Strategies for University-Industry Collaboration to Harness Digital Technology in Higher and Continuing Education

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Outline

• University-Industry (UI) Collaboration in Higher Education
• Digital technologies for learning in Higher Education
• Strategies
University-Industry Collaboration

Please go to www.menti.com and key in the code: 1447 6436
Why: Motivation for UI Collaboration

Necessity
- Government policy
- Strategic institutional policy

Reciprocity
- Access to complementary expertise, human resource, equipment, facilities, etc.
- Employment opportunities for graduates

Efficiency
- Access to funding and financial incentives (e.g., tax exemptions)
- Business opportunity
- Human capital development
- R&D opportunities

Stability
- Growth in new knowledge (knowledge-based economy)
- Insights to currently technologies and growth
- Multidiscipline nature of leading-edge technologies

Legitimacy
- Societal pressure
- Corporate image
- Service to society/community
- Contribution to economy and nation-building

Types of UI collaboration for education and training

- Research support (funding) and collaboration (joint research)
- Formal education enrolment of industry personnel
- Short term training and up-skilling
- Visiting lecturers and experts
- Joint course or training development (content and skills experts)
Collaboration with CREST and INTEL on innovative problem solving using TRIZ

- TRIZStation: developed TRIZ level 1 learning courseware with input from TRIZ level 3 expert from INTEL (RM102,400 funding from CREST) to train engineers and students in inventive problem solving
- Conducted TRIZ training sessions using TRIZStation during CREST’s Great Lab summer camps and workshops for university students and schools since 2015
The Collaborative Research in Engineering, Science and Technology Centre (CREST) is an industry-led collaborative platform for market-driven R&D and Talent Development to enable Malaysia to become a high income nation.

Based on the membership framework, CREST drives commitment from the Government, Industry and Academia members as active strategic partners.

VISION
To be the Premier Industry-driven Center for Collaboration in Research & Development, Talent Development and Commercialisation for the E&E Industry to accelerate economic growth in Malaysia.

MISSION
To advance scientific knowledge in the E&E sector through collaborative basic and applied research between academia and industry, forming a center of research excellence.

CREST at a glance

Industry-led E&E Focused R&D
Platform for collaboration
Forging local & International Strategic Partnerships
Research & Development, Talent Development, Commercialisation

Triple Helix Membership
Geography Agnostic
SMEs and local companies leading close to 60% of research projects

Generating solutions with economic impact
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What do these pictures show?
From Industrie 1.0 to Industrie 4.0

First Industrial Revolution
through the introduction of mechanical production facilities with the help of water and steam power.

First mechanical loom, 1784

Second Industrial Revolution
through the introduction of a division of labor and mass production with the help of electrical energy.

First assembly line, Cincinnati slaughterhouses, 1870

Third Industrial Revolution
through the use of electronic and IT systems that further automate production.

First programmable logic controller (PLC), Modicon 084, 1969

Fourth Industrial Revolution
through the use of cyber-physical systems

Source: DFK (2011)
Then, came the Pandemic Covid-19...

... followed by emergency remote teaching (ERT)
The faces behind ERT?
Online Learning Market

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Course Distribution by Subject

- Technology: 19.1%
- Business: 20.4%
- Mathematics: 2.0%
- Art & Design: 4.4%
- Engineering: 7.6%
- Health & Medicine: 7.7%
- Education & Teaching: 7.9%
- Social Sciences: 13.4%
- Science: 5.5%

By the Numbers: MOOCs in 2020
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What
21st-Century Skills

Foundational Literacies
How students apply core skills to everyday tasks
1. Literacy
2. Numeracy
3. Scientific literacy
4. ICT literacy
5. Financial literacy
6. Cultural and civic literacy

Competencies
How students approach complex challenges
7. Critical thinking/problem-solving
8. Creativity
9. Communication
10. Collaboration

Character Qualities
How students approach their changing environment
11. Curiosity
12. Initiative
13. Persistence/grit
14. Adaptability
15. Leadership
16. Social and cultural awareness

Lifelong Learning

Areas to work on for UI collaboration

- Online courses
- Immersive learning
- Infusing 21st century skills in on-line engineering courses
Scholarship in Higher Education

Research that contributes to new knowledge

Dynamic interplay between theory and practice, requiring rigour to apply knowledge in non-routine manners

Teaching not as a routine task, but transforming and extending, not merely transmitting, bridging teachers’ understanding and students’ learning

Connects across disciplines, bringing new insights to original research and placing specialties in new contexts
Online Engagement Framework

- Social engagement
- Cognitive engagement
- Emotional engagement
- Behavioral engagement
- Collaborative engagement
Commonly used Teaching and Learning (T&L) Model

1. Topic(s)
   - Told what to learn
   - Learn
   - Give exercises for illustration

Deductive T&L

Problem-Based Learning Model

1. Problem
   - Identify what to learn
   - Learn
   - Apply

Inductive T&L

Powerful for engaging learning & developing self-directed learning
Research-Teaching Nexus: Palm Oil Refinery Troubleshooting with Sime Darby Kempas Sdn Bhd

• Case studies written on troubleshooting of palm oil refining processes for training of technicians and engineers, and engineering students at undergraduate and postgraduate levels. Case study reviewed by members of Case Writing Association of Malaysia.

• Developed Fuzzy logic-based Palm Oil Refinery Troubleshooting System
FINAL CASE STUDY

Design of Automatic Control System for CCM Chemicals (M) Sdn Bhd

The Scenario
Now that you have experience as a process engineer, you have decided to join a process control consultancy firm, PARAGON Consulting Sdn. Bhd. You are hired because of your knowledge in chemical engineering, experience as a process engineer, and credentials. Since many of the firm’s engineers are electrical and mechanical engineers, your job scope includes: i) provide expertise to other engineers to understand, describe and analyze chemical processes, and ii) design automatic control systems for chemical processes.

One Tuesday morning, you received the following email from the general manager:

To: Design Team <design.team@paragon.my>
From: Abu Bakar Iman (abi@paragon.my)
Date: 25/03/2011 11:00AM
Subject: Design of automatic control system for CCM Chemicals

Good day engineers,

I had a meeting with CCM Chemicals’ plant manager last week. They are now having problems with the existing control systems of their chlorine gas absorption processes. To be specific, they are facing difficulty to maintain the process variables at the desired operating conditions. Plus, they are experiencing inconsistencies in the online measurement of the product specs too. There are two chlorine gas absorption columns operating, as part of Chloralkali Process for chlorine production, in the company. At the moment, CCM Chemicals is urgently looking for a prospective consultancy firm to solve these problems. Due to our excellent track record in the previous consultancy projects, they’ve invited us to bid for this project. Therefore, I want your team to design/modify the
Can you get to the red door?
Cooperative Problem-based Learning (CPBL)

Phase 1
- Individual meet the problem, restatement & identification
- Team discussion & consensus in problem restatement & identification
- Overall class problem identification & analysis

Phase 2
- Self-directed learning
- Individual notes, Peer teaching in team & overall class discussion
- Team synthesis & application for solutions formulation
- Team consensus on final solution generation

Phase 3
- Presentation, reflection & team feedback
- Closure

Cooperative Problem-Based Learning (CPBL) Model

Mohd-Yusof, et al 2011

* Insufficient understanding of learning issues to solve problem
** Incomplete or misunderstanding of problem requirements
Carmakers rush to check safety amid scandal at Japan's Kobe Steel

Julia Kollewe

Ford, Toyota, Honda, Mazda and Subaru are among those supplied by steelmaker, which admits it falsified quality data

Japan's third-biggest steelmaker, Kobe Steel, is embroiled in a deepening scandal over the

10/11/2017

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Volkswagen: The scandal explained

By Russell Hotten
Business reporter, BBC News

10 December 2015 | Business

What is Volkswagen accused of?

It's been dubbed the “diesel dupe”. In September, the Environmental Protection Agency (EPA) found that many VW cars being sold in America had a “defeat device” - or software - in diesel engines that could detect when they were being tested, changing the performance accordingly to improve results. The German car giant has since admitted cheating emissions tests in the US.

VW has had a major push to sell diesel cars in the US, backed by a huge marketing campaign trumpeting its cars' low emissions. The EPA’s findings cover 482,000 cars in the US only, including the VW-manufactured Audi A3, and the VW models Jetta, Beetle, Golf and Passat. But VW has admitted that about 11 million cars worldwide, including eight million in Europe, are fitted with the so-called “defeat device”.

The company has also been accused by the EPA of modifying software on the 3
Example of UI collaboration framework for higher education curriculum launched by MOHE

Experiential Learning & Competency-based Education Landscape (EXCEL)
Active Experimentation
Opportunity to experiment in the workplace or simulated environment.

Concrete Experience
Curated based on real task in the workplace.

Active Experimentation
Flexible pathways based on passion, competency and mastery-driven

Concrete Experience
Based on personalized/individual needs

Reflective Observation
Demonstration by industry worker and reflection using work performance rubrics.

Abstract Conceptualization
Establish facts behind work process and phenomena at the workplace.

Abstract Conceptualization
Agile curriculum, buffet-style learning with structured guidance

Reflective Observation
Provide autonomy and flexibility in deciding academic pathways
Active Experimentation
Opportunity to perform research in real settings.

Concrete Experience
Curated based on actual research through inquiry-based learning.

Abstract Conceptualization
Analyze and create meaning from research findings to modify and form new ideas.

Reflective Observation
Review and reflect on the research experience and activities.

CARE
Abstract Conceptualization
Revisiting, refreshing and building their knowledge and ideas for social innovation in community.

Reflective Observation
Deep understanding and appreciation of their roles and functions in their field/domain towards building community resilience.
Problem-Based Learning for Low Carbon Society (LCS) is a project funded by Japan International Cooperation Agency (JICA) for secondary schools in the region of Iskandar Malaysia to implement PBL to acquire knowledge and awareness on LCS. UTM is appointed as the expert to train teachers and study the effectiveness of the project. This project is in collaboration with, Kyoto Environmental Activities Association (KEAA), Kyoto City, Jabatan Pendidikan Negeri Johor (JPNJ) and IRDA.
Conclusion

• Digital technology currently utilised and explored for learning
  – Different levels of engagement and outcomes
• Implementing scholarly engineering education can lead to high impact outcomes
• University-Industry with government agencies participation has enormous potential for impactful and sustainable impact
Thank you for your kind attention

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