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Outcome-Based Approach (OBE) to Engineering Education

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OUTCOMES OF THIS PRESENTATION

After this presentation, the participants will be able to:

- explain what kind of engineering education program ABET-EAC* accredits,
- state his/her roles and contributions in OBE in case of Geomatics Engineering Program of ITU.

i.e. It is not important what I tell or show you in this presentation, but the important is how you develop it in the future (outcomes). If it is the case my work and your work is valuable. Otherwise all efforts are useless and waste of time, absolutely.

*ABET → Accreditation Board for Engineering and Technology (established 1932)
EAC → Engineering Accreditation Commission



OUTLINE OF THIS PRESENTATION

- ABET-EAC
- Why need Accreditation?
- OBE
- Programme Educational Objectives
- Student Outcomes
- Examples



What does ABET-EAC do?

EAC-Engineering Accreditation Commission

- Formulates and updates accreditation policies and criteria in engineering education
- Approves guidelines and operating procedures
- Oversees operational arrangements and appoints evaluation panel
- Receives evaluation reports and decides on accreditation
- Responds to complaints, appeals or any proposals for change
- Fosters the dissemination of developments and best practices in engineering education



Why need Engineering Education Programs Accreditation?

In many countries;

- No person is allowed to practice unless he is a professional engineer,
- Professional engineer may use “Ir” before his name or “PEng” after his name.

- Graduate engineers to register before taking up employment as an engineer

Respectively

- In Turkey “**Licensed Geomatics Engineers**”

Ir→ Belli bir alanda uzmanlaşmış mühendis, PEng→Profesyonel mühendis



Why need Engineering Education Programs Accreditation? continues..

International Mobility (Washington Accord)

- **The Washington Accord:** Agreement that establishes equivalence of other countries' accredited professional engineering programs.
- Accredited Engineering Programs Graduates are recognized by other signatory countries - **Possible employment as engineers in those countries without further examinations.**



Why need Engineering Education Programs Accreditation? continues..

International Mobility (Washington Accord-WA)

- Established in 1989,
- Institutions from the following countries are full members (signatory) of WA:
- Australia, Canada, Taipei, Hong Kong, India, the Republic of Ireland, Japan, Malaysia, New Zealand, Russia, Singapore, South Africa, South Korea, **Turkey-MÜDEK** (Haziran 2011), the UK and the USA.



Why need Engineering Education Programs Accreditation? continues..

Last accreditation of Geomatics Engineering Program of ITU was in 2011 for 6-years (till **October 2017**)

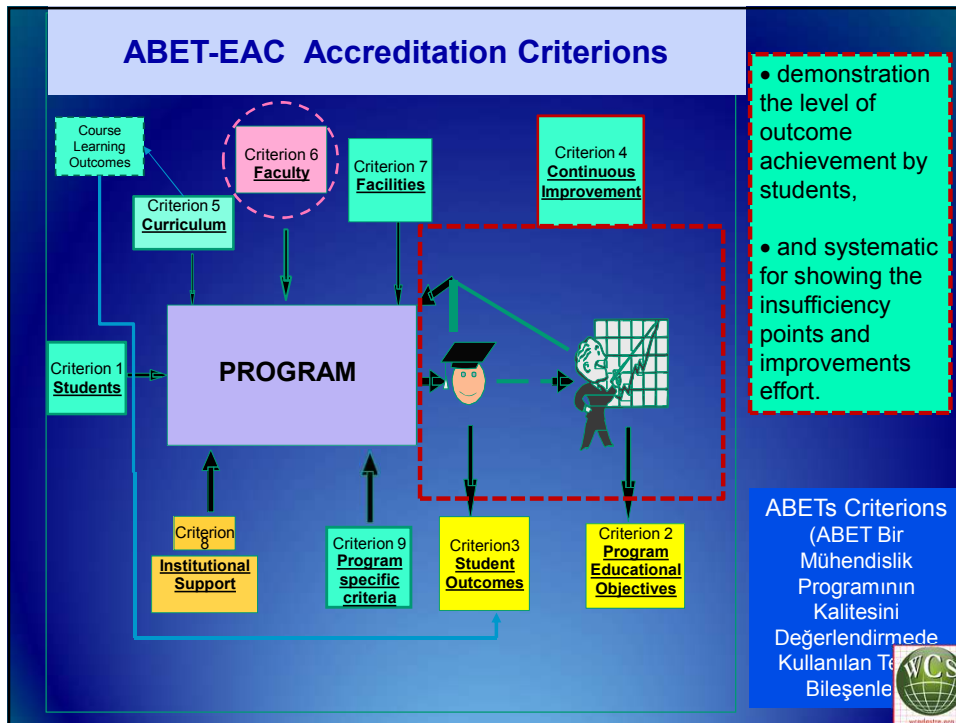
Next accreditation visit will take place in October 2016.

No OBE

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VERY DIFFICULT TO GET FULL ACCREDITATION





Important for accreditation;

- ✓ what kind of **infrastructure/facilities, students, curriculum** we have, and
- ✓ how good **the faculty** is (inputs components),

more important,

- ✓ **however which qualities** (outcomes components-course learning outcomes, student outcomes and program educational objectives) **our graduates acquire with our engineering program during four years.**



ABET-EAC Accreditation Criterion 5

■ Academic Staff (Requirements)

- Academic qualifications,
- Professional qualification, experience & development,
- Research/publication/consultancy,
- Industrial involvement,
- Teaching load/contact hours,
- Motivation and enthusiasm,
- Use of lecturers from industry/public bodies,
- Aware and practice of OBE



Deficiencies of Traditional Education

- Provides students with a learning environment, students are given with little attention to whether or not students ever learn the material or achieve intended outcomes.
- Grades and rankings compared to each other – students become **exam oriented** or **CGPA* driven**.
- Graduates are not completely prepared for the workforce.
- Lack of emphasis on soft skills needed in jobs e.g. communication skills, interpersonal skills, analytical skills, etc.

* CGPA→Cumulative Grade Point Average



What Is Outcome Based Engineering Education?

**IT'S NOT WHAT Academic Staff
TEACH,** (In this case there is no need to program outcomes and
program educational objectives)

**OBE is WHAT Students
ACHIEVE** (LEARNED Acquirements after completion
a course or program)



Introducing OBE

- **OBE** is an educational process.
- Directed/focussed at achieving certain specified concrete **outcomes** (action or result oriented knowledge, ability or behavior) in terms of individual student learning.
- **Outcomes** - key things students should **comprehend and be able to do** (hard skills) and or the other qualities they should **develop** (soft skills). Both types of skills are considered equal weight.
- Both structures and curricula with its all components are designed to be achieved those capabilities or qualities by students.
- Educational structures and **curriculum are regarded as means not ends**. If they do not do their job they are rethought and revised (Continuous Quality Improvement).



The top ten qualities that employers want*

VERBAL COMMUNICATION	1	Express your ideas clearly and confidently in speech
TEAMWORK	2	Work confidently within a group, Soft.
COMMERCIAL AWARENESS	3	Understand the commercial realities affecting the organisation, Soft
ANALYSING & INVESTIGATING	4	Gather information systematically to establish facts & principles, Problem solving (Soft-Hard).
INITIATIVE/SELF MOTIVATION	5	Act on initiative, identify opportunities & proactive in putting forward ideas & solutions, Soft.
DRIVE	6	Determine to get things done. Make things happen & constantly looking for better ways of doing things, Soft.
WRITTEN COMMUNICATION	7	Express yourself clearly in writing, Soft.
PLANNING & ORGANISING	8	Plan activities & carry them through effectively, Soft.
FLEXIBILITY	9	Adapt successfully to changing situations & environments, Soft
TIME MANAGEMENT	10	Manage time effectively, prioritising tasks and able to work to deadlines, Soft.

* Based on a number of surveys on the skills required by graduates undertaken by Microsoft, Target Jobs, the BBC, Prospects, NACE and AGR and other organizations here is our summary of the skills which were most often deemed important, 2014.



Others top qualities employers look for

1	Ability to work in a team
2	Leadership
3	Communication skills (written)
4	Problem-solving skill
5	Strong work ethic
6	Analytical/quantitative skill
7	Communication skills (verbal)
8	Initiative
9	Technical skills, Hard
10	Detail-oriented
11	Flexibility/adaptability
12	Computer skills, Hard
13	Interpersonal skills
14	Organizational ability
15	Strategic planning skill
16	Friendly/outgoing personality
17	Creativity
18	Entrepreneurial skills/risk-taker
19	Tactfulness

Source: National Association of Colleges and Employers (NACE), 2012




Outcome Based Education

- Rather than just look at the input and process to include measuring the output (*achieved results by students*)

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graph LR; Input[Input] --> Process[Process]; Process --> Output[Output];
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i.e. From a *Resource-Based* or *Input-Based* or *Process-Based* Approach to an **Outcome-Based** Approach




Outcome Based Education (OBE)

OBE is a process that involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than accumulation of course credits.

Amongst Expected Changes:

- Curriculum Restructuring/Revision
- Innovative/Flexible Delivery Method
- Variety of Assessment & Evaluation Methods
- Collection of Evidences
- Continuous Quality Improvement (**Closing the Loop**)



Outcome Based Education (OBE)

OBE addresses the following key questions to a course of a engineering education program:

- **What** do you want the students to have or able to do after completion a course successfully (Course Learning Outcomes)?
- **How** can a academic staff member best help students achieve them? (course instructional policies for you and for students)
- **How** will you know whether they have achieved them (using assessment tools)?
- If not **what** should constituencies* do different better next time? (improvement or making the course more and more effective, closing the loop!)

* First academic staff member, second students and the other responsible bodies.



The Relevancy of OBE

Coercive resources to Accreditation:

1. Quality Assurance System in education requested by the ITU (Istanbul Technical University) and YOK (The Council of Higher Education in Turkey)
2. Accreditation Requirement for Engineering Programme by the Engineering Accreditation Commission (ABET-EAC) and not to forget
3. Willingness of program constituencies (absolutely necessary for success of transformation).



Some Real Benefits of OBE

- More directed & coherent curriculum,
- Graduates will be more “relevant” to industry & sector, other stakeholders and society (**more well rounded graduates**),
- Continuous Quality Improvement is an inevitable consequence of OBE.



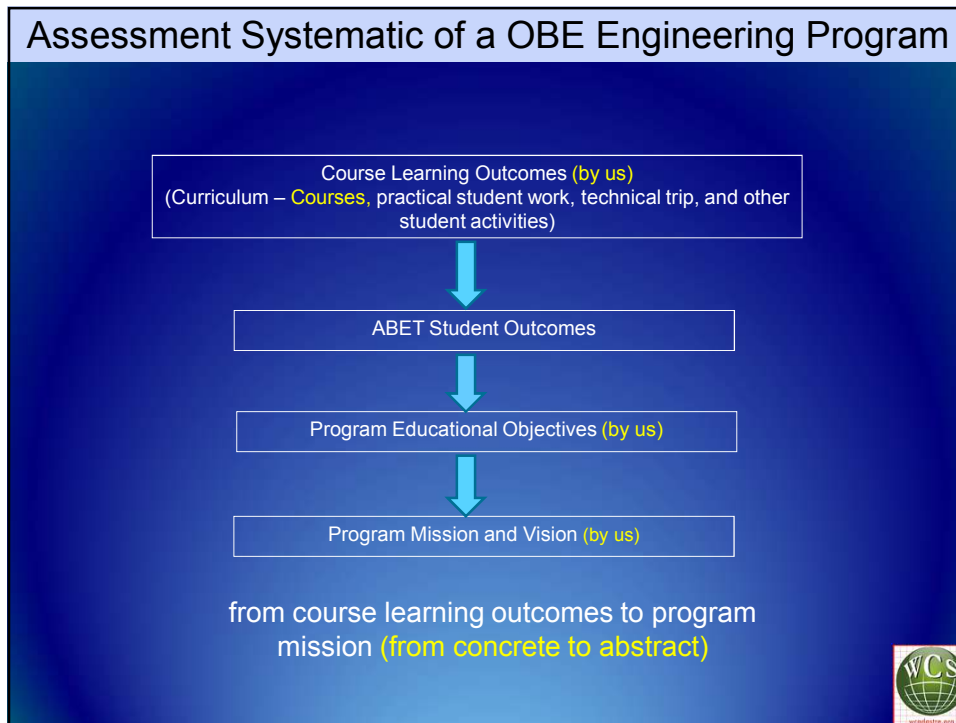
Program Educational Objectives (PEO)

Program Objectives are specific goals describing expected achievements of **graduates** in their career and professional life in a few years after graduation, and shall be:

- consistent with the mission and vision of the ITU, Civil Engineering Faculty and Geomatics Engineering Programs, and
- responsive to the expressed interest of various groups of program stakeholders

**PEOs are long term, more generally outcomes
(about 3 years from the time of graduation)**






Samples

Course Learning Outcomes (Course Name: Cadastre, 2 Hours weekly in fourth semester)

Students who complete the course successfully are able to;

1	<u>Understand</u> the cadastre and land management concepts. <u>Understand</u> the social benefits of the cadastre and <u>establish</u> the relationship between land management.
2	<u>Understand</u> the administrative structure and functioning of national and international cadastral land-surveying tasks regarding to development of land registry systems
3	<u>Understand</u> the legal and technical processes in the cadastral planning of the whole process of legislation relating to the cadastral surveying activities.
4	<u>Decide</u> and <u>select</u> the calculation and visualization methods, and necessary measuring models for the production of cadastral data sets and property maps.
5	<u>Organize</u> the first process of the cadastral surveying. <u>Manage</u> the administrative and technical process steps for manufacturing the parcel, <u>check</u> and <u>verify</u> .
6	<u>Recognize</u> the importance of sustainability and <u>update</u> the cadastre; <u>organize</u> the renovation process of Cadastre and <u>manage</u> the administrative and technical process steps, <u>control</u> and <u>verify</u> .
7	By organizing processes of technical works in cadastre (land subdivision-amalgamate etc.), <u>manage</u> the administrative and technical steps, <u>perform</u> the directives and <u>confirm</u> them.
8	<u>Manage</u> , <u>control</u> and <u>verify</u> cadastral parcels. <u>Determine</u> and <u>manage</u> parcel boundary limitations process.
9	<u>Interpret</u> and <u>make</u> relation among interdisciplinary areas like infrastructure, coastal, grassland and forest lands in terms of technical and legal regulations.
10	<u>Understand</u> the purpose of Land Registry and Cadastre Information System and their functions. <u>Impl</u> and <u>design</u> parcel-based land information system, and <u>analyse</u> the requirements. (30 concrete professional activities, big inevitable course for our profession! To much activities to assess the course effectiveness, or to demonstrate the attainment of the course aim via learning outcomes!)



Samples cont...

Educational Objectives of Geomatics Engineering Program

(current, but in revision)

Graduates of the Istanbul Technical University Geomatics Engineering Program are expected to:

1. Be competent and ready to serve at high level theoretical and practical knowledge of fundamental subjects of Geomatics Engineering, and have design experience.
2. Be in leadership positions and to understand the necessity of life-long learning,
3. Communicate professionally in both written and oral forms,
4. Able to work both as individuals and as members of teams and demonstrate leadership,
5. Be aware of ethical principles and professional responsibilities of production and services.



Last remarks!,

Where are we now in our transformation efforts from tradition to OBE?

- ✓ We are almost finished with the design of our outcomes based education Geomatics Engineering Program **after two years.**
- ✓ It was hard to shifting from tradition to new paradigm.
- ✓ Thanks all my College at ITU for their rich contribution to changing management.

And I believe it will be not easy for our academic staff to apply this approach effectively in practice. But I am sure they and our students success it with their will- and endurance power.



Thank you for your attention!

