UoL4.0 Challenge 2019: Challenge-Based Learning as an approach to develop students' 21st Century digital skills, through UoL and businesses technology-based co-production

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Background

University of Lincoln Strategic Plan (2016-2021) recognises that "21st Century is creating profound changes to our society and our economy". One of these changes involves the digitalisation of businesses; known as 'Industry 4.0' (I4.0). Current awareness of I4.0 inside UK higher-education institutions is low. This suggests that I4.0 could become a competitive differentiator against competitors, with initiatives such as: (a) building students' capabilities to design and manage technology-based business projects, (b) supporting students' capabilities to design and implement I4.0 initiatives, particularly at the micro-level, and (c) reflecting on the implementations conducted and disseminating lessons learned.

The **UoL4.0 Challenge** Initiative is a 'Challenge-Based Learning' educational strategy to support UoL students and Lincolnshire businesses and organisations in the discovery of opportunities concerning the digitalisation of industry and services (e.g. Big Data/Analytics, Blockchain, the Cloud, Internet of Things and wearable sensors).
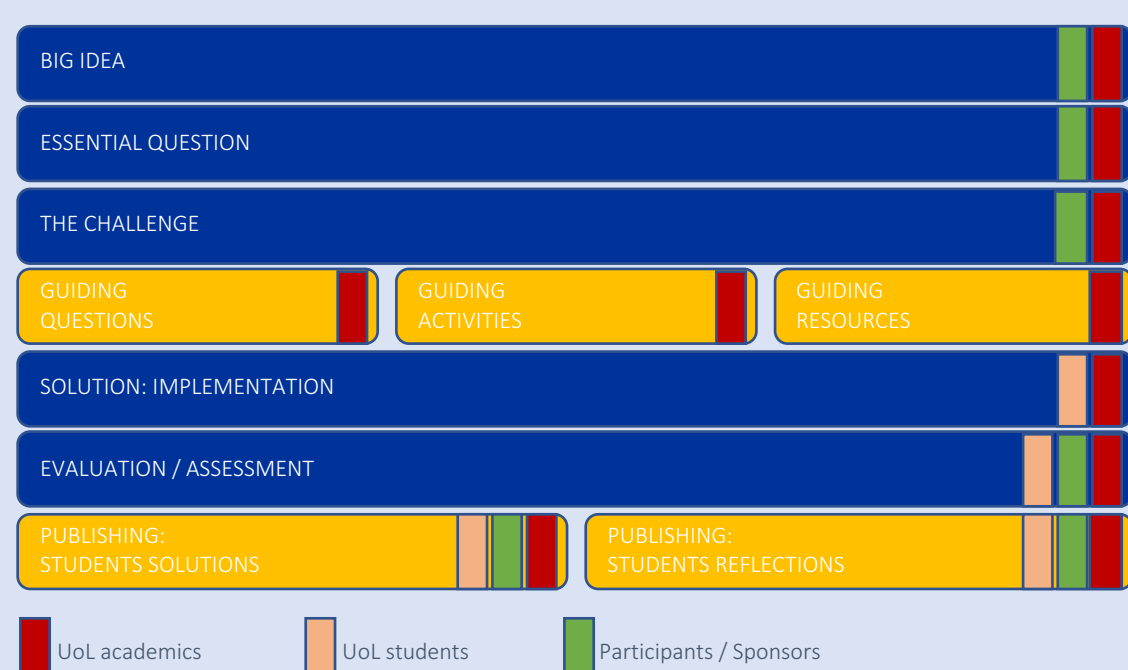
Figure 1. Challenge-based learning approach (Apple, 2010).

Objectives

The goal for this project was twofold:

- **for students** to increase their employability, by means of developing technology-based entrepreneurial and problem-solving skills, to better deal with cyber-physical systems.
- **for businesses** to connect their new commercial ideas with their potential markets, through the development and use of digital technologies.

Procedure

UoL4.0 Challenge 2019 was conceptualized in two stages:

1. **'UoL4.0 Design'** where the challenge is identified and structured. Students from different colleges were invited to identify potential configurations that the 'UoL4.0 Competition' could take. A focus groups was run.
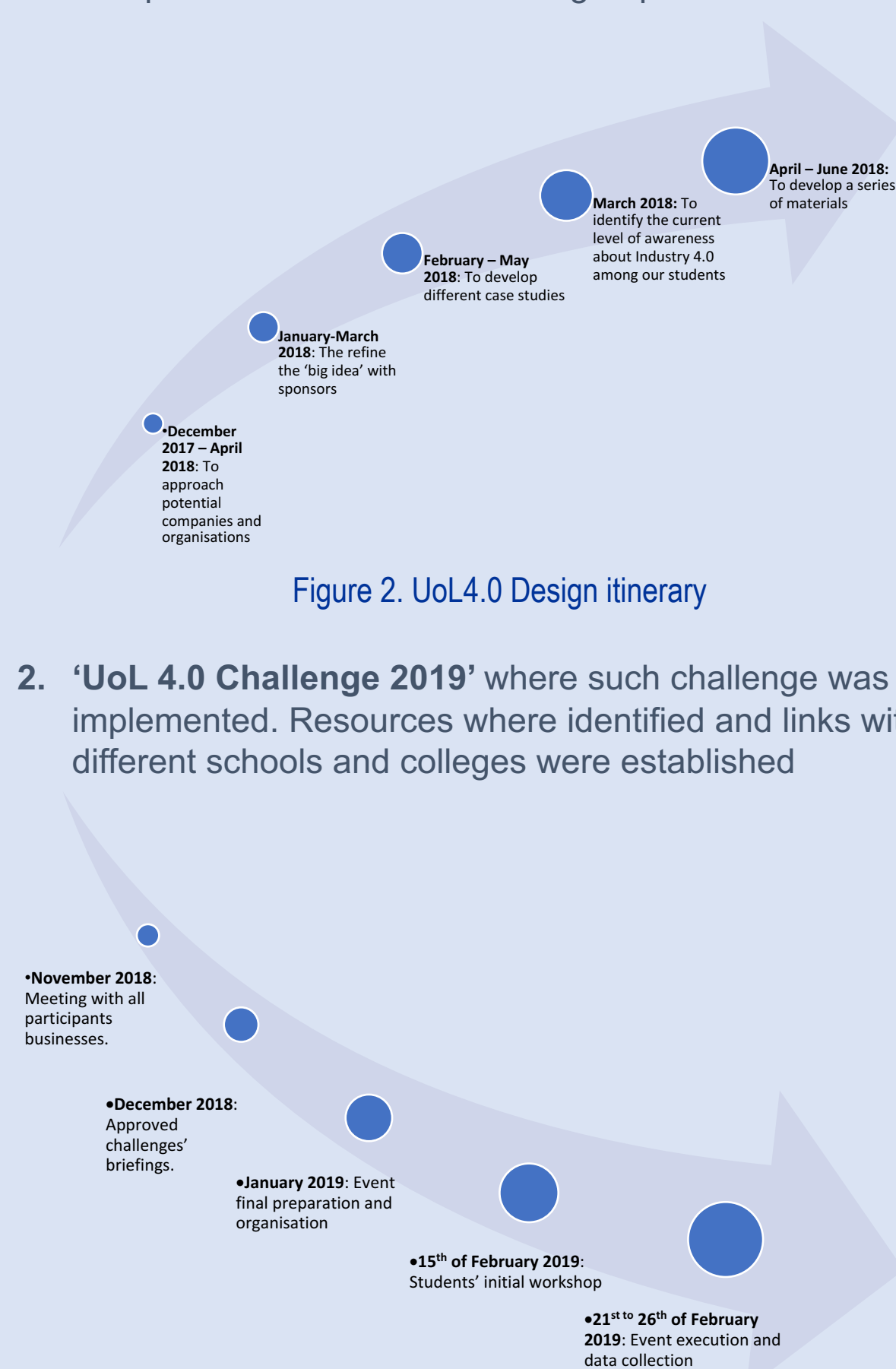
Figure 2. UoL4.0 Design itinerary

2. **'UoL 4.0 Challenge 2019'** where such challenge was implemented. Resources where identified and links with different schools and colleges were established

Figure 3. UoL4.0 Challenge 2019 itinerary

Step 1. UoL4.0 Design

Students from different Colleges (**Arts, LIBS and Science**) participated in the conceptual development of UoL4.0 Design, through a focus group. Their reception to the idea was very positive, and their interest in participating was made explicit.

Figure 4. Focus group – Challenge-based learning approach for connecting ideas to the market, UoL4.0

Local businesses were also very positive with the UoL4.0 concept. The initial idea was to identify one organisation acting as participant/sponsor; however, the good reception made us widen the target to eight companies. Participants considered for the first event were Branston, Exec Dev @ LIBS, Lindum Group, New Theatre Royal Lincoln, Ruddocks, Siemens, Stokes and Wren Kitchens. Other conversations with sponsors took place; some of these were the Chartered Institute of Logistics and Transport (CILT), Innovate UK and the Operational Research Society (ORSoc). Three companies and one sponsor were selected.

Participant businesses | **Sponsors**

Figure 5. Participant businesses and sponsors

Ten **academics** from three different schools (**Business, Computing and Design**) participated actively in this initiative:

W Christian, Lincoln School of Design, College of Arts
Dr P Dickinson, School of Computer Science, College of Science
Mrs Sarah Eyre, Industrial Digitalisation Project, College of Science
Ms C Ge, LIBS, Work-based Distance Learning
Prof M Hingley, LIBS, Marketing and Tourism
Dr A Khudenko, LIBS, Strategy and Enterprise (Proj. Mgt.)
Dr G Lakshmi, LIBS, Accountancy, Finance and Economics
Mr. G Lingwood, Lincoln School of Design, College of Arts
Ms R Michel-Villarreal, LIBS, Strategy and Enterprise (Ops. Mgt.)
Dr E Vilalta-Perdomo, LIBS, Strategy and Enterprise (Ops. Mgt.)

The UoL4.0 concept/project was assessed by a specialist in the I4.0 field; Dr Javier Rainer-Granados, academic, from the Universidad International de la Rioja (Madrid, Spain).

The assessment provided a typology of different ways that a UoL4.0 CBL may be designed and conducted.

The selected version for a future edition of the UoL4.0 Challenge considers "making a comparison of tools available in the market to solve a problem that requires Digital Transformation".
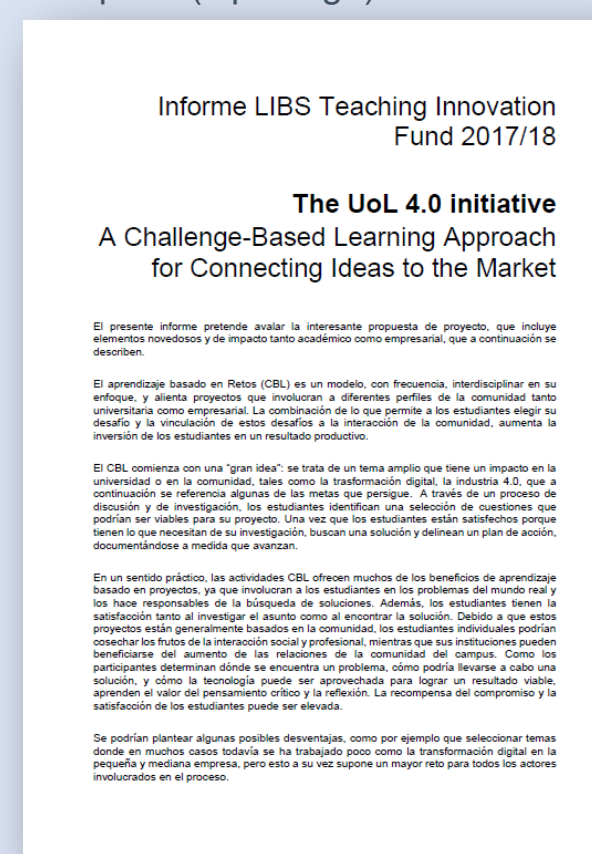
Figure 6. External validation report

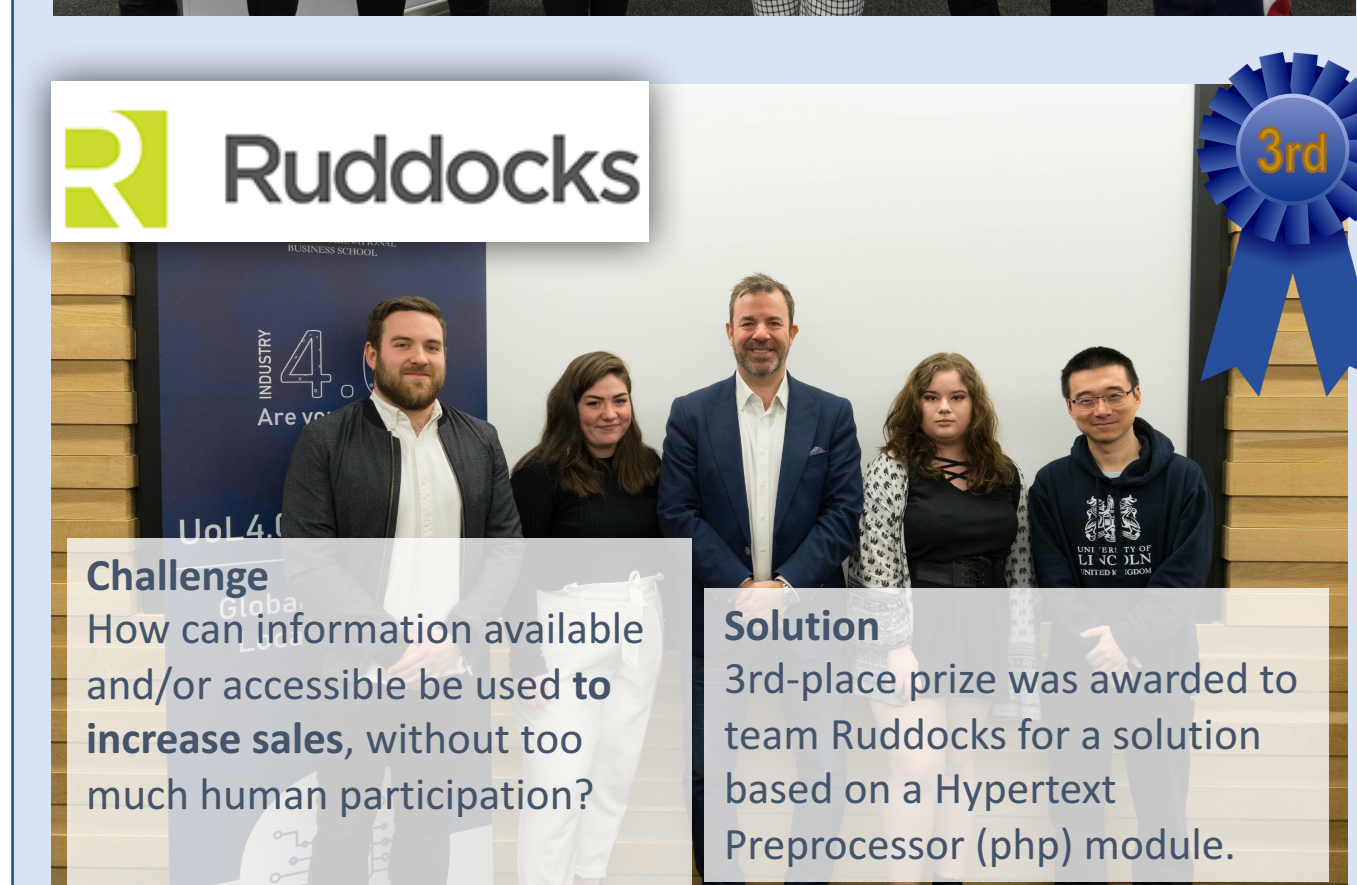Figure 7. First dissemination event

Step 2. UoL4.0 Challenge 2019

This event took place between 21st and 26th of February, with the participation of 13 students from the following programmes: Agri-Food Tech, MSc; Biomedical Science, PhD; Business & Management, BA; Computer Science, BSc; Electrical Engineering (Electronics), BSc; Interactive Design, BA, and International Business BA.
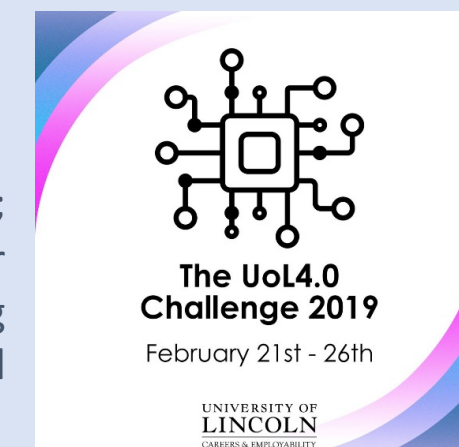
Essential question
How may digital technologies positively impact Lincolnshire's economy?

Support activities – Workshops
- 'Successful teamwork, roles and rules' by Paul Banton (Ruddocks) & Craig Marsh (LIBS)
- 'How to use supportive technologies for the UoL4.0 Challenge 2019' by Chang Ge (LIBS)
- 'What is Challenge-Based Learning?' by Eliseo Vilalta-Perdomo (LIBS)
- 'Inspired Ideas' by Gyles Lingwood (School of Arts
- 'Industry 4.0 revolution' by Eliseo Vilalta-Perdomo
- 'Professional abilities in a digital economy' by Neil Everatt (Selenity)
- 'Effective business communication' by Adam Cartwright and Anthony Latimer (Siemens)

Challenge
How can we **measure the dry matter of every single potato in the processing line to increase** uniformity in the quality of finished products?

Solution
The winner of the UoL4.0 Challenge 2019 was team Branston with a solution based on the use of Near-Infrared spectroscopy for the grading of potatoes.

Challenge
Productive activities concentrate at later hours of the days. Can digital technologies help **to increase the utilisation of the building**?

Solution
2nd-place prize was awarded to team New Theatre Royal for a solution based on projection mapping of the history of the theatre.

Challenge
How can information available and/or accessible be used **to increase sales**, without too much human participation?

Solution
3rd-place prize was awarded to team Ruddocks for a solution based on a Hypertext Preprocessor (php) module.

Future steps

Further development on the UoL4.0 Project include:
Project Teams and the companies discuss possibilities of extending the project into real-impact cases of implementing digital technologies

Applications for additional funding, a new application has been submitted and is under evaluation.

References

- Apple (2011) Challenge-based learning. A classroom guide. Available at https://images.apple.com/education/docs/CBL_Classroom_Guide_Jan_2011.pdf