核心素養融入專業課程的設計
Designing Core Competence Embedded in Professional Courses

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有什麼問題？What's the Problem?

- **對確立/維持公民社會、民主、自由的焦慮**
  Anxiety of establishing and keeping civil society, democracy, and liberty
  - 臺灣尚不是成熟的公民社會
  - 自由、民主還未成爲理所當然的生活習慣

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- **對就業能力的焦慮**

  Anxiety of lacking abilities to be hired

  - 溝通能力+合作能力+專業能力+解決問題的能力+工作態度+…
  - 學生、家長對就業所需能力的認識有偏差（與雇主、教授比）

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- **專業教育與此二者皆有關**

  Professional education is related to both

  - 專業能力對就業能力的貢獻與不足

    professional capabilities' contribution and lack for work abilities
  - 專業工作者也是公民，甚至可能是更有力量的公民

    Professionals are also citizens, maybe more powerful citizens.

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為何要在專業課程?
Why in professional courses?

- 高中教學不足
  Insufficient & ineffective high school education
- → 大學基礎(含通識)課程不足
  Thus, it leads to the insufficiency of fundamental (incl. general education) courses
- 學習專業知識與技能後的整合與融通
  Synthesis & integration after learning professional knowledge and skills
- 缺乏、也不需額外的時間或課程
  Extra time or courses is lacking & unnecessary.

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為何要融入式？Why embedded?

- **產生意義的學習 Meaningful learning ways**
  - 有脈絡的更有效 More effective with context
  - 問題導向學習 Problem based learning
    - 什麼問題？ What problem?
- **新興議題無空間 No space for new issues**
  - New problems for society and industry
  - New ideas
- **專業課程的停滯困境 Stalled Professional courses**
  - 缺乏開創與領導能力 Lack of creativity and leadership
  - 系統性的課程結構缺失 Systematic shortage in course structure
- **培養跨領域能力**
  Cultivating Interdisciplinary competence

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培養跨領域能力

Cultivating inter-/cross- disciplinary competence

- 從跨領域的認知開始
  From recognition of inter-/trans-disciplinary activities
- 認識問題的複雜性與關聯性
  Recognize the complexity and correlation among problems
- 認識學科/專業的優勢與侷限
  Recognize the advantages and limits of professions
- 跨領域的學習：融入專業課程
  Inter-/cross- disciplinary learning: embedded in professional courses
- 最後整合 **Final synthesis and integration**

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可能的問題 Possible Problems

- **教師不易準備 Not easy to prepare**
  - 跨領域的素養 Inter-/trans-disciplinary competence
  - 需要資料 need data/material
  - 上課方式 teaching methods
- **學生的學習慣性與成見**
  Students' inertia and prejudice of learning
  - 中學的補習班式教學 cram school's type of learning
  - 特性 characteristics：
    - 非問題導向 → 與生活脫節
      Non-problem based → disconnected from life
    - 去脈絡化 De-contextualized
    - 簡化 Simplified
    - 零碎→缺結構觀 Fragmented → lack of structural view
    - 技巧重於概念 More skill than **concept**

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- **專業的抵抗**

  Resistance from professional community
  - 專業知識不足？

    Not enough professional knowledge?
  - 知識 knowledge = competence 能力？
  - 更多工具輔助 More tools now & in the future
- **學習效果的評量**

  Evaluation of learning effectiveness
  - How? Need to learn from education experts.

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課程規劃 Course Planning

- **檢視課程結構 Review curriculum structure**
- **課程地圖的應用 Use of curriculum map**
- **調整課程模式 course change modes**
  - 加入新課程 new course
  - 減少課程 remove old course
  - 融入內容 competence embedded

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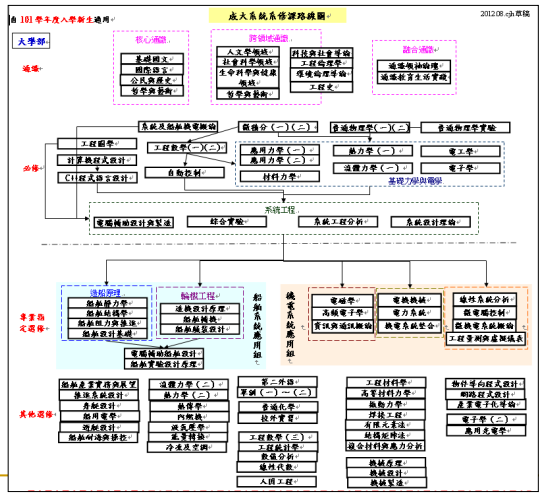
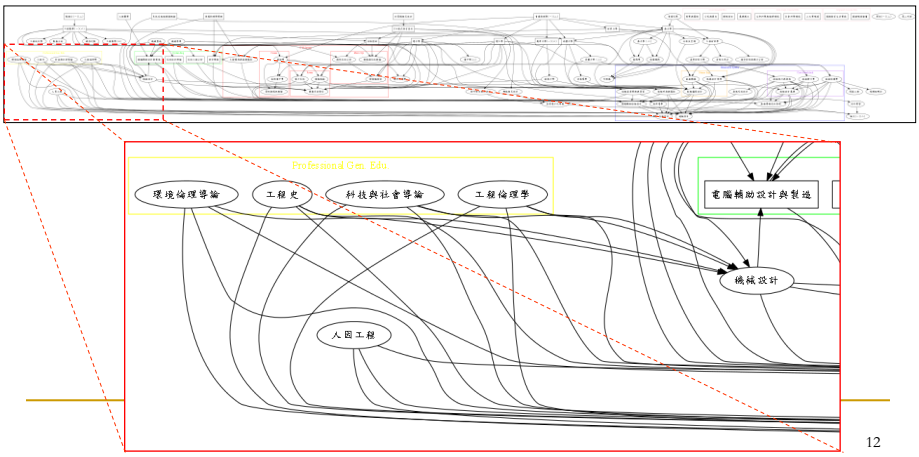
檢視課程結構與課程地圖的應用
Course structure review & Application of curriculum map

- **Traditional table / map**
  - Edited by professors
  - Created by *Word*
  - Only within dept.



- **課程地圖 Curriculum map**
  - A map of correlation among courses



加入新課程 New courses

- **成大工學院專業選修：科技與社會小學程**
  NCKU College of Engineering: STS courses
  - 科技與社會導論 Introduction to STS
  - 工程倫理 Engineering Ethics
  - 環境倫理 Environment Ethics
  - 工程史 History of Engineering
- **都是跨領域課程 All interdisciplinary courses**
- **也是他院的通識**
  Also as General Education courses for other colleges

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- **跨領域的認識與整合：**
  學生李盛弘、陳宥霖的成就
  Interdisciplinary learning & synthesis：Two students' accomplishment
  - 修工程史(李)、STS導論(李、陳)
    Took *History of Engineering*, *Intro. to STS*
  - 融合課程所學理論（ANT理論）於設計流程的畢業作品獲工業設計大獎
    Winning International Design Awards by applying ANT Theory (learned in class) in the design process

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主題融入專業課程Embedded Course

- 融入什麼？ What to embed?
- 融到哪裡？Where to be embedded?
- 如何融入？How to embed?

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以熱力學為例 Ex.: Thermodynamics

- 素養搭配

  Matching and selection core competences
  - 民主、科學、倫理、美學、媒體

    democracy, science, ethics, aesthetics, media
  - 利用課程地圖思考 Use “curriculum map” for thinking
    - What’s the connection?
    - What’s an appropriate topic?
    - What are possible activities?
      - Homework, project, discussion, debate, exhibition, exam.?

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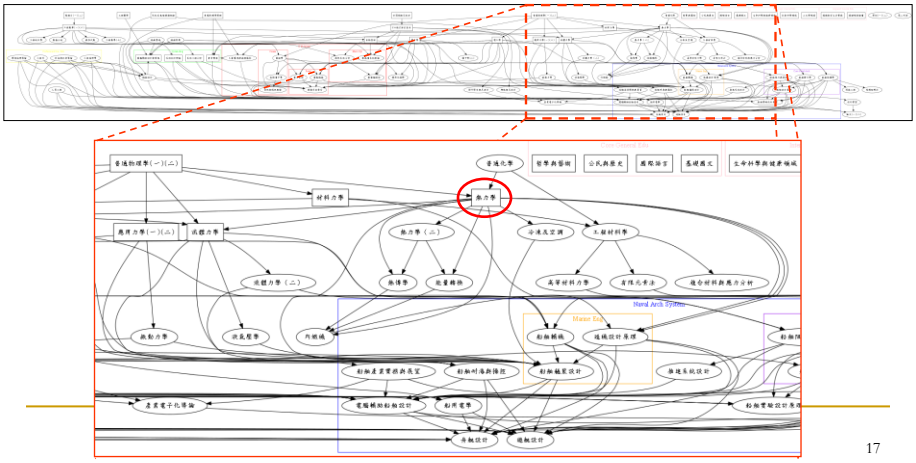
- **系課程地圖 A department curriculum map**

（建置中）



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- **熱力學的課程關聯影響**

The connection and influence of Thermodynamics in curriculum structure

- 應用性課程：內燃機、造機設計原理、 冷凍空調…
- 進階理論課程：熱傳學、能量轉換 …
- 相關性課程：流體力學
- 專業兩組皆有相關

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- **可能的方向 Possible direction**
  - Ethics of vehicle engineering: cars, ships, airplane,…
  - **Energy**

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- **評估 Evaluation**
  - 科學 Science：不適用 N/A
  - 民主 Democracy：
    - 科技、能源、產業等公共政策
    - Public Policies: S&T, Energy, Industry
  - 倫理 Ethics：
    - 環境倫理→環境議題 Environment
    - 專業倫理→科學研究法 Professional (Scientific Research)
  - 美學Aesthetics：教師不擅長not my expertise
  - 媒體Media：
    - 科普節目可連結，但(1)間接 (2)教師不擅長
    - Pop science program, but indirect & not my expertise

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- **主題尋找 What topic?**
  - 能源 **Energy**
- **評估**
  - 核心能力 Competences
    - 倫理ethics
    - 民主democracy (somewhat)
  - 性質Properties：
    - 公共性 Public affairs: It's a public affair.
    - 自主性 Autonomy: It could be a person's, family's, community's, region's, or country's decision.
    - 多樣性 Diversity: multiple disciplines, subjects, methods, tools,…

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- **上課方式 Teaching methods**
  - 講課 lecture
  - 討論 discussion
  - 作業 homework
  - 計畫 project
  - 需要結構性安排，貫穿課程
    - Structural arrangement to go through the whole course
- **學生反應 Students' reaction**
  - 很好、開啓視野　　good, vision opening
  - 無聊、與課程無關　boring, irrelevant

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- **小結 Summary**
  - 老師準備已不容易 Not easy for teacher to prepare
  - 學生尚未準備好 Students are not ready
    - 對課程所學的期望與落差
      Expectation and difference in course contents
    - 學習結構的預設與落差
      Expectation and difference in learning structure
    - 課程教法的期望與落差
      Expectation and difference in teaching methods
    - 不同意見學生比例
      Ratio of students with different opinions

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Questions & Discussion

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