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Entrepreneurial Mindset Development in Engineering Students through a Business Model Canvas Approach

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1 Introduction and Major Challenges

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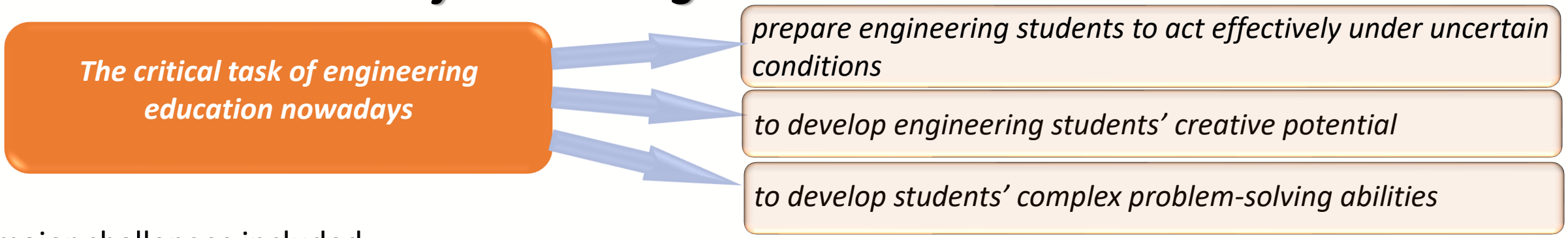

The major challenges included:

- introduction of customer-centric practices to the engineering students' projects
- keeping up engineering students with the latest business trends
- transformation of the engineering learning environment
- understanding by the engineering students who their ideas were oriented to, who was the user and, finally, who would pay for the solution

*Thus, **engineering education must be focused on the entrepreneurial mindset development** alongside with analytical thinking, design thinking and creativity, which would enable socially valuable innovations.*

All those conditions required the search for new methods and practices to develop engineering students' entrepreneurial competence.

2 Aim and Research Tasks

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The research aim was to substantiate the effective entrepreneurship teaching method which could be embedded in a course of engineering discipline and could foster the development of engineering students' entrepreneurial mindset.

Research tasks included:

- Development of an instrument for assessment of the level of engineering students' entrepreneurial competence growth
- Development of an entrepreneurship teaching method oriented on the growth of engineering students' entrepreneurial mindset
- Testing the method and estimating the results of its application to engineering learning project

3 Research Methodology

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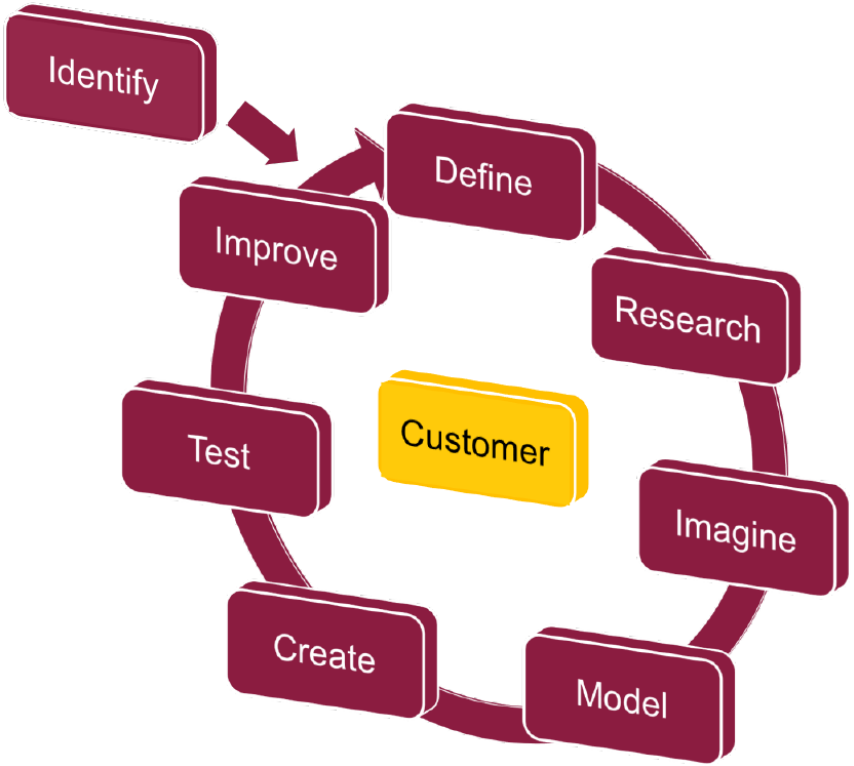
Step 1. Development of the assessment instrument was focused on such dimensions as Analytical Skills, Design Thinking & Decision Making, Business Oriented Thinking and Communication & Leadership

Identification of dimension items in the assessment process

Dimension	Description of the item
D1. Analytical Skills	To search for and analyse data
	To identify customer needs
	To analyse the market trends
D2. Design Thinking &	To generate ideas
Decision Making	To make informed decisions
	To model the solution
D3. Business Oriented	To analyse the customer segment
Thinking	To identify the added value of a product/service
	To analyse and define cost structure and revenue streams
D4. Communication &	To choose and organise the work inside the team
Leadership	To manage risks, motivate and monitor teamwork
	To admit errors, give response to a particular request/action/event

3 Research Methodology

Step 2. The experimental method for teaching entrepreneurship was based on the cooperation of business theory and sharing successful business experiences

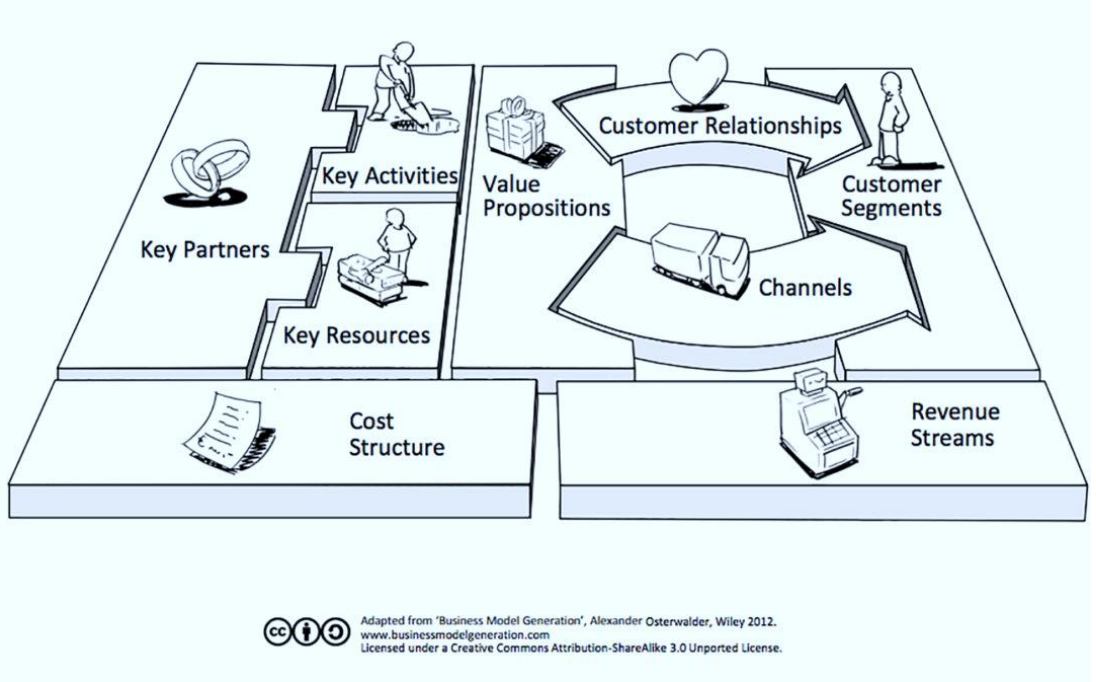


Engineering Design Process

Source: Introduction to Engineering: Imagine. Design. Engineer! Arizona State University.
URL: https://courses.edx.org/courses/course-v1:ASUx+FSE100x+2177C/course/

Business Model Canvas

Source: What is a Business Model Canvas?
URL: https://merlin-ict.eu/what-is-a-business-model-canvas/



4 Results

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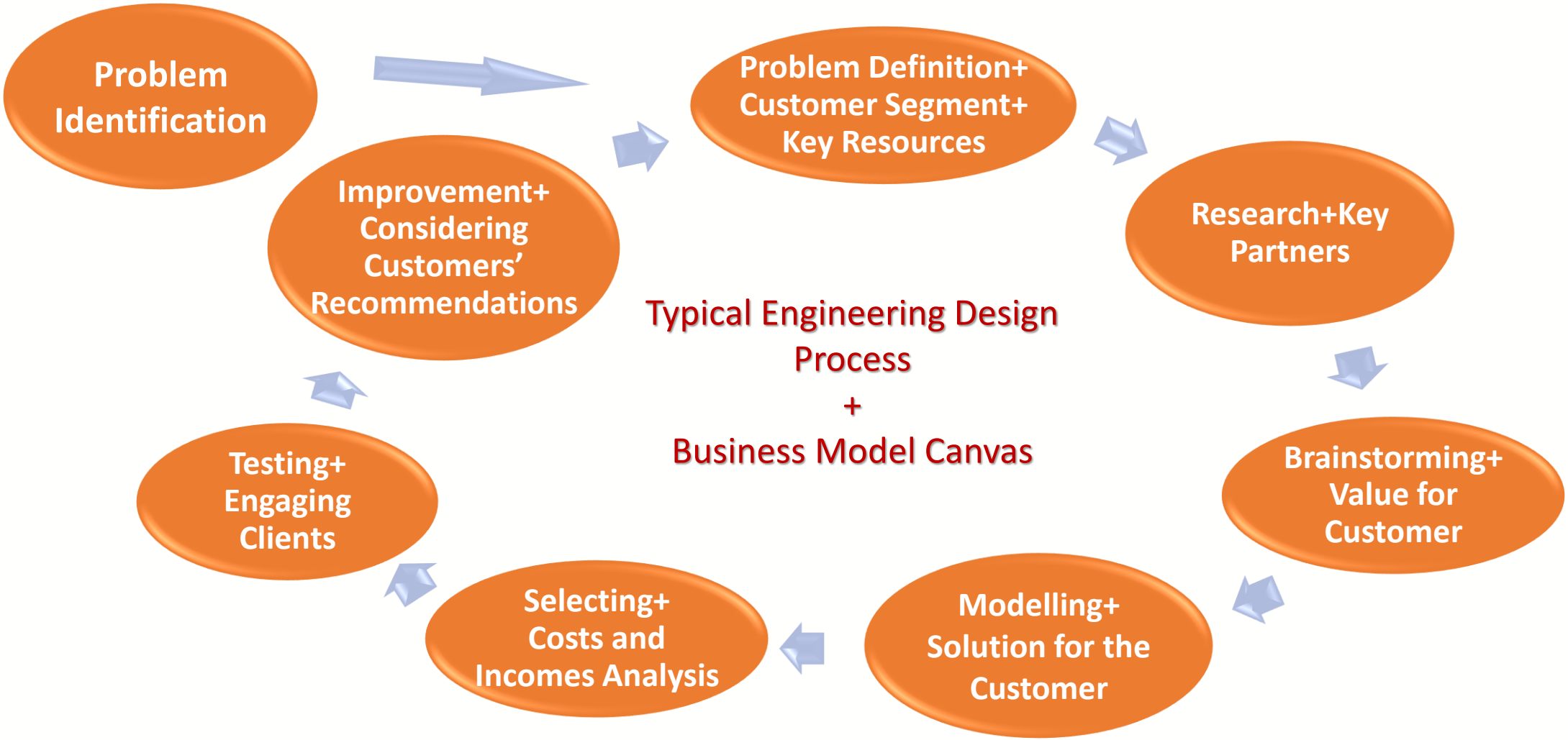
The experimental method for teaching entrepreneurship

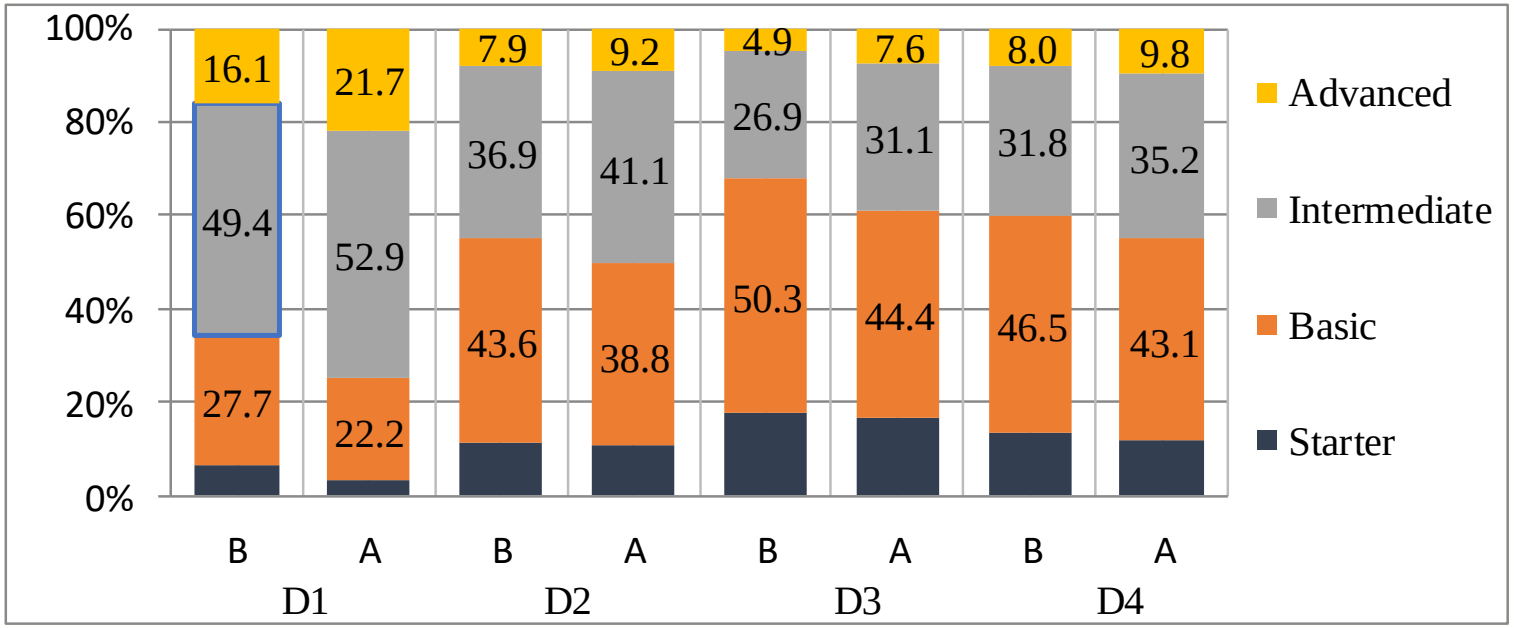


4 Results

The experiment in 2021 took place at Dmytro Motornyi Tavria State Agrotechnological University

- 112 engineering master students (Agricultural Engineering, Industrial Engineering, Power Engineering)
- development of students' final individual projects using the experimental method
- combination of two approaches: the 7 Steps Engineering Design Process and Business Model Canvas

4 Results



The results of the engineering student's entrepreneurial competence assessment:
B and A are results *before* and *after* the experimental learning

D1 is an Analytical Skills dimension,
D2 is Design Thinking & Decision Making

D3 is Business Oriented Thinking
D4 a Communication & Leadership dimension.

4 Results

- The participants demonstrated ***significant positive changes*** in Business Oriented Thinking and Design Thinking & Decision Making.
- The respondents demonstrated ***quite high levels*** of Analytical Skills both at the beginning and at the end of the experiment (as the skills were in focus during the university studying).
- The Communication & Leadership aspect ***needed additional development*** through providing more group activities.

The experimental method enabled to create the conditions which could promote the engineering students' entrepreneurial mindset development

5 Conclusions

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- The introduction of the entrepreneurship aspects into engineering education became the necessary step for the training of the new generation of engineers.
- To evaluate the engineering students' entrepreneurial competence the assessment instrument was developed.
- The assessment instrument enabled to check at the beginning and at the end of the experiment the effect in such dimensions as Analytical Skills, Design Thinking & Decision Making, Business Oriented Thinking and Communication & Leadership.
- The experimental method combined the typical 7 Steps Engineering Design Process and Business Model Canvas approach.
- Students focused their attempts on the design of a technical solution and such aspects as value proposition, customer segment, key resource, cost structure, revenue stream etc.
- The engineering students' entrepreneurial competence assessment after the course showed some improvement (up to 5,9 per cent) in all the dimensions.
- The method's positive effect in engineering students' entrepreneurial mindset development was confirmed.
- Further research could be devoted to the effective methods for engineering students' financial literacy development as well as the problem of engineering teachers' entrepreneurial competence growth.

Thank you very much for your attention!

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