

# Teaching Strategies

## 1. Simulation-based and Game-based learning

Common struggles students usually encounter during learning some advanced subjects are that

- the contents are too complex for them to imagine and comprehend.
- they lack experience to appreciate the importance of the topics.
- the topics are too far-reaching from their life to relate to.

Two approaches which aim to address these problems are

- **Simulation-based learning** where the students participate in a controlled setting that abstracts out the less important details of the real-world situation, leaving only the key things for students to learn.
- **Game-based learning** where games are used to help students visualize what they may encounter and how they would act while enjoy the fun during the game.

Many CPE courses have incorporated simulations and games in the class to help students learn the complex concepts during the class. For instance,

### **Software Engineering**

In 2006, the building a house game was used to introduce the concept of software engineering, the problems that the topics try to address, and the importance of the resolution. (The feedback was highly positive and motivating. The impact is also long-lasting. Recently, the instructor of that course—Dr. Suradet Jitprapaikulsarn—had an opportunity to ask two former students from that class for their opinions on his teaching and something they can remember from his teaching. Both former students talked about the games that they played during the class six years earlier.)

The positive feedback led to incorporate more games and activities for this and other classes. Many games and activities are used during a workshop on Personal Software Process taught by the instructors. The building a house game is now used at many universities such as Chiang Mai University, Payao University, Burapha University, King Mongkut's University of Technology North Bangkok (KMUTNB), and the Asian Institute of Technology (AIT).

The table below shows the games and simulations used in the 2012 software engineering course.

**Table Error! No text of specified style in document.–1 Games and simulations in 2012 software engineering class**

<b>Topics</b>	<b>Game or Simulation</b>
Overall software engineering concept	- Building a house
Software processes: waterfall, spiral, iterative, incremental, agile, Kanban	- Building paper planes - SimSE game
Software estimation	- What's in the box? - How high is it? - How big is it?
Software measurement	- What's in the box?
Project management	- Cooking game - Planning card - Scrum in 40 minutes
Requirements	- 20-question game - What is the word?
Designing	- Dominos - Jenga
Construction	- Lego
Verification	- Finding the orange ping pong ball - How to test a noodle dish?
Maintenance	- Jenga

### **Algorithm Analysis and Design**

Since 2008, students have brought a stack of cards into the class to practice an algorithm by hand and learn about the complexity of the algorithms [Exhibit 2.4(3) Algorithm Analysis and Design Syllabus]. For instance, students manually rearranged 64 cards using bubble sort, insertion sort, selection sort, shell sort, merge sort, heap sort, quick sort, and so on. They also practiced various searching strategies using these cards; for instance, linear search, shuffle search, binary search, and so on.

### **Data Communication and Computer Networks**

Since 2007, students wrote programs to simulate many concepts in data communication such as data encoding, bit ordering (Big-endian and Little-endian), line coding, and implementing some network protocols.

## **2. Research-based and Project-based learning**

The University has a vision to be a research-based university by 2017, which encourages academic staff and students to learn through doing research and experience. Consistent with the orientation of the university, the Department of Electrical and Computer Engineering, specifically the Computer Engineering program employs a teaching and learning strategy which is characterized predominantly by project-based learning while incorporating researching activities. The projects are in the forms of assignments and term projects. This strategy enables students to explore prior knowledge, analyzing and integrating the knowledge through doing research and creating or applying innovations through assignments and projects in each course.

The weight of assignments and projects in computer engineering courses are usually equal or greater than their lecture and theory counterparts

Using this learning strategy earlier in the course, students are taught theory and materials adequately for them to do their research and projects. Then, they are given project instructions and specifications, and by the end of the course they have to deliver their projects or research results. The senior project in their fourth year enables the students to integrate bodies of knowledge, both prior knowledge from courses taken earlier and unexplored knowledge which they have to research in the final year.

### **3. Laboratory-based learning**

To support project-based learning, the academic staff also employ laboratory-based learning, which enables students to learn and gain experience by doing. In this approach, students are taught both in lecture styles and laboratory styles. Students are encouraged to learn, individually and collaboratively, to construct deliverables, such as pieces of programs or electronic artifacts in either laboratory settings or taken home as their assignments under the guidance of academic staff. The laboratory-based approach is closely related to the project-based approach which usually takes place in the same course.

### **4. Internship**

Related to the above approaches is the students' internship at the end of their third year. Students are required to do their internship during their summer semester between their third and fourth years. This internship enables students to apply the knowledge they acquired during their 3 years of study in real-life situations. This also makes them realize their strengths and weaknesses, so that they can have time in the final year to improve.

### **5. Other Activity**

In addition to formative assessments, peer evaluation, paper writing, and paper presentation, other assessment methods are used to address various aspects of students' understanding.

The curriculum also encourages that for each course speakers specializing in subjects related to the course be invited from other notable institutes or from the industry to share their knowledge and experiences. Not only does this approach widen the students' perspectives, but it also helps the students in establishing a connection with the industry.