CDIO
The Aston Approach

Gareth Thomson
Head : Mechanical Engineering + Design, Aston University

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Background to CDIO

- Concern worldwide that Engineering graduates were no longer meeting needs of industry.
- Programmes were turning out good engineering scientists but poor engineers.
- Graduates lacked the breadth of skills associated with being a successful, professional engineer.
- University appointments panels were driven by research which tended to result in narrow but very specialist skills.

CDIO

- **CDIO** stands for :
- **CONCEIVE** – to understand engineering problems and be able to synthesise a solution.
- **DESIGN** – to take the conceptual idea and convert it to a practical solution
- **IMPLEMENT** – to construct and refine a physical solution
- **OPERATE** – to be able to show how the physical solution resolves the problem or challenge.

CDIO Organisation

- Started with 5 institutions – MIT + 4 Scandinavian Universities.
- Around 100 Institutions currently

Danish Technical University

Tsinghua University (China)

Sydney University

Duke University

US Naval Academy

University of Liverpool

- Aston is now entering 7th year of CDIO based programmes.

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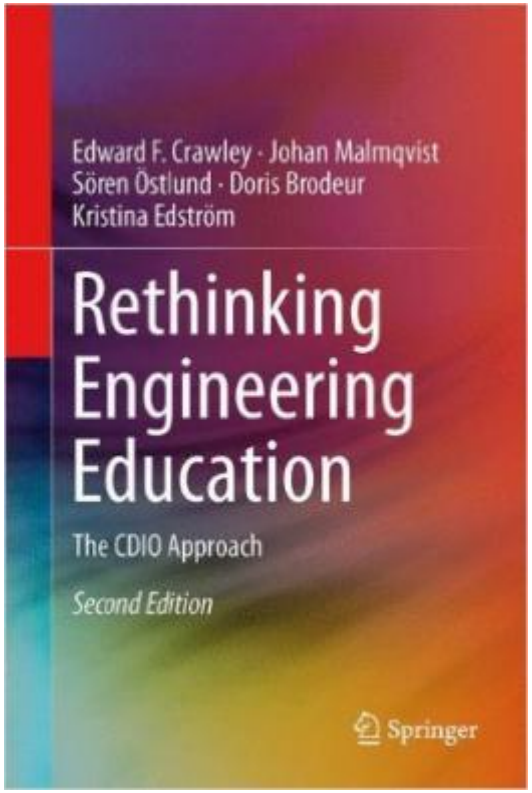
CDIO the Book



Rethinking Engineering Education: The CDIO Approach

Ed Crawley, Johan Malmqvist, Sőren Őstlund, Doris Brodeur & Kristina Edstrőm

Springer
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CDIO Standards – a continual improvement process

- STANDARD 1: CDIO as Context
- STANDARD 2: CDIO Syllabus Outcomes
- STANDARD 3: Integrated Curriculum
- STANDARD 4: Introduction to Engineering
- STANDARD 5: Design-Build Experiences
- STANDARD 6: CDIO Workspaces
- STANDARD 7: Integrated Learning Experiences
- STANDARD 8: Active Learning
- STANDARD 9: Enhancement of Faculty CDIO Skill
- STANDARD 10: Enhancement of Faculty Teaching Skills
- STANDARD 11: CDIO Skills Assessment
- STANDARD 12: CDIO Program Evaluation

Example : Standard 6 — Engineering Workspaces

Engineering workspaces and laboratories that support and encourage hands-on learning of product, process, and system building, disciplinary knowledge, and social learning

The physical learning environment includes traditional learning spaces, for example, classrooms, lecture halls, and seminar rooms, as well as engineering workspaces and laboratories. Workspaces and laboratories support the learning of product, process, and system building skills concurrently with disciplinary knowledge. **They emphasize hands-on learning in which students are directly engaged in their own learning, and provide opportunities for social learning**, that is, settings where students can learn from each other and interact with several groups. The creation of new workspaces, or remodeling of existing laboratories, will vary with the size of the program and resources of the institution.

Workspaces and other learning environments that support hands-on learning are fundamental resources for learning to design, implement, and operate products, processes, and systems. Students who have access to modern engineering tools, software, and laboratories have opportunities to develop the knowledge, skills, and attitudes that support product, process, and system building competencies. These **competencies are best developed in workspaces that are student-centered, user-friendly, accessible, and interactive**.

Rubric

Scale	Criteria
5	Evaluation groups regularly review the impact and effectiveness of workspaces on learning and provide recommendations for improving them.
4	Engineering workspaces fully support all components of hands-on, knowledge, and skills learning.
3	Plans are being implemented and some new or remodeled spaces are in use.
2	Plans to remodel or build additional engineering workspaces have been approved by the appropriate bodies.
1	The need for engineering workspaces to support hands-on, knowledge, and skills activities is recognized and a process to address the need has been initiated.
0	Engineering workspaces are inadequate or inappropriate to support and encourage hands-on skills, knowledge, and social learning.

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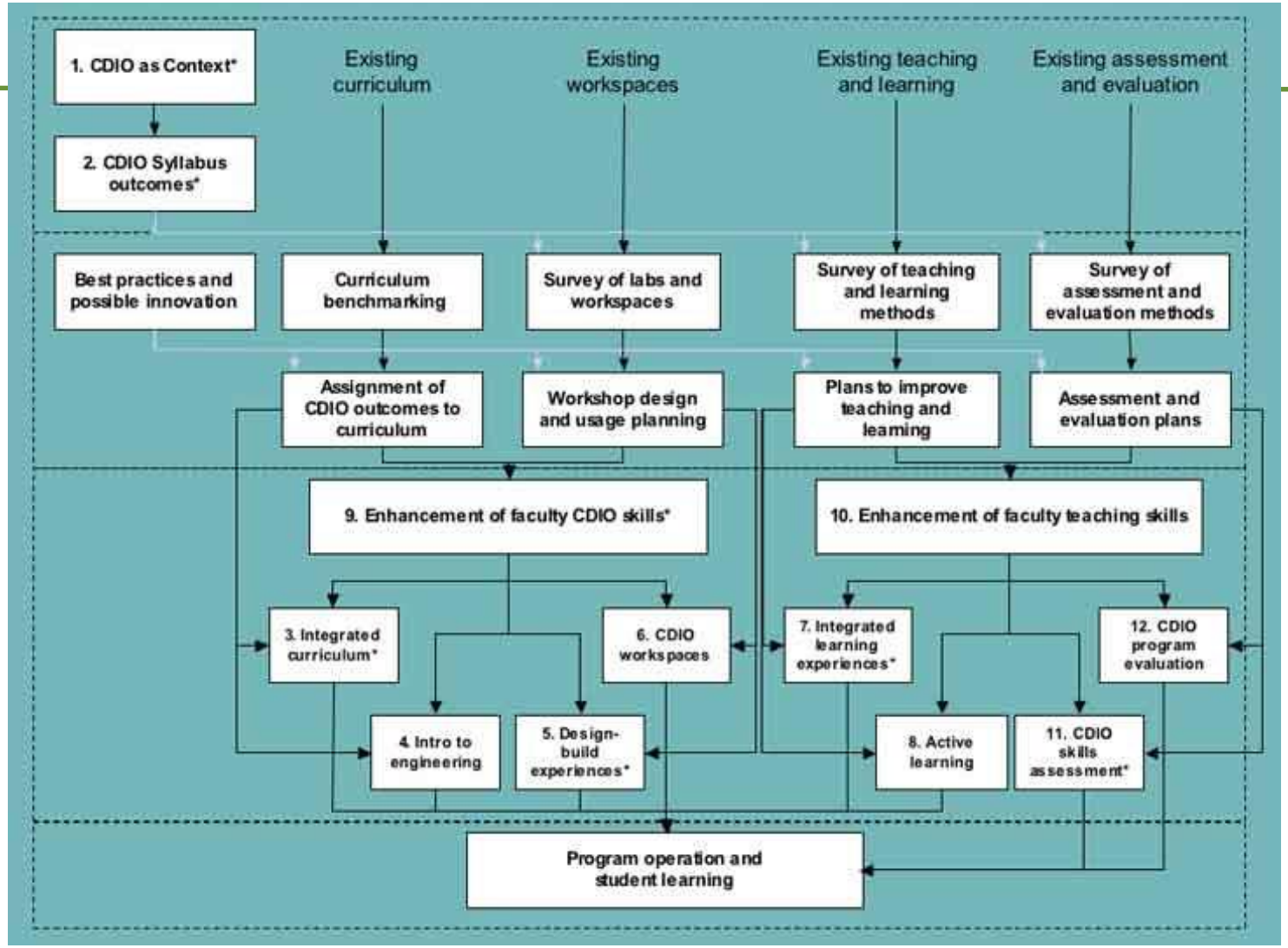
Implementation



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Why was CDIO right for Aston ?

- We wanted to ensure we continue to provide cutting edge courses attractive to both students and employers.
- CDIO thinking can show significant benefits in reduction of early year failures
- A significant reduction in the module and assessment count. Focus is on quality of integrated learning not quantity of modules and assessments.
- A course which is more flexible and enjoyable for both students and staff.

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Why was CDIO right for Aston ?

- A recognition that traditional teaching methods were not as effective as they could be in fostering deeper learning
- A need to provide a competitive environment for our own courses and also for our graduates.
- A need to demonstrate internally that we were serious about education and were prepared to take risks to get to where we wanted to be.

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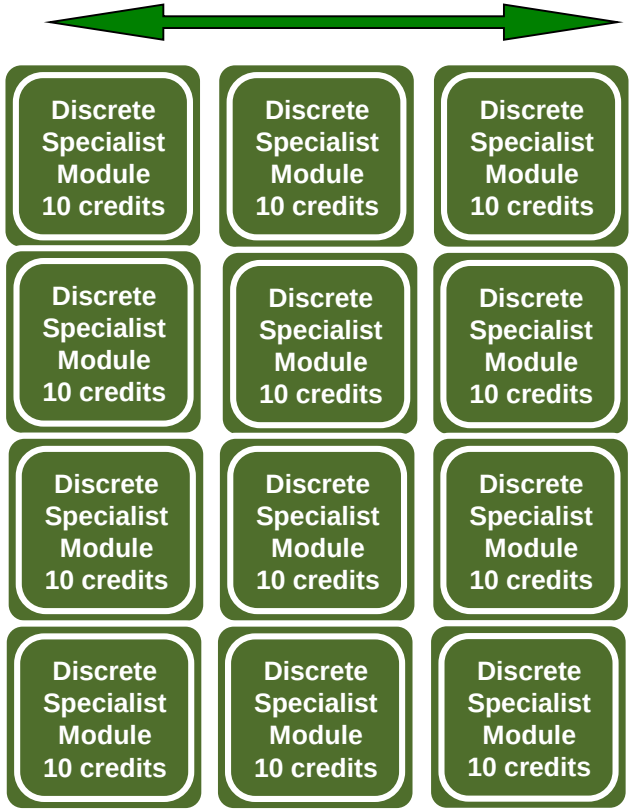
Previous Programme Structure (Yr 1 & 2)

mechanical engineering degrees

product design degrees



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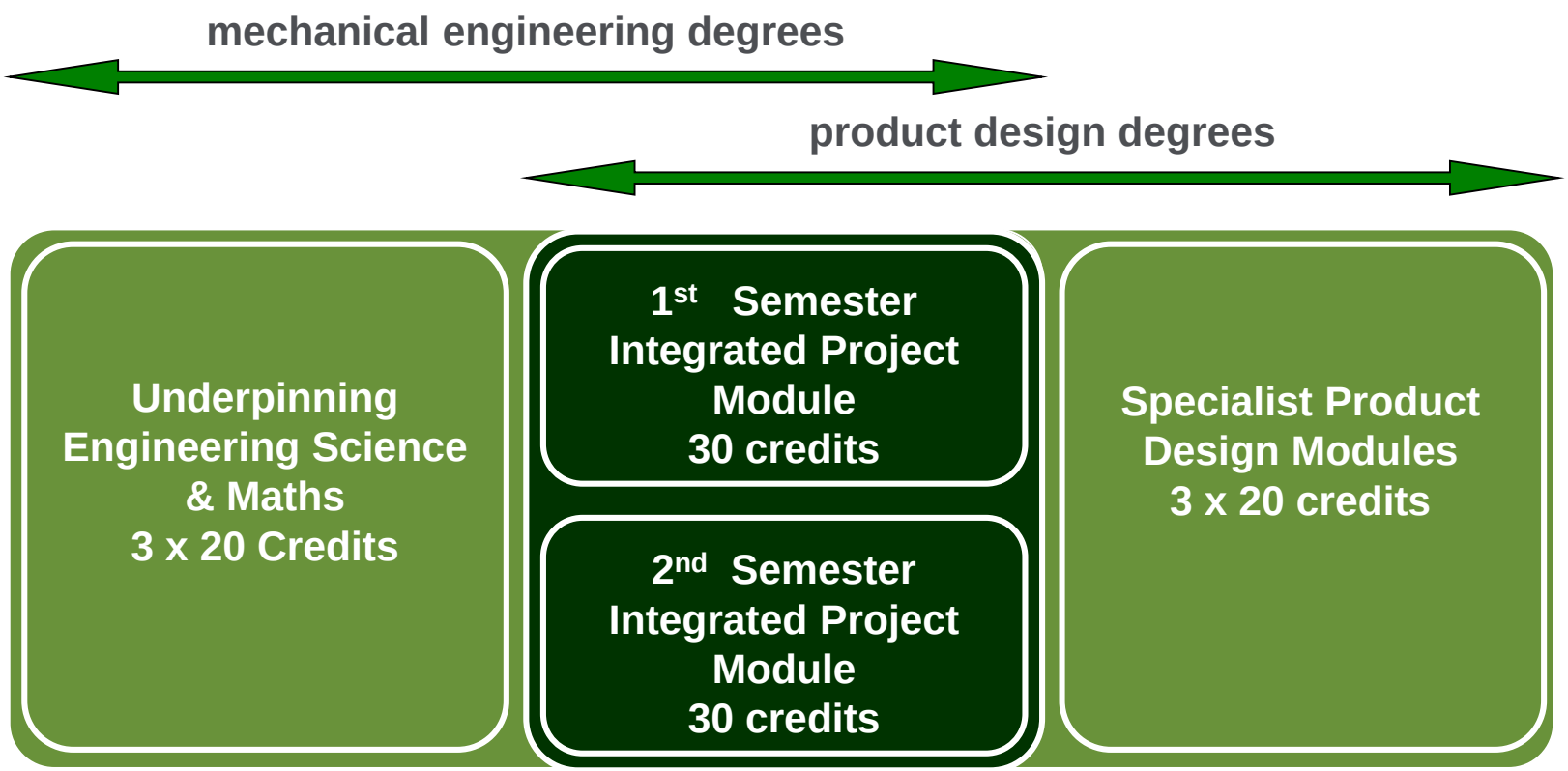
CDIO Programme Structure (Yr 1 & 2)



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Project Class Structure

- Students work in groups of around 5
- Sessions last whole day
- Multiple teaching methods in a single session :
  - Mini-lecture
  - Discussion
  - Tutorial
  - Mini laboratory
  - Practical
  - Design, build test

Introduce new learning, knowledge and skills
Typically 20-30 minute bursts of activity
Front loaded

Apply, develop and explore new learning

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Some snapshots from first semester of CDIO

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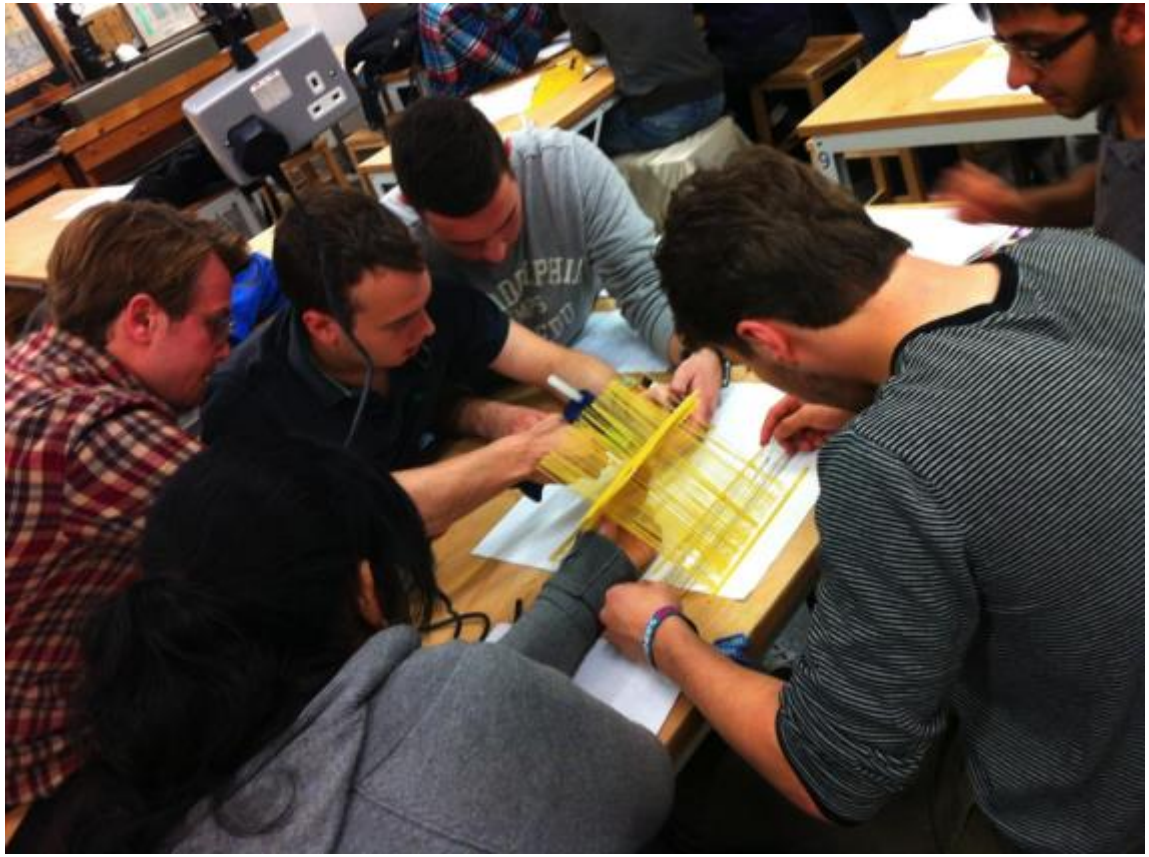
CDIO in Practice



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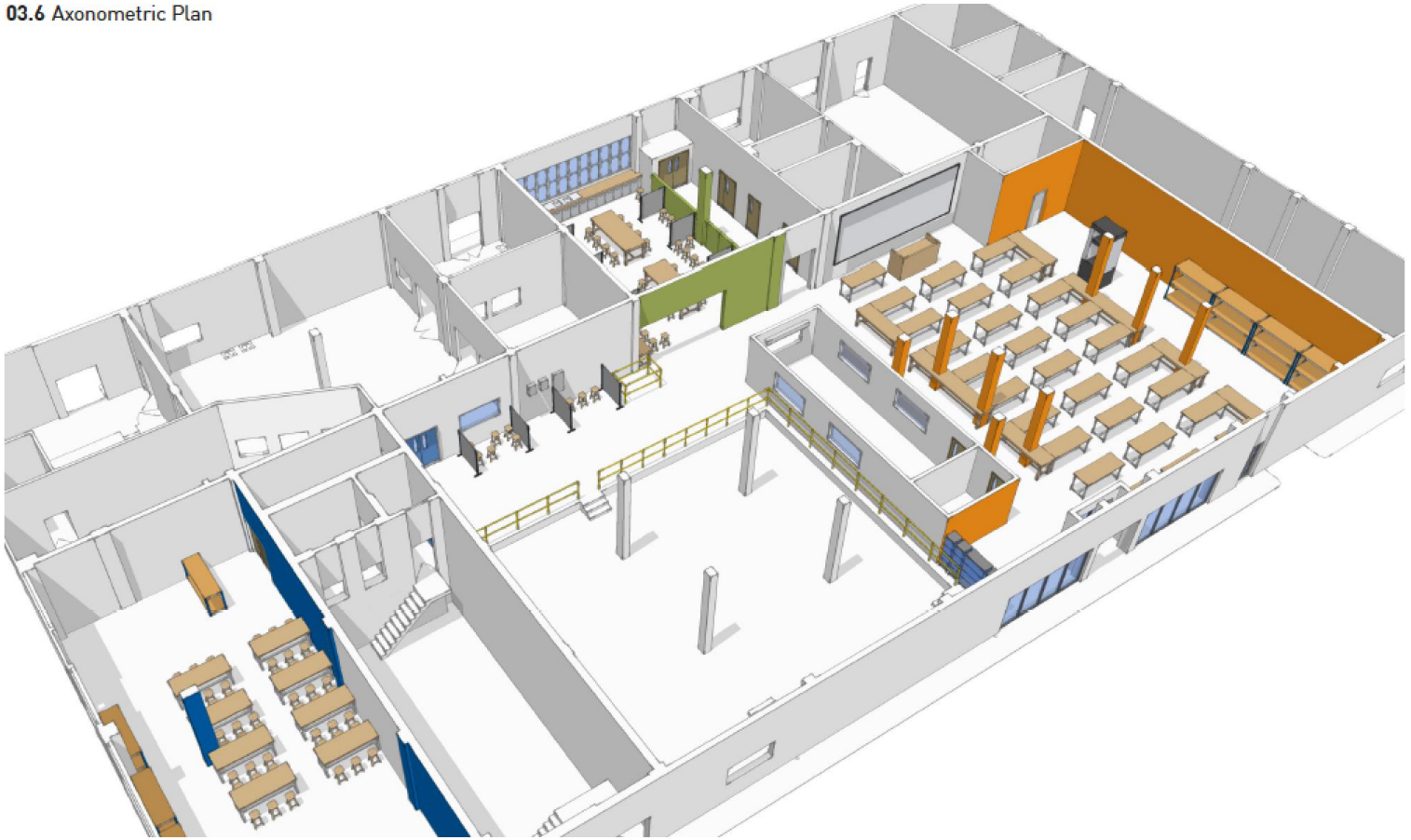
Workspace development…

03.6 Axonometric Plan



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Year 1 : Semester 1 Module : Current Car Project

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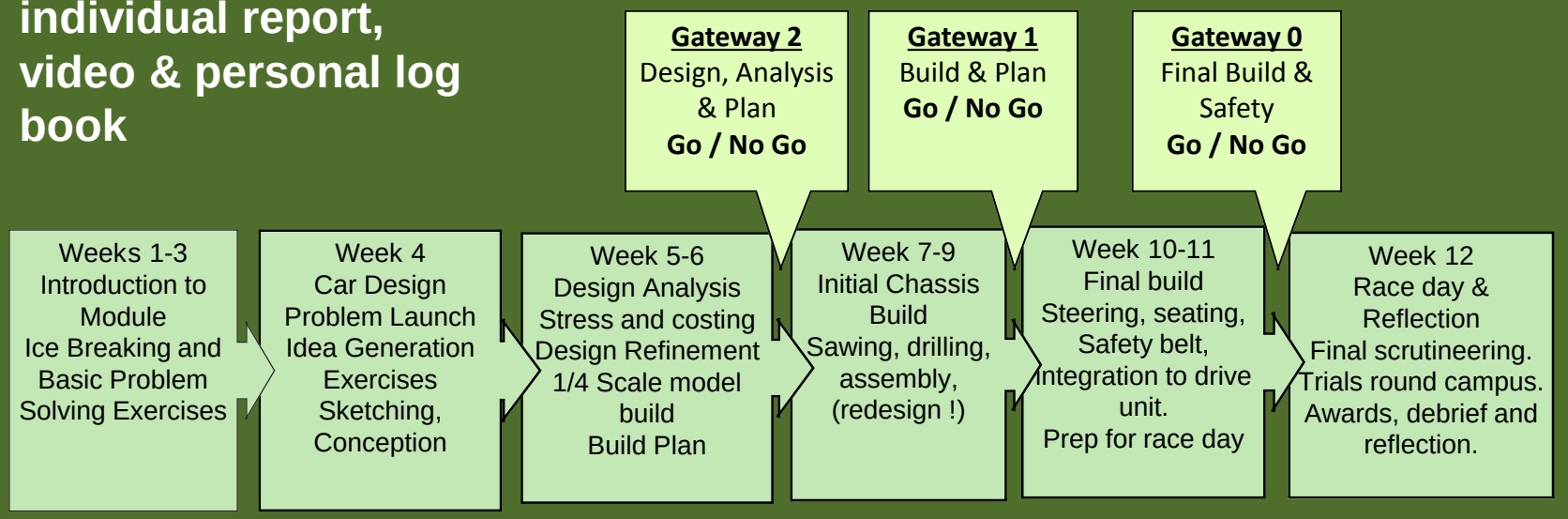
Year 1 : Semester 1 Module : Current Car Project

Module Structure

Assessed via individual report, video & personal log book

Timings shown are nominal and if groups failed to hit gateways, they would be stopped from progressing until objectives were met.



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CDIO in Practice

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CDIO in Practice

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CDIO in Practice

Wind Turbine

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Lessons Learned – Student Issues

- Students who got it, really impress
- High level of motivation on practical work
- Students seemed to enjoy the open nature of briefs
- Students responded well to use of plippers
- Some students uncomfortable with less formal teaching
- Moving students to focus on learning rather than gaining marks will take time
- Avoiding group work cruisers is an ongoing issue

Lessons Learned – Staff Issues

- High level of effort on staff part
- Different mindset
- Working in pairs is very beneficial
- Staff silos are broken down
- Prior briefing for academic and technical staff on each session is crucial.
- Assessment methods need review
- Not all staff embrace CDIO methodology immediately

CDIO – The Community

- An open community
- Non-prescriptive
- Supportive and with he aims of sharing best practice
- Operates at regional and international level
- Conference held annually

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CDIO
being a “collaborator”

- Non-prescriptive
- No inspections
- No complex paper work
- No membership fee
- Expectation you will be active in the community
- Participate in UK and Ireland regional events (1-2 mtgs p.a.)
- Participate in UK and Global conferences & meetings
- Engage with partners in UK, Europe & globally on shared initiatives.
- Ready made network for external examiners, student exchanges, collaborative grants etc.

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CDIO - our students' achievements

Aston student team at International CDIO event Barcelona.

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CDIO - our students' achievements

Aston student team winners of STEM awards 2015 for the *Posture Bra* Design.

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Any questions ?

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