOMOTOR DOMAIN INCLUDES PHYSICAL MOVEMENT, COORDINATION & USE OF THE MOTOR SKILL AREAS



Based on "Taxonomy of Educational Objectives", B.S. Bloom Editor. 1956

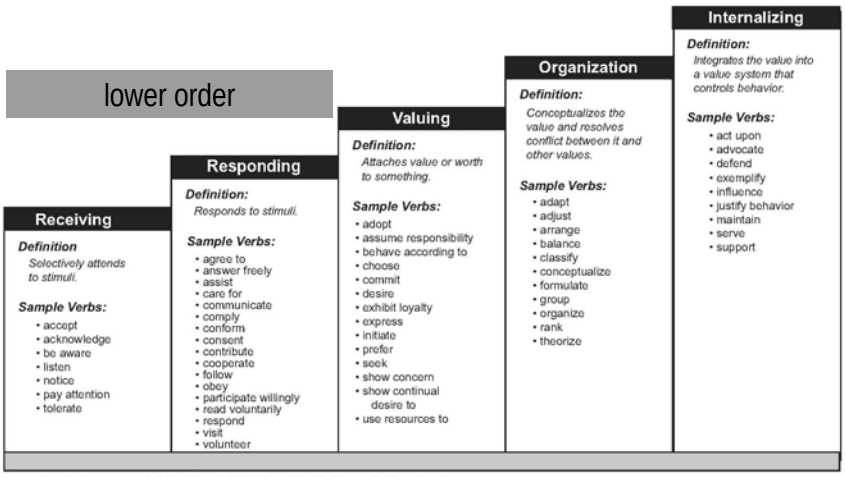
Affective Domain

(feeling, attitudes)

WITH THINGS EMOTIONALLY (e.g. FEELINGS, INTERESTS, ATTITUDES, APPRECIATION, ENTHUSIASMS, MOTIVATIONS) - THAT MIGHT RESULT FROM INSTRUCTION)

Higher order

lower order



Based on "Taxonomy of Educational Objectives", B.S. Bloom Editor. 1956

Writing Course Outcomes for Psychomotor and Affective Domains

Examples : Graduate Attributes

- Communication skills
- Teamworking
- Problem Solving
- Adaptability
- Life long Learning
- Self Esteem
- Ethics and Integrity

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Writing Course Outcomes for Psychomotor and Affective Domains

By the end of the course, students should be able to:

1) independently seek and present information on the collapse of the WTC (Lifelong Learning & Communication Skills)
2) participate actively in class discussion on issues related to ... (Communication Skills)
3) work collaboratively in groups to complete an assigned project on… (Teamworking)
4) demonstrate positive teamworking attributes by contributing actively in group projects. (Teamworking)

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Course Outcomes for Generic Skills

Cont…

5) state and critically evaluate the main principles of .... (Problem Solving)
6) analyse data gathered from a target situation analysis and design instructional materials for a specific group of learners. (Problem Solving)
7) orally present information and answer questions with confidence on an assigned project. (Comm. Skills and Self-Esteem)
8) apply principles of management in organising an assigned project within stipulated schedules and with available resources. (Teamworking & Adaptability)

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Planning CO at Subject Level: A Reminder

- Examine the curriculum and refer to the programme outcomes.
- Examine the type of students and resources available.
- Include course outcomes for cognitive, psychomotor and affective domains.
- Include higher order skills/ taxonomy level.
- As far as possible, embed the affective and psychomotor domain in content (eg. incorporate generic skills through the content of the course).

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Checklist for writing course outcomes

- Focus on outcomes, not processes
- Start each outcome with an action verb.
- Its good to use only one action verb per learning outcome
- Avoid vague verbs such as *know* and *understand*.
- Check that the verbs used reflect the level of learning required.
- Ensure that outcomes are observable and measurable.
- Write the outcomes in terms of what the learner does, not what the instructor does.
- Check that the outcomes reflect knowledge, skills, or attitudes required in the workplace.
- Include outcomes that are woven into the entire course (such as *work effectively in teams*).
- Check that there are the appropriate number of outcomes (no more than three per major topic)
- List the sub-outcomes for each outcome
- Check that the outcomes fit within program and course goals

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Course outcomes for this component of the workshop

By the end of the workshop, participants should be able to:

1) Write an effective learning outcomes that include lower and higher order cognitive skills for a one-semester course.
2) develop learning outcomes that show the incorporation of affective and psychomotor skills through the content area of the course.
3) analyse and evaluate learning outcomes, and make suggestions for improvement.

45

Improve on these CO where necessary:

After this presentation, the participants shall:

1) **have better understanding of OBE concept.**
2) **be more aware of EAC's OBE requirements.**
3) **be more aware his/her roles and contributions in the OBE business.**
4) **be able to identify and improve any weaknesses**

46

Improve on these CO where necessary:

After this presentation, the participants shall:

1) have better understanding of OBE concept.

Orally describe OBE concepts according to EAC reqt

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Improve on these CO where necessary:

After this presentation, the participants shall:

2)be more aware of EAC's OBE requirements.

Identify factors .. clearly the OBE reqt according to EAC Standard

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Improve on these CO where necessary:

After this presentation, the participants shall:

3) be more aware his/her roles and contributions in the OBE business.

Translate his/her roles and contribution in OBE implementation according to EAC Manual 2006

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Improve on these CO where necessary:

After this presentation, the participants shall:

4) be able to identify and improve any weaknesses

identify clearly and improve any weaknesses on OBE imp currently practised in his organisation

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Improve on these CO where necessary:

Selepas mengikuti kursus ini, pelajar seharusnya berupaya:

1) **Menerangkan serta memahami konsep dan prinsip asas XX didalam sebuah organisasi.**
2) **Memahami dan menyedari kepentingan mengikut garis panduan yang telah ditetapkan.**
3) **Mengaplikasikan teori yang dipelajari dalam menyelesaikan tugasan untuk membuat keputusan yang rasional dan tepat.**

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Improve on these CO where necessary:

Di akhir mata pelajarn ini pelajar akan dapat:

(MP: Statistics)

1) **mengenalpasti kaedah pengendalian data kualitatif dan kuantitatif.**
2) **mengenalpasti ukuran kecenderungan memusat dan serakan.**
3) **mengenalpasti kaedah membuat unjuran.**
4) **mengenalpasti asas kebarangkalian.**

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Improve on these CO where necessary:

Setelah mengikuti mata pelajaran ini, pelajar-pelajar akan berupaya:

1) **Memahami dan mengapresiasi kepelbagaian gelagat pengguna yang perlu diambil kira dalam membangun dan melaksanakan sesuatu program pemasaran.**
2) **Menilai impak kepelbagaian sosio-budaya, ekonomi, perkembangan digital dan persekitaran semasa keatas gelagat pengguna.**
3) **Mengenal pasti dan menganalisis pelbagai aspek gelagat pengguna dan kesannya kepada aktiviti pemasaran termasuk berkemahiran memberi cadangan yang konstruktif dan gambaran konseptual bagi menambah nilai produk dan perkhidmatan serta menambah baik program pemasaran yang konsisten dengan budaya, persekitaran dan sosial pengguna.**

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Improve on these CO where necessary:

4) Mengenal pasti dan menganalisis pelbagai aspek gelagat pengguna dan kesannya kepada aktiviti pemasaran termasuk berkemahiran memberi cadangan yang konstruktif dan gambaran konseptual bagi menambah nilai produk dan perkhidmatan serta menambah baik program pemasaran yang konsisten dengan budaya, persekitaran dan sosial pengguna.
5) Mendapatkan informasi daripada pelbagai sumber dan menggunakan maklumat gelagat pengguna untuk membuat persembahan lisan dan laporan dengan yakin, jelas dan berkesan menggunakan teknologi ICT.
6) Berinteraksi dengan yakin dan berkesan dengan pelajar lain, mampu menghargai perbezaan idea personaliti rakan serta saling melengkapi dengan kumpulan untuk melaksanakan tugasan dan projek gelagat pengguna mengikut perancangan ditetapkan.
7) Berfikir secara positif dan mempunyai keyakinan diri yang tinggi melalui aktiviti kerja, tugasan, interaksi bersama rakan dan pensyarah serta penyertaan aktif semasa pengajaran dan pembelajaran.

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