11th International Week
3rd ATHENA International Week

Role Playing and its Effects in a First Semester Computer Programming Course

Nikolaos (Nikos) Spanoudakis, Evangelia (Lia) Krassadaki
School of Production Engineering and Management,
Technical University of Crete

Outline

- Problem Statement
- Background
- Methodological Approach
- Experiment – Participants
- Results

Problem statement - Programming courses in Non-Computer Science Curriculum (1)

- Computing courses are characterized by complexity and difficulty for many reasons (Byrne and Lyons, 2001)
- Complexity of modern software
  - tools and libraries
  - virtual environments
  - deployment
- Leads to transition of practice
  - from individual programming
  - to team-based software development

Problem statement - Programming courses in Non-Computer Science Curriculum (2)

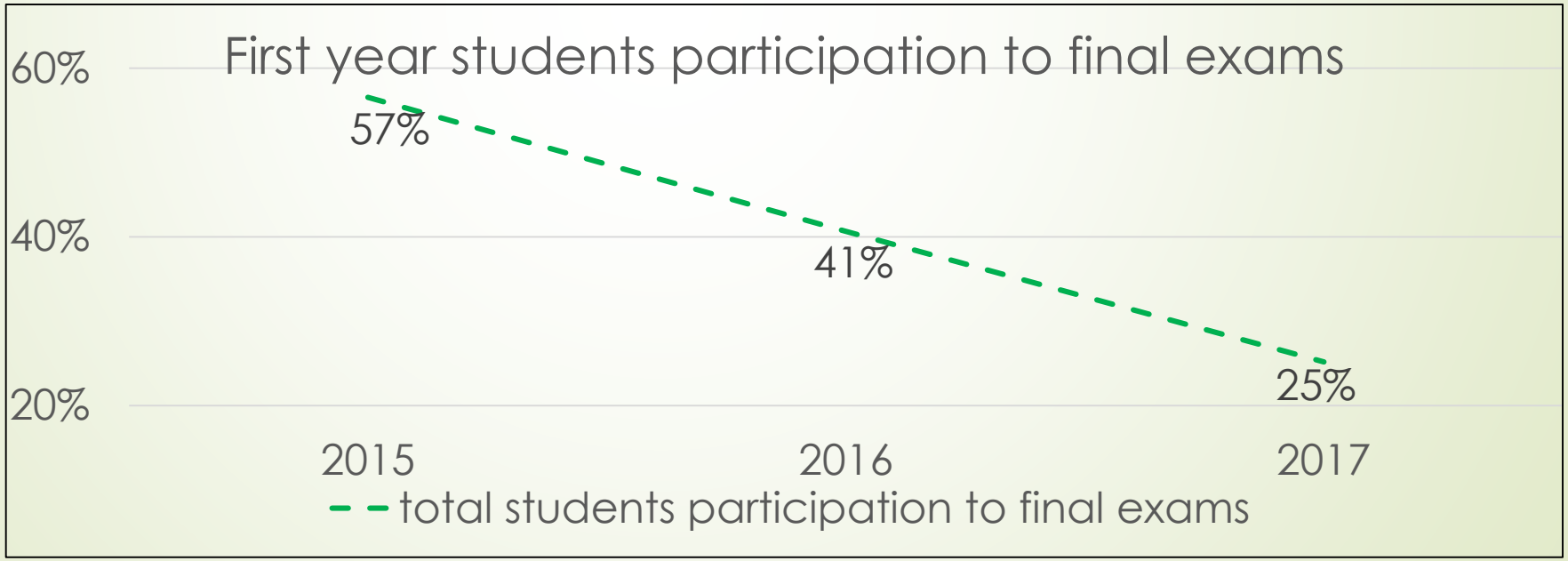
- Students require time and patience to
- Understand the theoretical concepts
  - Language Grammar and syntax
  - Programming styles and methods
- Relate them to (Stoilescu and Egodawatte, 2010)
  - User requirements
  - Software frameworks and target machines
  - Their field of study
- The time frame of the 13 weeks is insufficient (Jenkins, 2002)

Problem statement - Programming courses in Non-Computer Science Curriculum (3)

- Females face more problems
  - They have to overcome fears and stereotypes
- Although most countries have more women than men enrolled in tertiary education
  - Females who choose STEM fields are 15-26% (Chavatzia, 2017; National Girls Collaborative Project, 2023)
  - This is identified in the employment sector as the "gender gap" (Kahn and Ginther, 2017; Barros et al., 2018; García-Peñalvo et al., 2022)

Problem statement - Current situation in TUC

- 2 hours of lectures and 3 of lab sessions per week
- Low participation of first year students in the final exams



Background

- Group project (Palmer and Hall, 2011)
- Role-playing (Vilas Arias and Solla, 2012)
- Combination is inline with Modern team-based software development
  - Strengthens the soft skills of
    - team-working, cooperation
    - preparation of a written report
    - public oral presentation
  - Helps for active engagement of adults/students

(Kokkos and Lionarakis, 1998; Rogers, 2010)

We adopted both

- With original elements
  - Capture the situation before the experiment
  - Interpret qualitative elements of the process
  - Give feedback to the tutor
- Aiming to
  - Engage and motivate the students
  - Show the relationship to their specialization
  - Enhance learning

Methodological Approach

1st Phase: Analysis

- Current situation analysis

2nd Phase: Role Playing

- Role assignment
- Role-play
- Analysis of the survey

3rd Phase: Feedback

- Classification of the pilot application characteristics

Role Playing Experiment – Participants (1)

- Experiment setup
  - At the start of the course the students were given the task to form teams with the following roles:
    - Coordinator
    - Analyst
    - Programmer A
    - Programmer B
    - Tester

The talk in the cafeteria that week was about role selection!
First year students met each other and formed teams

Role Playing Experiment – Participants (2)

- Experiment setup (cont.)
  - Then each team was given a CRM related project and they had to deliver
    - Software
    - Report
      - they were supplied with a template to complete with chapters dedicated to each role
    - Powerpoint presentation of the team achievements
  - Finally, the students were given a questionnaire to complete

Role Playing Experiment – Participants (3)

- Experiment participation
  - 169 students were admitted
  - 50,9% (86/169) of the students participated in the group projects
  - 18 groups were formed
  - 71.4% (20/28) of the females participated in groups
  - 76.7% (66/86) of the students completed their questionnaires

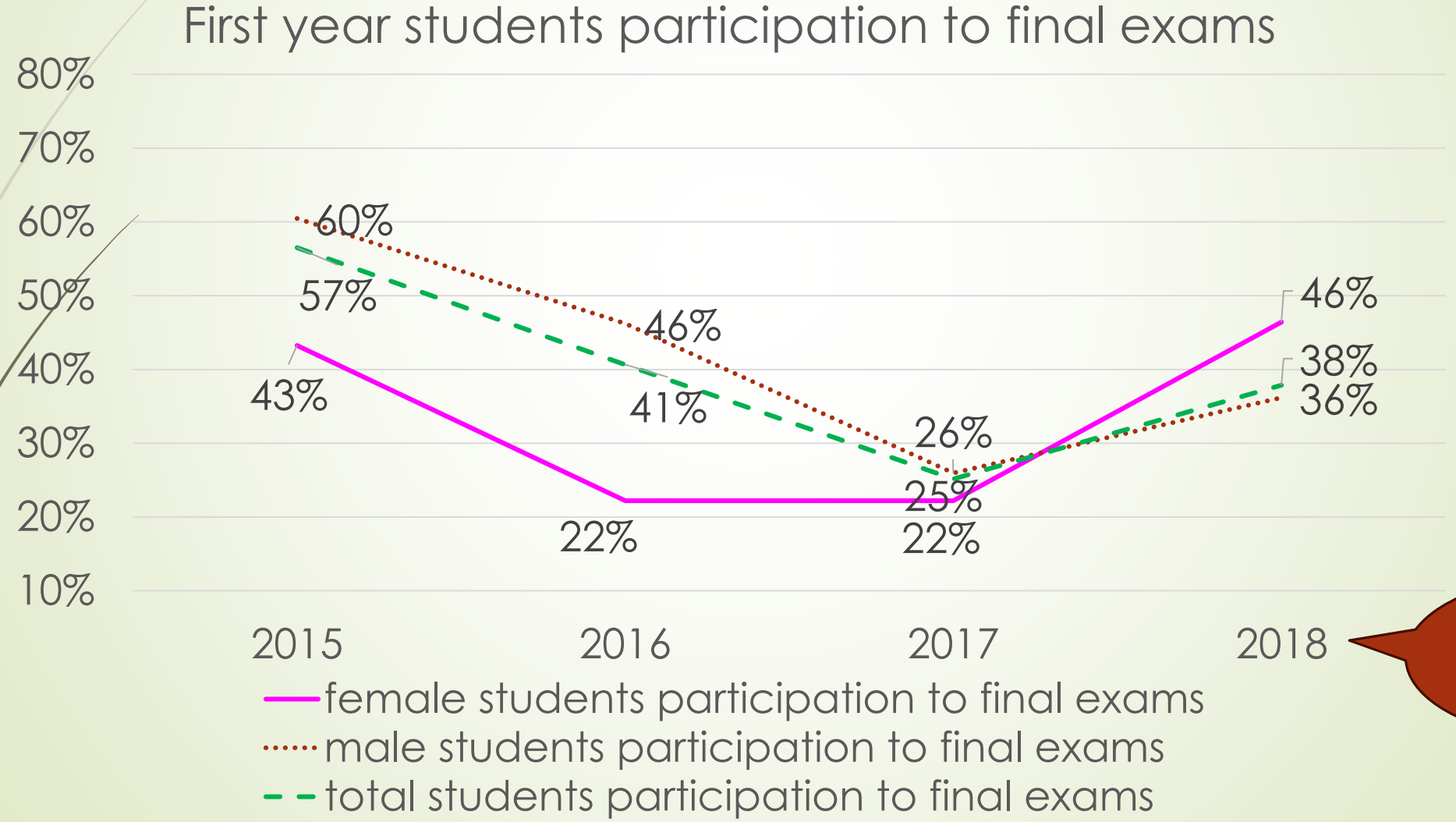
Demographics & Roles
(data from survey)

		f	%
Gender	Male	56	84.8
	Female	10	15.2
Role	Coordinator	14	21.2
	Analyst	13	19.7
	Programmer A'	13	19.7
	Programmer B'	13	19.7
	Tester	13	19.7
Most Valuable Role	Coordinator	22	33.3
	Analyst	7	10.6
	Programmers (A' and B')	31	47
	Tester	6	9
Confidence for future involvement of students on similar programming projects without support or guidance from the instructor	Not at all confident	1	1.5
	Low confidence	8	12.1
	Medium confidence	34	51.5
	Very confident	15	15
	Absolutely confident	8	12.1
Total		66 students	

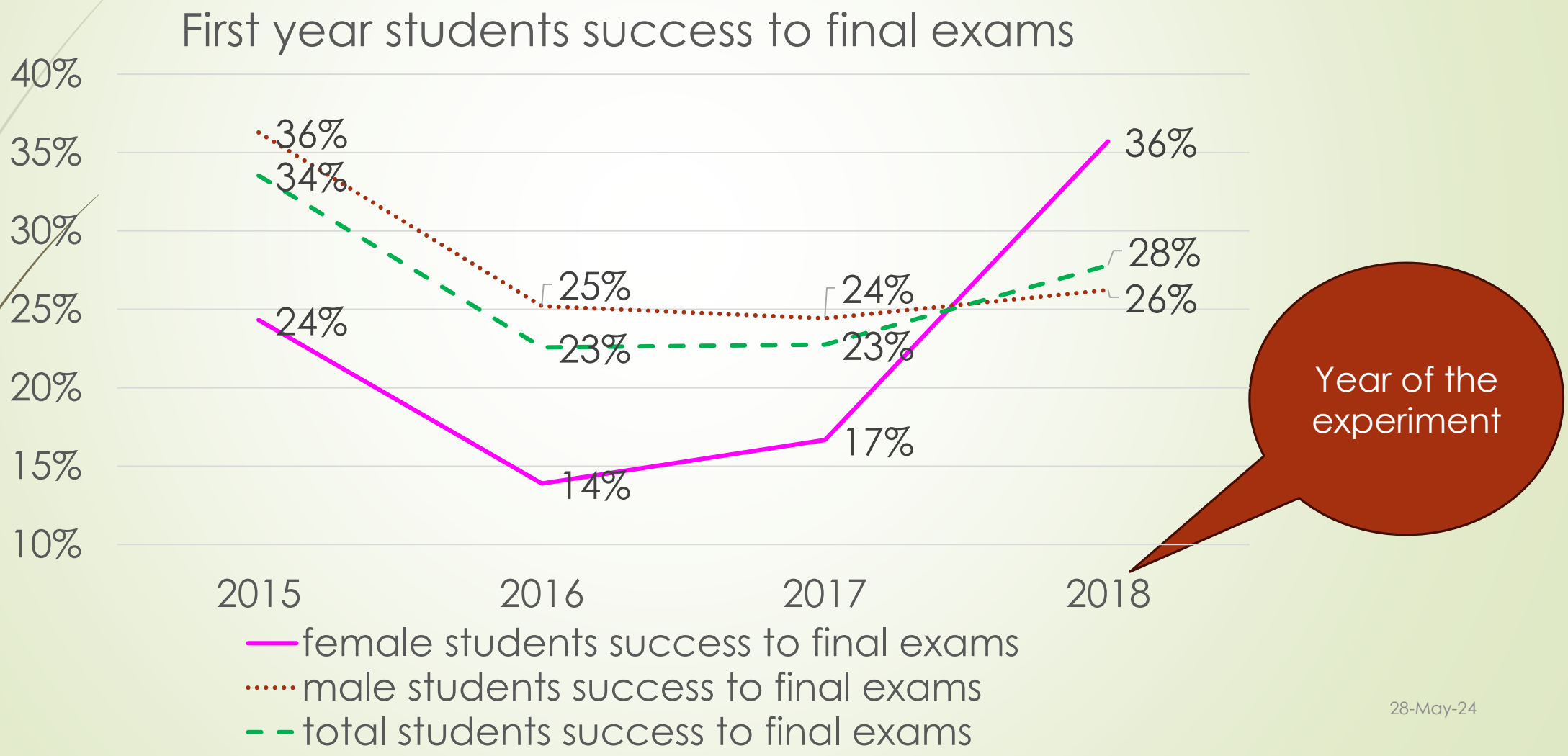
Results – Roles by Gender

		Male	Female	Total
Team Role	Coordinator	10	4	14
	Analyst	10	3	13
	Programmer A	13	0	13
	Programmer B	13	0	13
	Tester	10	3	13
	Total	**56**	**10**	**66**

Results – Participation to final exams



Results – Success to final exams



Results – Significantly related

- The Pearson Chi Square test showed that
  - **Role Playing in combination with Group projects**, and,
  - **Participation in final exams**
- are not independent of each other

		Participation in Role Playing Group Project		
		Yes	**No**	**Total**
Participation in final exams	**Yes**	46	18	**64**
	No	40	65	**105**
	Total	**86**	**83**	**169**

- X^2 (1, N=169) = 18.155, p = .000

Results – Desired, Indifferent and Attractive quality attributes (1)

- Using the Kano model, we analyzed the attributes of the pilot application,
- Specifically, we focused on:

Teaching

- PC operation
- Programming using the C language
- Designing Flowcharts
- Editing Data Flow Diagrams

Tools Usage

- Code::Blocks IDE
- Word
- PowerPoint

Enhancing Soft Skills

- Collaboration
- Written documentation
- Time management
- Problem solving

Kano model attributes classification template

Qualitative scale (Likert scale)

Frequencies. Higher frequency determines classification of attribute

		Low performance of attribute				
		VS	SS	NN	SD	VD
High performance of attribute	VS			A	A	D
	SS	S	S	I	D	E
	NN	R	R/I	I	I	E
	SD	R	R/I	R/I	S	
	VD	R	R	R	S	

VS: Very Satisfied, SS: Somewhat Satisfied, NN: Neither Satisfied Nor Dissatisfied, SD: Somewhat Dissatisfied, VD: Very Dissatisfied, A: Attractive, D: Desired (one-dimensional attribute), I: Indifferent quality, R: Reverse quality, E: Expected or must-be quality, S: Skeptical (re-examine the quality).

Results – Desired, Indifferent and Attractive quality attributes (2)

Teaching

- PC operation
- Programming using the C language
- Designing Flowcharts
- Editing Data Flow Diagrams

Tools Usage

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Enhancing Soft Skills

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Legend

Desired quality characteristics:	The higher the level of fulfilment, the higher the satisfaction level and vice versa
Indifferent quality characteristics:	Neither satisfaction, nor dissatisfaction
Attractive quality characteristics:	Fulfilling these leads to increased satisfaction. Not fulfilling them does not lead to dissatisfaction.

Template for the Written Report (ToC)

Results – Threats to validity

- The possibility that most motivated students selected the team projects
  - However, the participation increased in general
- The possibility that female programmers did not fill in the questionnaire
  - This result is inline with literature findings
    - Low participation of women in computer science or computer engineering or related specialties

Conclusion

Role-playing in combination with group-based project

- Increases engagement of the first-year students to the course

Moreover, using a post-experiment survey we found out that

- Females actively engaged to the course even though they avoided the role of Programmer
- Most course attributes were desirable
- One skill-enhancing attribute was classified as attractive
  - composing written written reports
- One teaching attribute as indifferent
  - Data Flow Diagrams

The tutor decided to substitute them with use cases in following years

Future work

- The covid 19 pandemic prevented us from repeating the experiment in the following academic years
- we plan to rerun it in the coming years
- In the next iteration we plan to employ collaborative tools, such as Trello or Slack (Jackson et al., 2022)
  - track student progress during the semester
  - gain more knowledge on team collaboration and its dynamics

Thank you

Contact us for more information

Nikolaos (Nikos) Spanoudakis
nispanoudakis@tuc.gr

Evangelia (Lia) Krassadaki
ekrasadaki@tuc.gr

School of Production Engineering and Management
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