

# Assessing the Product Development & Design Courses within the MIT–Portugal Program

Yehudit Judy Dori

*Engineering Systems Division, Massachusetts Institute of  
Technology, Cambridge, MA 02139 and Technion, Israel  
Institute of Technology, Haifa 32000, Israel*

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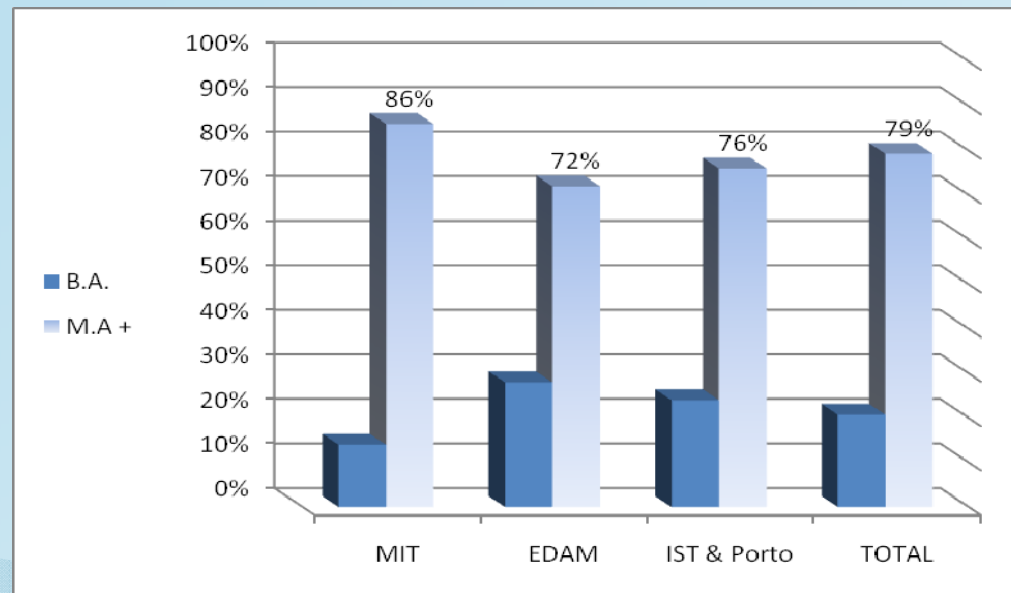
# Background and Research Goal

- ▶ The Product Design and Development (PDD) course is part of the curriculum that Ph.D. and Advanced Study students in the Engineering Design and Advanced Manufacturing (EDAM) study.
- ▶ It is part of the MIT–Portugal program.
- ▶ The PDD course is taught by Portuguese faculty in collaboration with MIT faculty.
- ▶ The goal of this research was to assess the PDD course within the EDAM MIT–Portugal Program.

# Participants

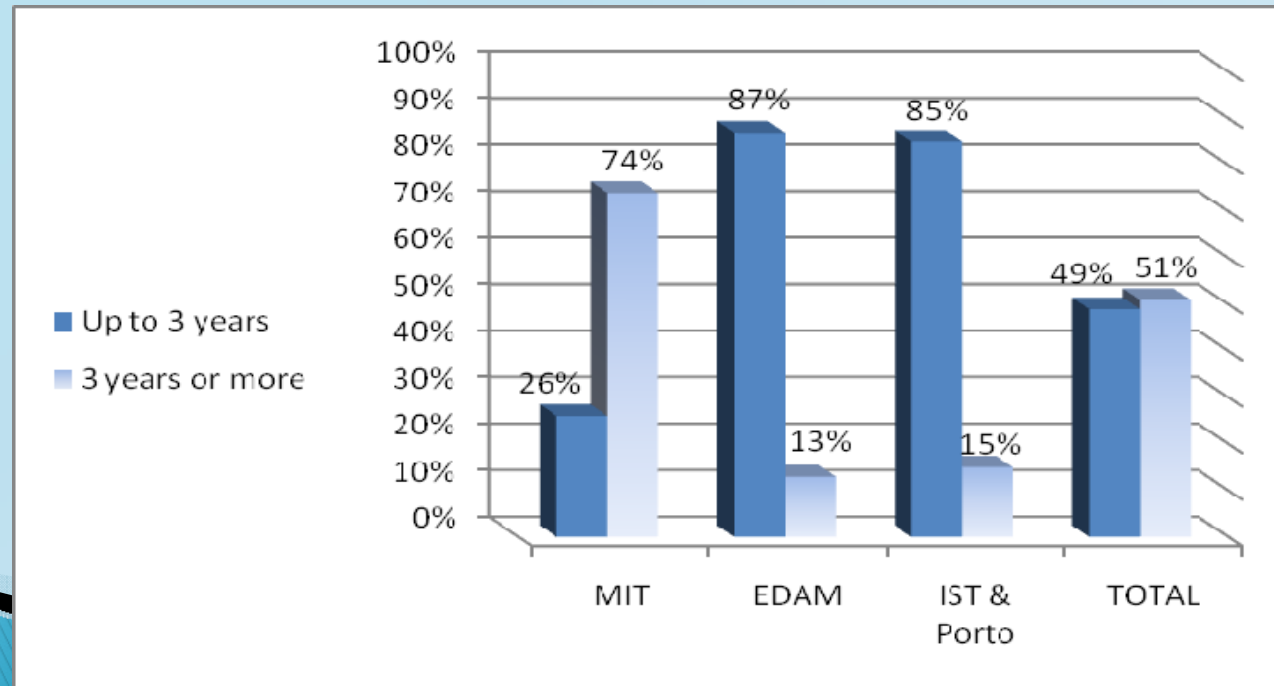
The research participants included about 116 students who were divided into three groups:

- ▶ (1) Engineering Systems Division at MIT (N=50),
- ▶ (2) **EDAM program, which included students from several universities in Portugal (N=25), and**
- ▶ (3) Instituto Superior Técnico (IST) and University of Porto (N=41).



# Participants Expertise and Experience

Area of Expertise	N	Percent
Engineering	75	60%
Management	66	52%
Manufacturing	51	41%
Industrial Design	36	29%
Other	28	22%



# Research Tools

- (1) Pre- and post-questionnaires, administered to the students of all three research groups, and
- (2) Focus groups for EDAM faculty and students.
  - ▶ Questions included:
    - ❖ describing key PDD concepts and processes,
    - ❖ ranking reasons for product success despite failing technical specifications,
    - ❖ identifying team and individual skills required for working on a product development project.
  - ▶ In the open-ended questions, students' responses from all three groups were analyzed and the extracted items were grouped into categories.

These categories were primarily based on the courses textbook (Ulrich and Eppinger, 2008) with refinement based on the text written by the students.

# Projects – Examples of products

## MIT teams:

- ▶ A battery integrated carry-on bag for heavy business travelers,
- ▶ a medicine dispenser with two compartments,
- ▶ remote keyless door opener,
- ▶ a task management system for blind people living with others, rechargeable briefcase, and
- ▶ a rack for storing cans and bottles before taking them in for a refund.

## Portuguese teams:

- ▶ "baby bottle anywhere",
- ▶ a portable device to easily carry bags,
- ▶ solar energy supported baggage,
- ▶ exploitation of solar energy for glacier refrigeration,
- ▶ a cane with sensors for the blind,
- ▶ orange Juicer for children,
- ▶ a social network for elderly people,
- ▶ "Soapy Soap" – a soap with a surprise inside to help parents with kids hygiene.

# Questionnaires Findings:

## Students' ranking of a product's critical success factors

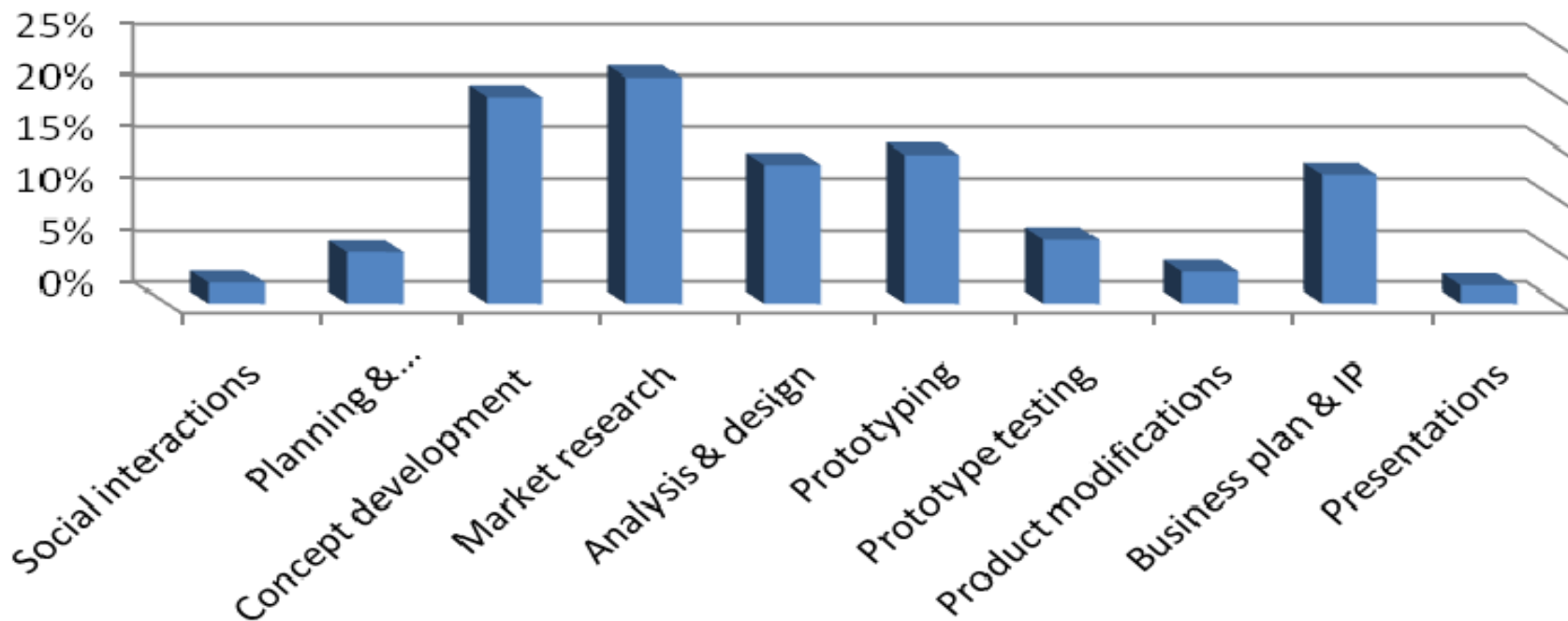
Item	PRE N = 109		POST N = 75	
	Mean	S. D.	Mean	S. D.
The product is easy to use	3.8	1.3	<b>4.3</b>	1.0
The product is attractive	3.2	1.5	3.6	1.2
The product is trendy	2.2	1.3	<b>2.9</b>	1.3
The product is novel	2.7	1.5	3.1	1.5
The product's price seems fair	3.5	1.5	<b>4.0</b>	1.1
The product is portable	2.2	1.4	<b>2.8</b>	1.4
The product fulfills its intended function	4.6	0.9	4.6	0.9
The product fulfills a critical customer need	4.3	1.3	4.5	1.0

- ❖ The score of the post is consistently higher than that of the pre.
- ❖ The highest ranking items in both the pre and the post are fulfillment of (1) the product's intended function and (2) critical customer need.
- ❖ Trend, portability, fair price, and ease of use increased the most due to the fact that in the post-questionnaire, the students had to relate these factors to the product they had developed in the PDD course.

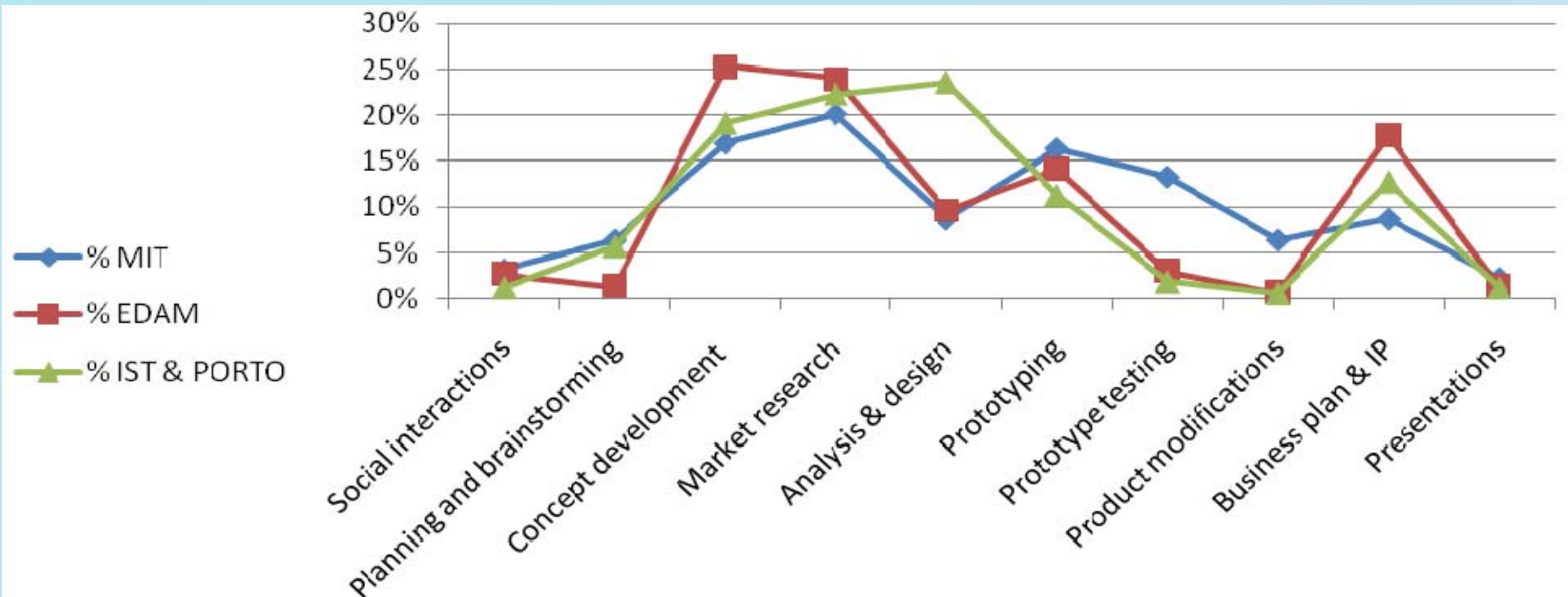
# Questionnaires Findings:

Number and distribution of product development items listed by students in the post questionnaire

Research Group	N Items	N Students	Items/Student
MIT	218	26	8.38
EDAM	146	17	8.59
IST & PORTO	157	21	7.48
<b>Total</b>	<b>521</b>	<b>64</b>	<b>8.14</b>



# Questionnaires Findings: Distribution of product development categories in the post questionnaire by research group



Overall the pattern is similar, but there are some interesting differences:

- ❖ MIT students were more inclined to handle later product lifecycle phases, such as prototyping, prototype testing and modification, than their Portuguese peers.
- ❖ Edam students were more focused on early stages of concept development and market research, as well as later stages of business plan and IP. Analysis & Design was highest for IST & Porto students.

# Students' Perceptions: Pros and Cons

## MIT teams:

*"I think that project-based is the best way to learn in PDD class as it leads students to think on how to apply the knowledge in the project. Lecture-only approach will not be beneficial if we don't have to work on any project in class."*

*"There was a huge learning curve that took a lot time for the project... [We] wanted to learn material better, but [were] focused too much on project."*

## Portuguese teams:

*"The intensive lectures are a good opportunity to develop our skills to plan, organize and study the materials before the lessons... I can be more effective and focused in my work... The students need to express their thoughts more effectively, perhaps with more visual thinking. The role of concurrent development of the projects (or thesis) is an excellent way to learn new knowledge (project based learning)..."*

*"In some cases, limited time didn't enable full discussion of subjects during classes. Homework and assignments scheduling during lecturing periods must be properly coordinated between different courses in order to enable students to properly carry out such tasks."*

# Portuguese Faculty Insights

- "I think that the one intense week has the advantage of the students being completely concentrated in the program, and not disperse with their company problems. The fact that they are away from their job place is also very important for their success in the program. This is not common in the Portuguese system... but after a period students will find great advantages in this system..."*
- "...the main advantage is the bridge between industry and university. ... It is difficult for the students from the industry to get all the assignments on time. PhD students are more invested in the learning but they [the professors] try to combine them [full time students with those who have jobs in industry] together."*
- ▶ *"They [faculty] are doing everything as before, but in addition... they also teach PDD in collaboration with other faculty because it is [an] interdisciplinary program and requires more expertise. The load is much higher for EDAM than for a regular program but they aren't getting extra salary or credit for teaching in the program. They also can't get time for research."*

# Summary

- ❖ This study assessed the PDD course within the MIT–Portugal Program.
- ❖ **The findings indicate that the PDD course has a positive impact on the students.**
- ❖ The project–based learning approach that follows the MIT PDD course example has been instrumental in successfully incorporating hands–on activities into the formerly teacher–centered Portuguese approach.
- ❖ **In a focus group session with the EDAM students, they were appreciative of the program and the efforts made by the faculty to provide an excellent experience.**
- ❖ However, both the students and the faculty noted that the workload during the teaching weeks is heavy and intensive, especially for the students who continue working in the industry during their study, and for the faculty who teaches additional more traditional courses.