פיתוח מערכות תוכנה

סיכום

אוהד ברזילי

מה בתוכנית

- כל צוות יסכם את העבודה שלו לאורך הסמסטר ויציג את המוצר הסופי
- מבנה המבחן
- מחקר שנערך על הקורס, עיצובו, מטרותיו והשגתן
- דיון

המבחן

- שעתיים וחצי
- מורכב מ-5 חלקים, 14 שאלות
- משקף את החומר שנלמד בקורס
- כולל שאלות בקיאות וכן שאלות של השלכה ויישום

- דומה מאוד למבחנים קודמים
  – מופיעים באתר הקורס

- המבחן ללא חומר עזר

Evaluation of a Software Engineering Course by Reflection*

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**In ITiCSE 2009: Proceedings of the 14th annual ACM SIGCSE conference on Innovation and technology in computer science education, pp 273-277, 2009*

Agenda

- Background:
  - Designing an advanced SE course
  - Multidimensional syllabus
- Using reflection
- Reflection as an evaluation tool

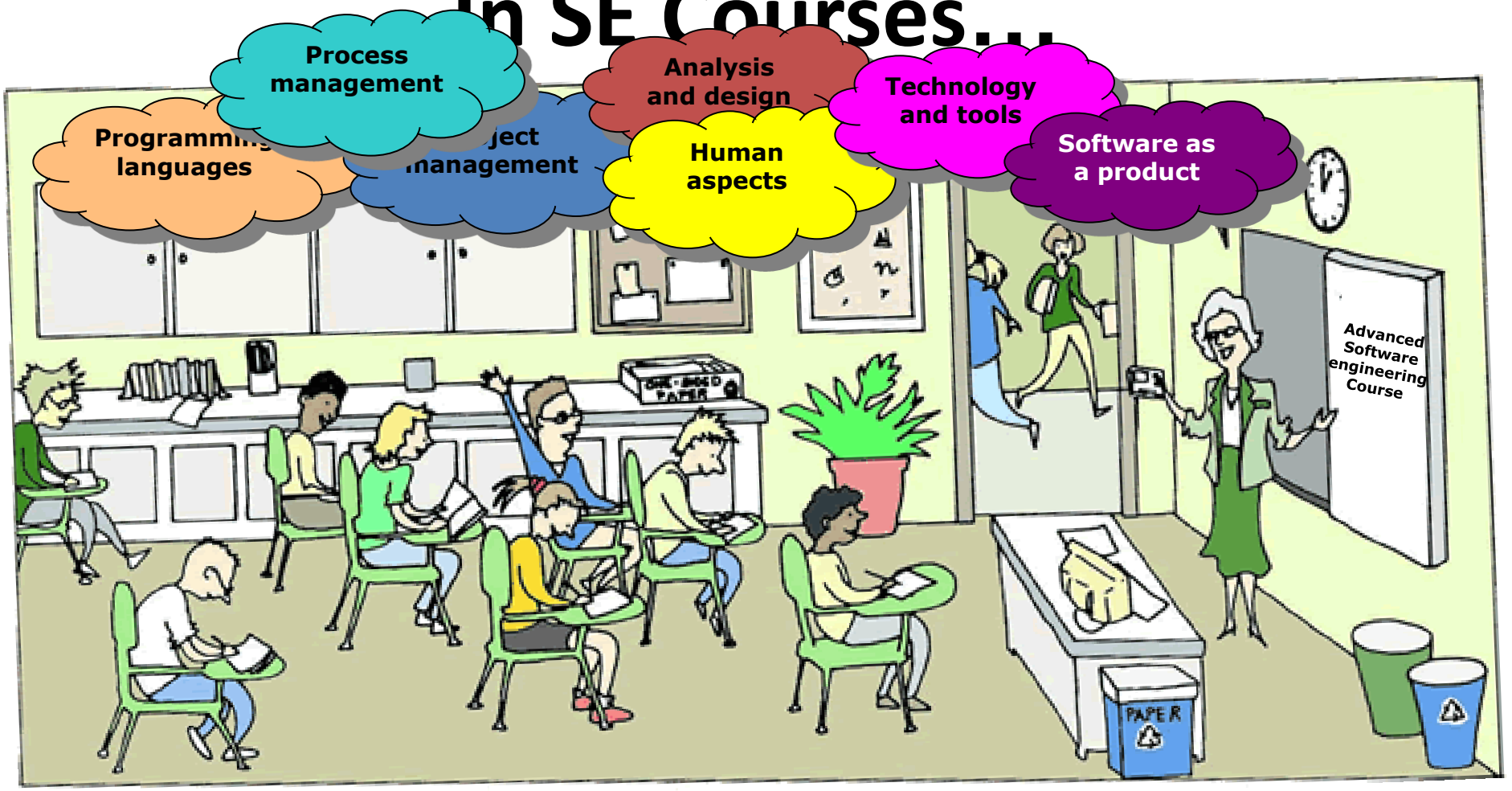
Designing an advanced SE course

- What is an **advanced** SE course?

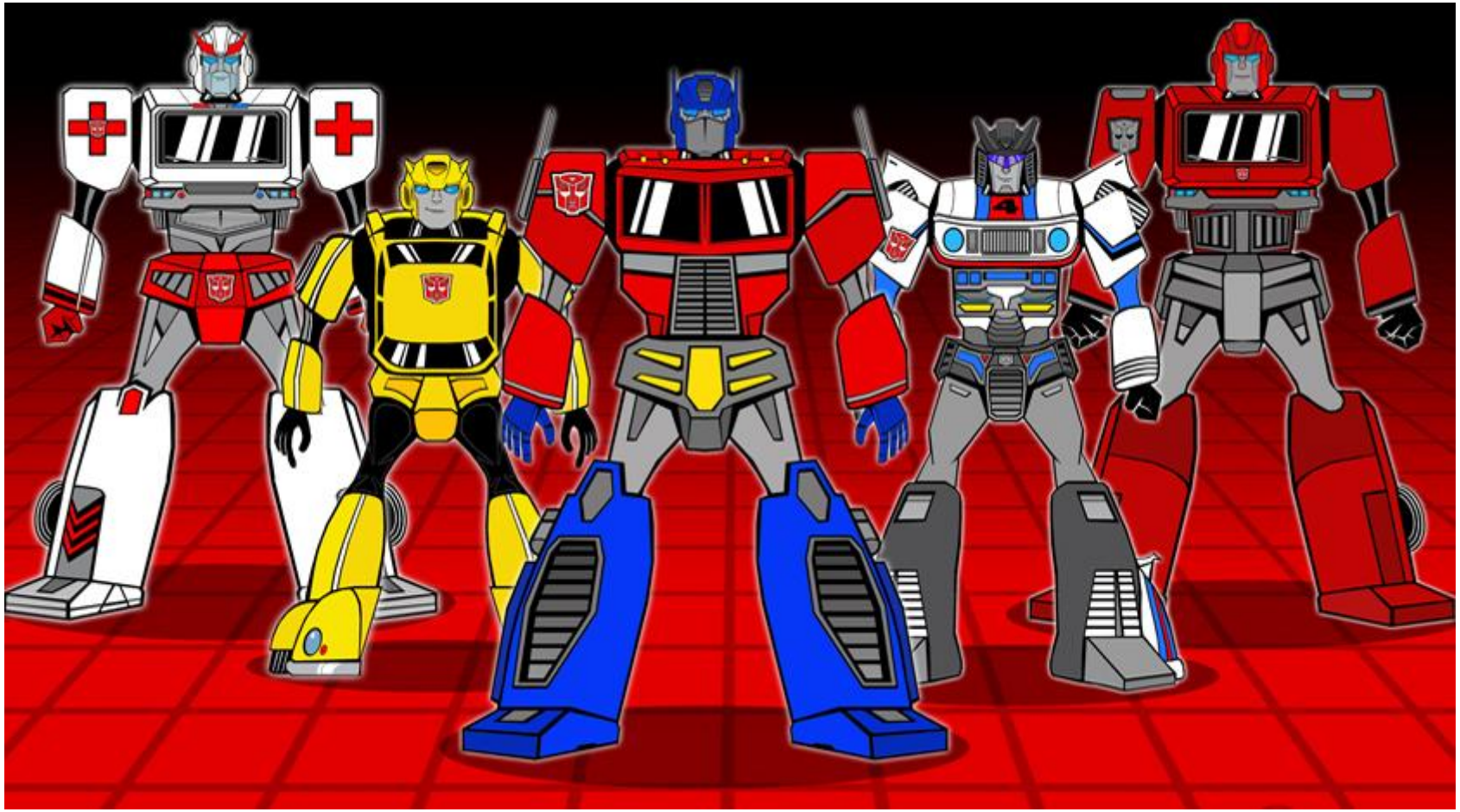
- Many **advanced** SE courses focus on a **specific** aspect of SE:
  - Analysis/design/process management/domain specific Etc.

- We focus on **putting it all together**

In SE Courses…

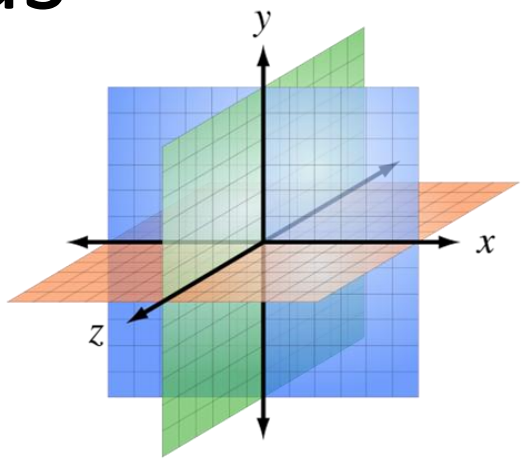


We seek for Holistic Approach



Designing a Multidimensional Syllabus

- 4 educational axes:
  - **Foundations of SE**
  - **Practices and tools**
  - **“Productization”**
  - **Technology evolution**

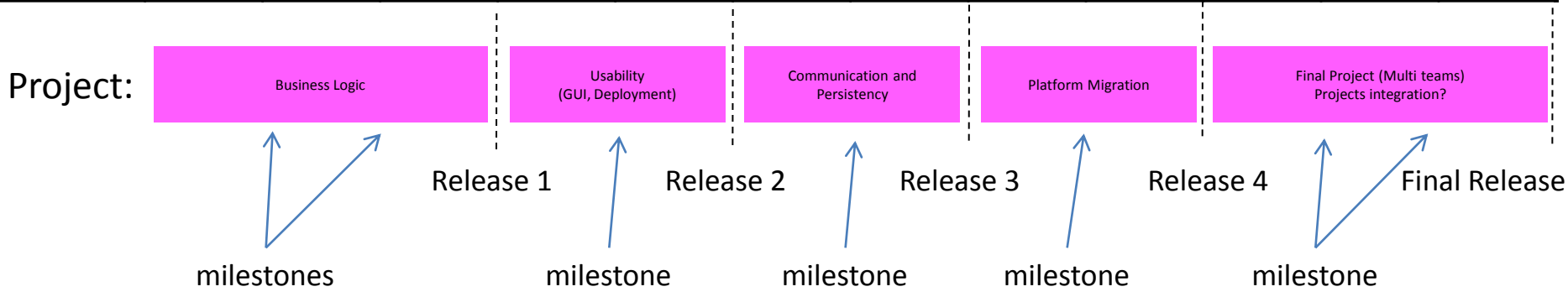


- Working in large teams (6-8 students) along the semester, using Agile methodology
- Lots of self learning
- Frequent deliveries, status reports, iteration planning, constant “client” feedback

- ***A Multidimensional Software Engineering Course***
  Barzilay, Hazzan, Yehudai. IEEE Journal of *Transactions on Education, 2009*

Course Outline

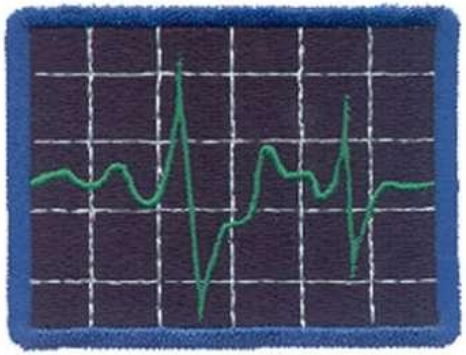
Week	1	2	3	4	5	6	7	8	9	10	11	12
Foundations of SE	Introduction	Classic Texts			Standards	Programmers in the Movies		Principles			Domain intersections	Industry Guest Talk
Practices and Tools	XP1: TDD, Refactoring	XP2: CVS, Planning game	XP3: The Team						Training			Frameworks, tools and languages
Productization			Distribution and Deployment	MVC		Crosscutting Concerns	Configuration		Platform	Reverse Engineering	Ease of Use	
Technology Evolution			Enabling Technologies: Eclipse	Concurrency	Networking and Communication	Persistency	Enabling Technologies: XML	Web Programming		Enabling Technologies: Spring		



- שיעור ראשון - מבוא ל- eXtreme Programming ותכנות מונחה בדיקות
- שיעור שני - SVN,תכנון פרוייקט
- שיעור שלישי - הבטי תקשורת, מדדים, רפלקציה, מבנה צוות XP
- שיעור רביעי - מבוא לארכיטקטורת תוכנה: חתכי רוחב והוספת כח אדם לפרוייקט מאחר
- שיעור חמישי - הזרקת תלויות ושיבוץ דוגמאות
- שיעור שישי - מסדי נתונים, מתכנתים בהוליווד
- שיעור שביעי - תקנים: שימושי XML, תקנים לפיתוח תוכנה
- שיעור שמיני - יישומי אינטרנט (חלק א')
- שיעור תשיעי - יישומי אינטרנט (חלק ב')
- שיעור עשירי - מקביליות, תצורה
- שיעור אחד עשר - פלטפורמות התקנה והפצת תוכנה
- שיעור שניים עשר - סלולר, הרצאת אורח: גיל מגידיש
- שיעור שלושה עשר - גלגולם של רעיונות טובים, הרצאת אורח: יורם יעקובי
- שיעור ארבעה עשר - הצגת פרוייקטים וסיכום

Challenges

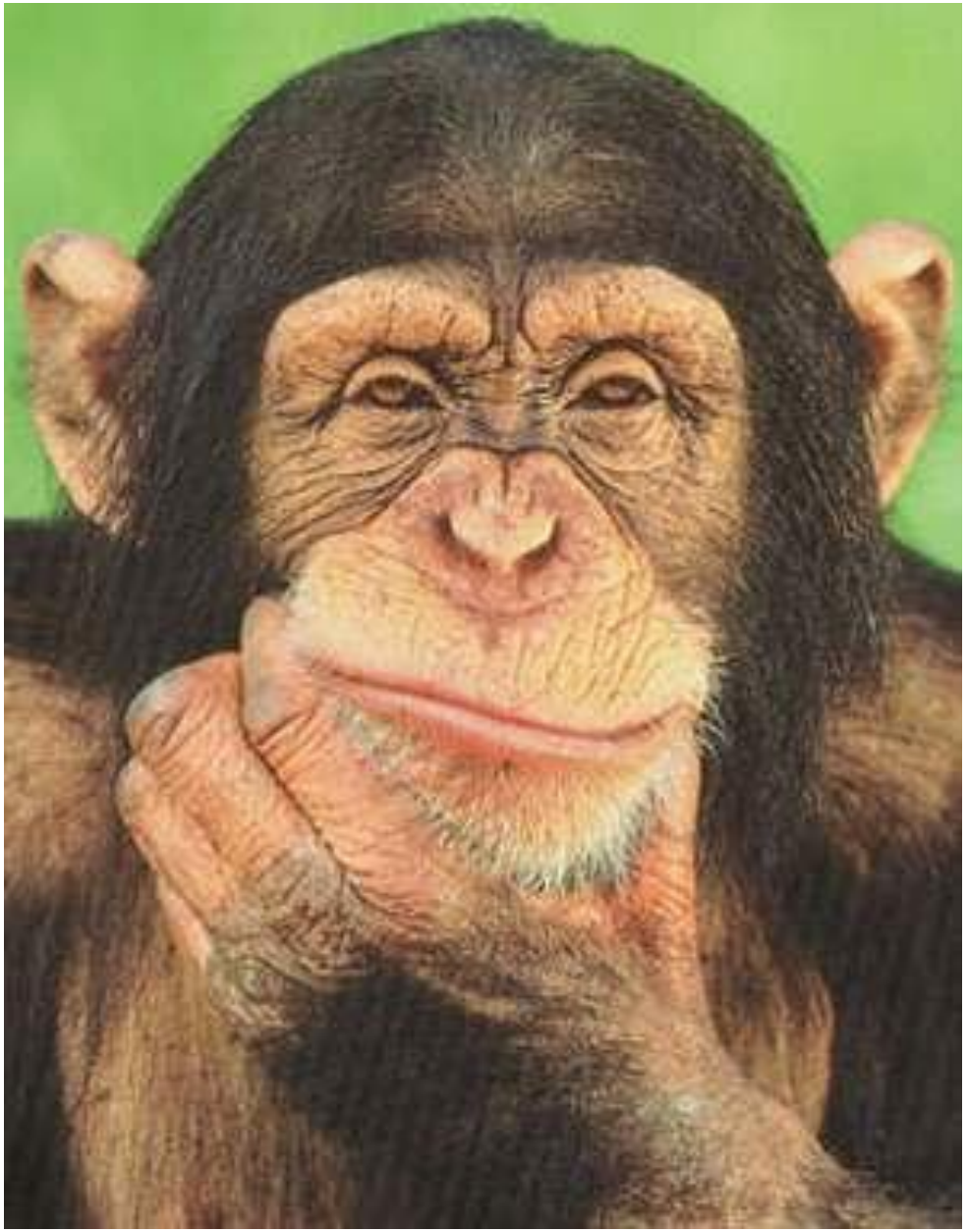
- What about ***less is more***?
- Balancing technical and methodological content
- How to monitor goal accomplishment?



Learning outcomes

- **E**xpose students to the **multidimensional nature of SE**
- **E**stablish effective and **manageable team work**
- **E**nhance students' understanding of the **rationale** of building **software tools** and using certain technologies
- **E**ducate students for **effective learning** and for **self-learning**
- **E**nable students to gain additional programming experience while **addressing the different axes**

- Applying the **reflective practitioner** perspective
  - Rethink and examine professional creations during and after the accomplishment of the creation process [Schön, 1983,1987]
  - SEE Adaptation [Hazzan, 2002]
- Students
  - Exploiting course iterative structure
  - Elicit awareness for SE dimensions
- Educators
  - Feedback and monitoring



Reflection Questionnaires

Week #	Question
3	What is your **primary insight** after the first 2 weeks of the course?
5	Was your work in the current iteration **influenced by insights** you had during the course? Please explain how and why.
7	○ Did you **change** your perception about SE following the first half of the course? To what extent? How? ○ Did the first half of the course contribute to **establishing already-existing perceptions** you had regarding SE? To what extent? How? ○ Did the first half of the course affect your perception about things that are **not necessarily related to SE**? To what extent? How?
9	○ What are the three main **characteristics** of your software development project so far? ○ Describe **problems** that appeared in the project so far and suggest ways to overcome them in the next iteration.
11	Describe in a few sentences the **3 most important things** you learned during the course.

Reflection vs. Feedback

- **Feedback**
  - The student is asked to evaluate and criticize
  - Addresses the course, the teacher, the material and their quality

- **Reflection**
  - The student is asked to look into herself
  - Focuses on the students' perspective: what she has learned, her insights and perception regarding her own personal experience, and more.

- Using reflection for monitoring and feedback
  - Reveals exposure, awareness, influential aspects

Data Analysis (cont)

- Here, we focus on the 5th reflection assignment:

  Describe in a few sentences the **3 most important things** you learned during the course

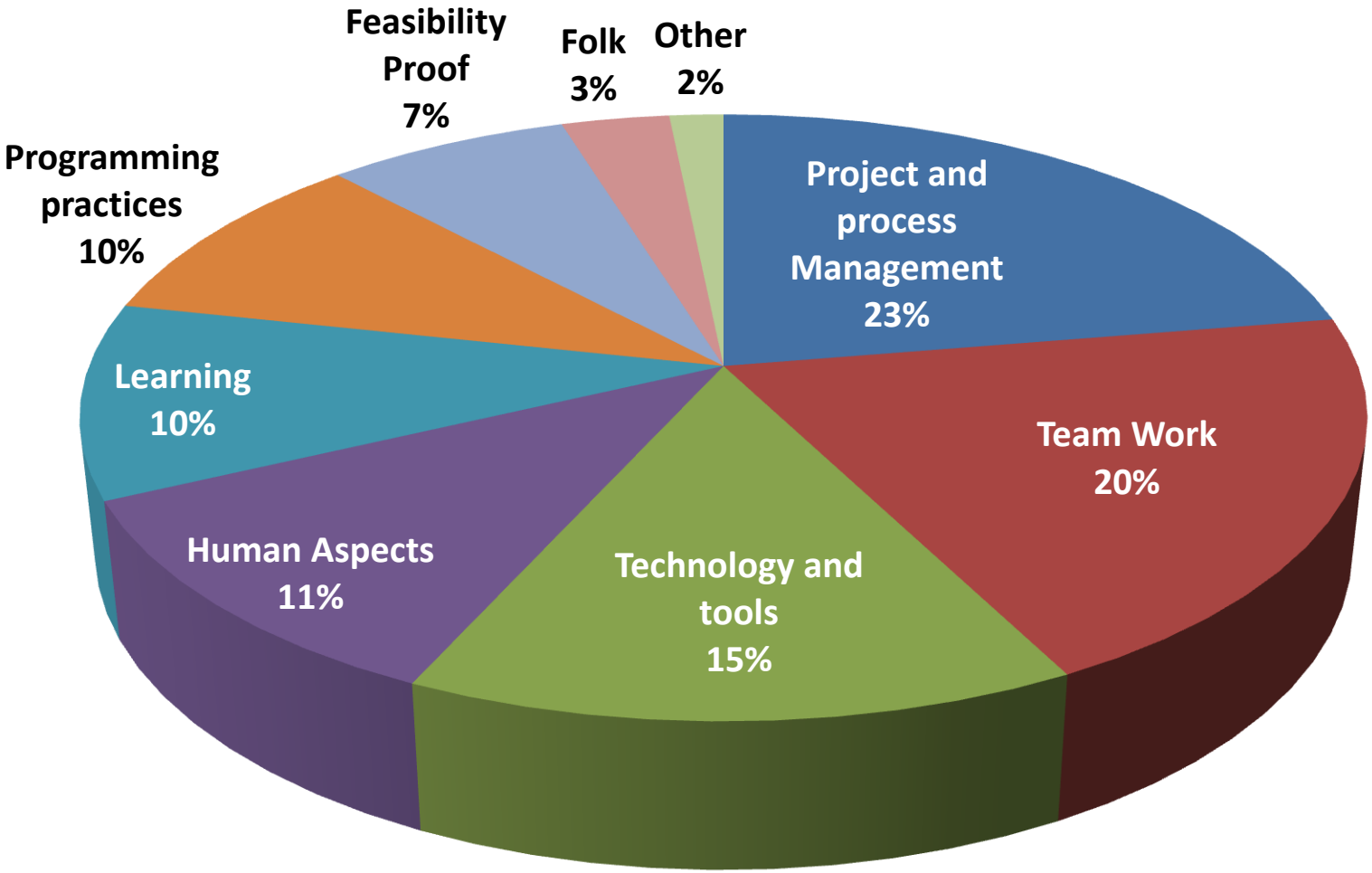
- Data was analyzed:
  - Bottom-up: investigate actual awareness (field grounded)
  - Top-down: investigate how is the course agenda reflected in students assertions

Data Analysis

- 5-step iterative process:
  1. Questionnaires were **read** and input into a large matrix (5x34)
  2. All questionnaires were **conceptualized** (summarized in one sentence)
  3. Each of the sentences was **tagged** using 1-3 words.
  4. Tags **were reviewed for similarities**
     - Merging , introducing new tags, verifying
  5. Repeat (4) at a higher level of **abstraction** to form **trees of tags**

Results

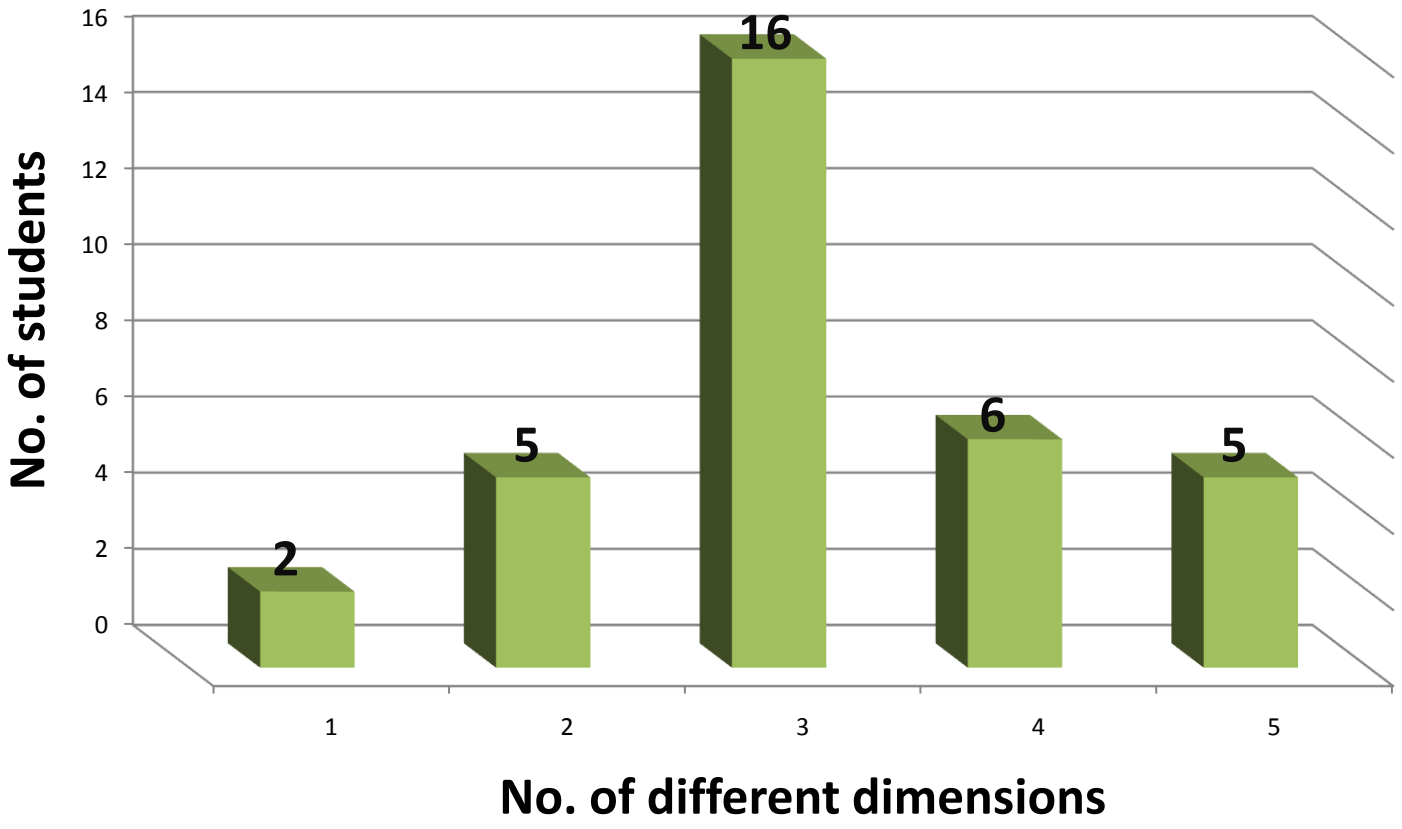
Top-level categories in students' reflections



Multidimensionality

- "There are many approaches to programming, not necessarily [all] with a technological aspect, as I had thought till today…"

#students addressed #SE domains



Learning

- 32% of the students

- We **found evidence** for versatile learning processes:
  - learning by doing, trial and error, learning in class, learning from experience, learning by reflecting, online tutorials, and learning in- and among teams

- "[I learned] that a difficult task can be accomplished in a short time and new technologies can be **learned in a relatively very short period of time** without taking an entire course."

- "In the course, we had to implement various methods and technologies with which we weren't familiar beforehand, and had to become familiar with them, **on a satisfactory level**, within two weeks [in order] to **provide working versions**."

Rationale of building software tools and using certain technologies

"I was very surprised to find that working with J nsk. I

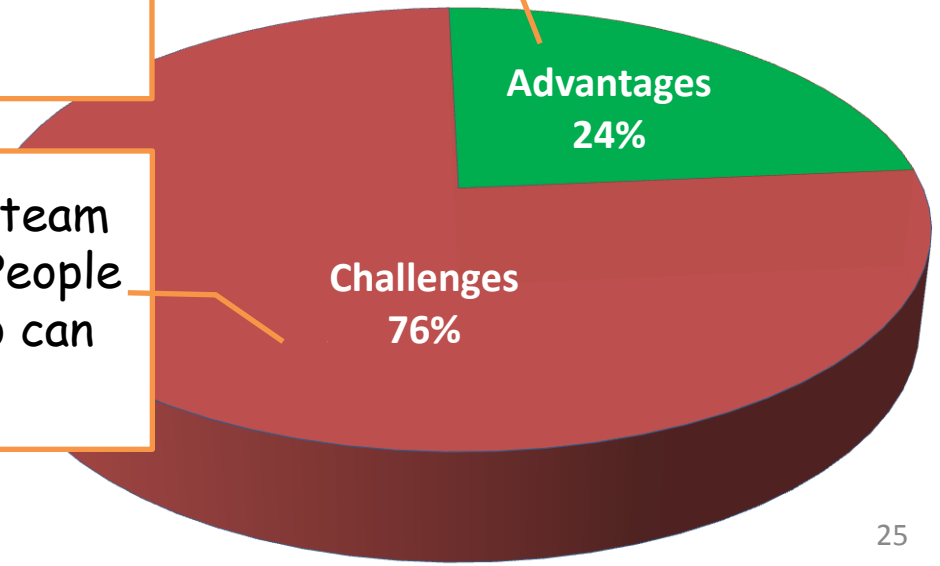
CVS is the most **effective** tool learned in the course. I can't imagine how was it to work without it. We also started using it [in another course] to manage 3 people in 1 week projects.

Reflections on teamwork

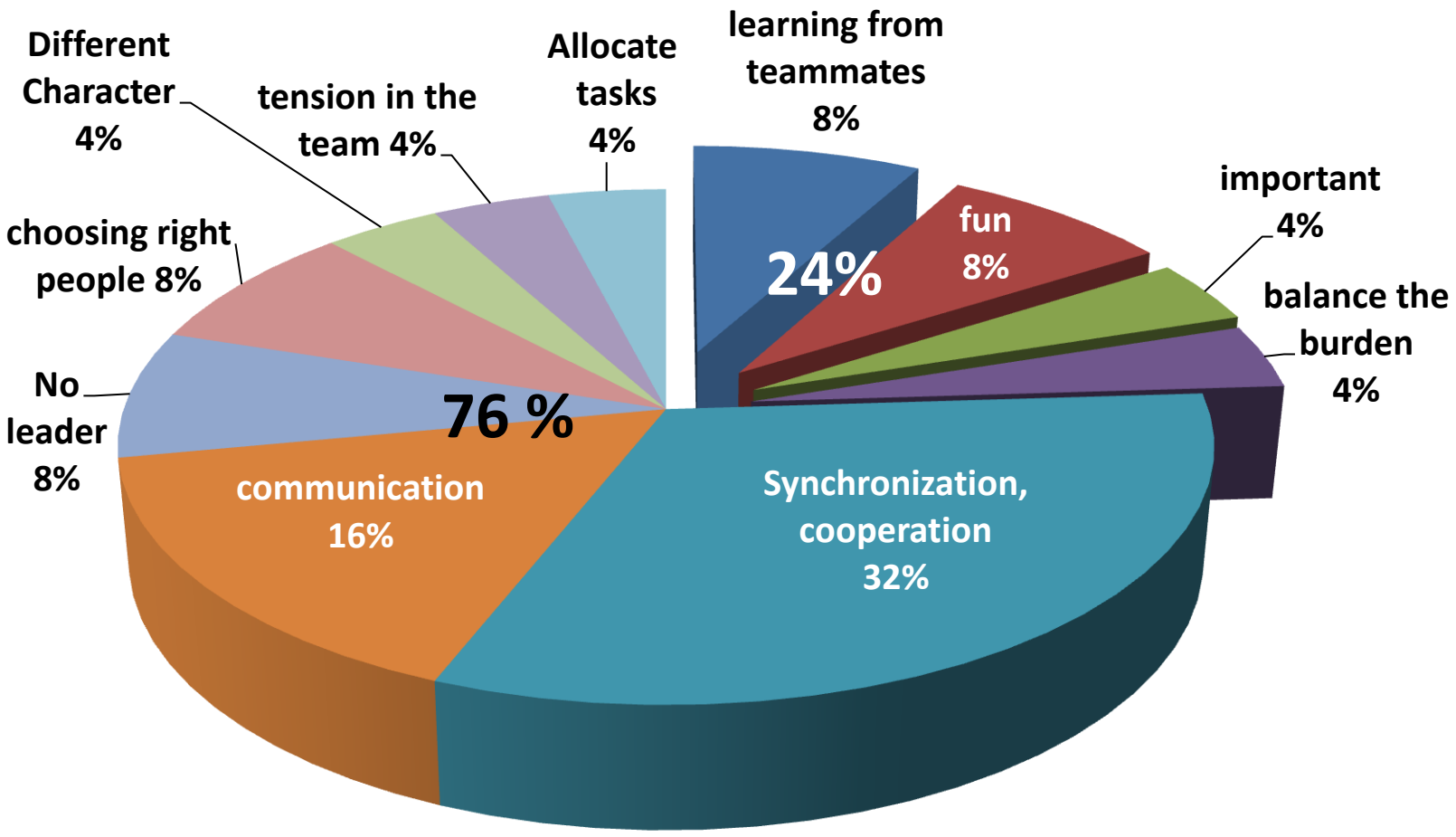
- 68% students mentioned teamwork as one of the 3 most dominant aspects of the course

"Working in teams is fun. I usually prefer to work alone, but I had the greatest fun when I sat together with my teammates – the more the merrier."

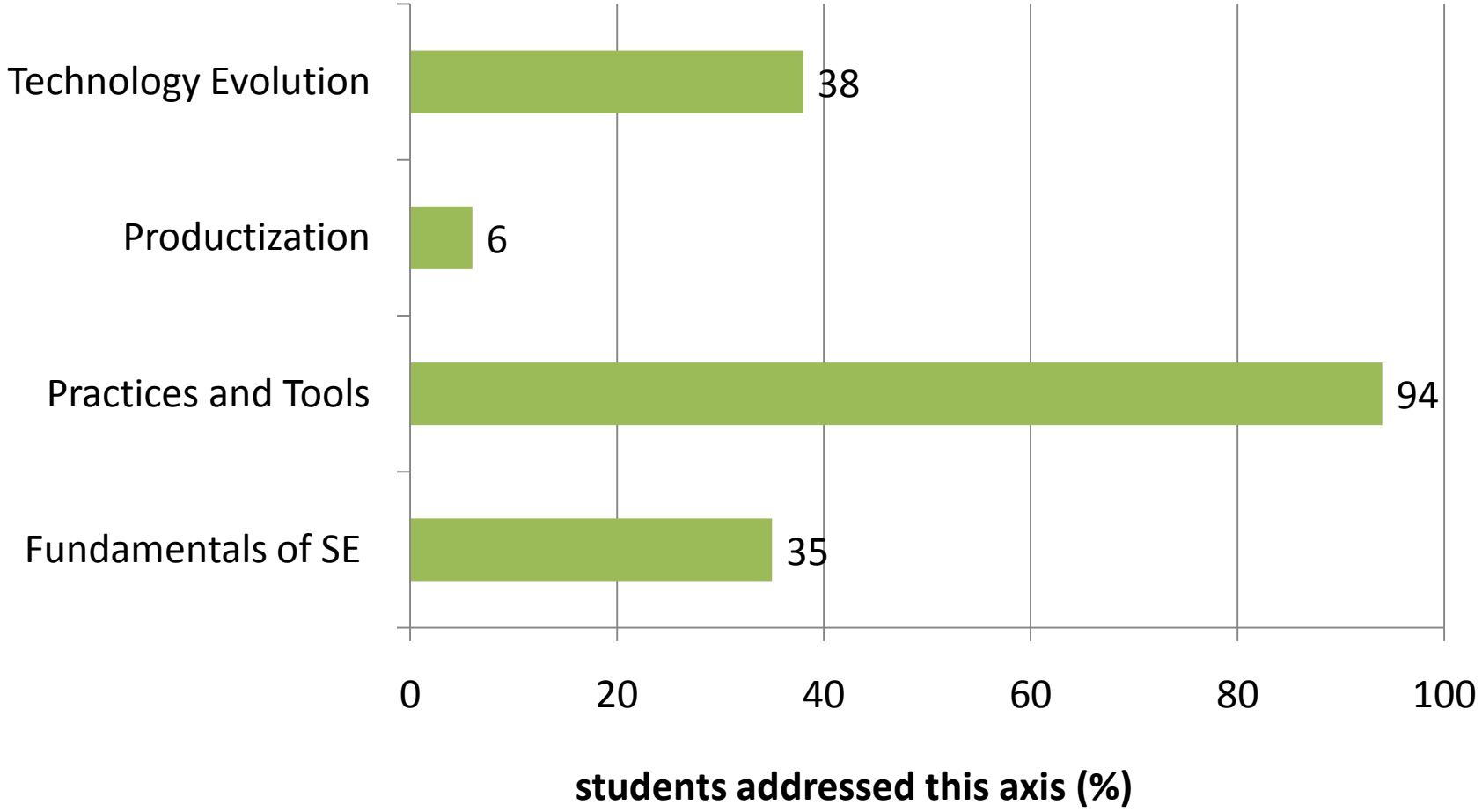
"[I] learned how to work without a team leader. Not a pleasant experience. People need guidance [from] someone who can see the larger picture."



Breakdown of Reflections on teamwork



Educational axes in students reflections



Future Work

- Analyze students' reflections from a **timeline perspective**
  - Examining whether or not the reflections represent **change** in students' conception throughout the course

- Investigate students' reflections on a **team level**
  - Addressing similarities as well as differences between teammates and between teams.

Summary

- Use Multidimensional syllabus – it works!

- Encourage students to reflect
  - They would benefit from it
  - You could also use it as an evaluation tool

Thank You

Discussion and questions

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