

Learning and Teaching *

Jens Lechtenbörger

Computer Structures and Operating Systems 2023

Contents

Introduction

1. Think of something you are really good at
 - Write it down (won't be shared with anyone)
2. Briefly describe how you got to be good at that thing
 - One or two words
3. Submit how you got to be good at Pingo (pingo.coactum.de → 796643)

*This PDF document is an inferior version of an [OER HTML page](#); [free/libre Org mode source repository](#).



(Source of activity: [14])

Learning

Brain \approx Muscle

- Learning involves brain's **long term memory**

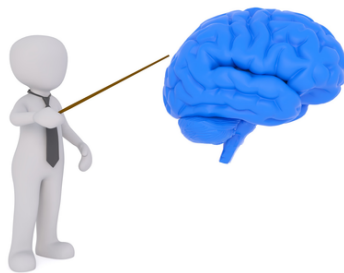


Figure 1: “Teacher explains brain” under CC0 1.0; converted from Pixabay

- Long term memory needs **repeated** retrieval and practice
 - Spaced out **over time**
 - Effect: Changes in brain's **proteins**

- (Learning does **not** happen [solely] in lectures)

Deliberate Practice

Characteristics of **Deliberate Practice** to acquire expert skills ([Eri08], see also [EKT93; 14])

1. Task with **well-defined goal**
2. Individual **motivated** to improve
3. **Feedback** on current performance
4. Ample opportunities for **repetition** and **gradual refinements**

(Traditional lecturing is “teaching by telling”, does not share **any** characteristic of Deliberate Practice)

- First, go through enumeration
- Then, refer back to practice vs talent
 - 10,000 hours to compete internationally in variety of domains
 - 10,000 h / 40h per week / 50 weeks = 5 years
- Finally, “teaching by telling”

Active Learning

- **Active Learning** increases student performance in science, engineering, and mathematics ([Fre+14])
 - Active Learning is an umbrella term for diverse interventions
 - * Group problem-solving
 - * Worksheets or tutorials completed during class
 - * Use of personal response systems with or without peer instruction
 - * Studio or workshop course designs
 - Notice: Above interventions share at least 3 of the 4 characteristics of Deliberate Practice
 - * (Motivation may increase, but ultimately rests with **you**)

Quotes from Experts

- On [Fre+14]
 - Carl Wieman, Nobel Prize in Physics 2001
 - * “A lecture is basically a talking textbook”
 - * In [Wie14]: “However, in undergraduate STEM education, we have the curious situation that, although more effective teaching methods have been overwhelmingly demonstrated, most STEM courses are still taught by lectures—the pedagogical equivalent of bloodletting.”

- Eric Mazur, Harvard physicist
 - * “This is a really important article—the impression I get is that it’s almost unethical to be lecturing if you have this data”
- [SR17]: “Saying Goodbye to Lectures in Medical School—Paradigm Shift or Passing Fad?”
 - “60 slides in 45 minutes may seem like an efficient way to teach, but it is unlikely to be an effective way to learn”

CSOS Approach

Initial Problem and Improvement

- 2016: Classroom response system revealed lack of student understanding
 - Yet, no in-class discussions, leaving me frustrated
 - * Waste of our time
- After introduction of JiTT: Situation improved

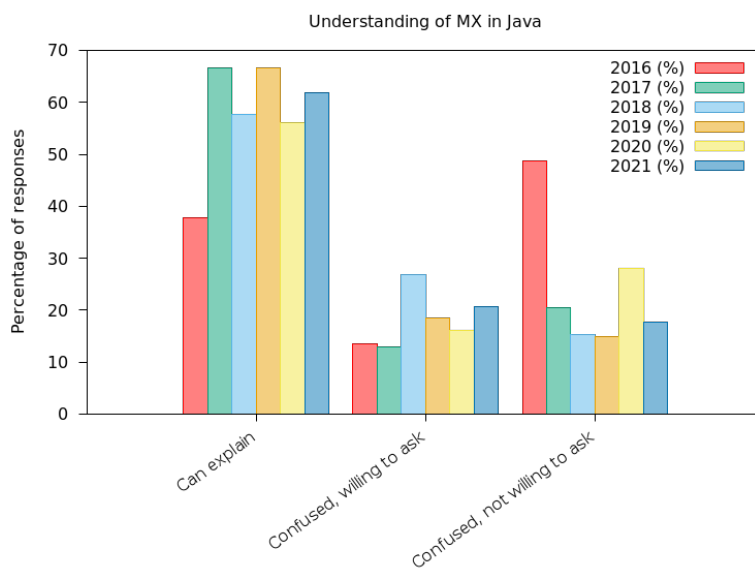


Figure 2: Improved Java MX understanding

General Improvements

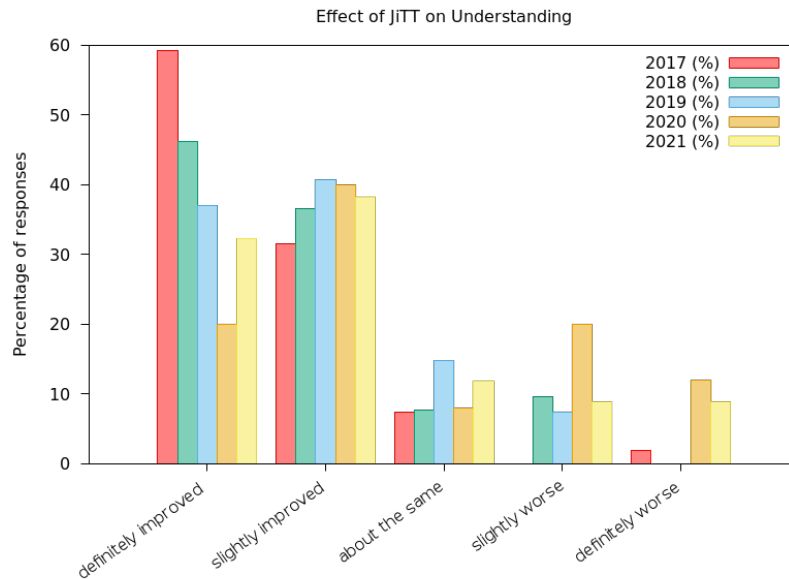


Figure 3: Improved understanding compared with traditional lecturing

CSOS Teaching History

- In 2016, I taught CSOS in its entirety
 - With lots of in-class quizzes of questionable effect, as just explained
- Subsequently, Prof. Dr. Vossen taught CS part, I OS
 - With slightly different flipped classroom approaches
- Since 2021, I'm teaching CSOS again in its entirety
 - Again with different formats for CS and OS
 - * Reuse of CS videos from 2020
 - * HTML presentations such as this one for OS
 - * With evaluation of both formats
 - With uniform use of JiTT quizzes in both parts, explained next

Just-In-Time Teaching (JiTT)

Overview

- JiTT
 - Teaching and learning strategy based on web-based study assignments (self-learning) and active learner classroom

- * See [JiTT on Wikipedia](#)
- * [MSN16] demonstrates improved learning for statistics courses
- Instance of **active** learning, which leads to improved learning in general [Fre+14]
- Instance of flipped/inverted classrooms [LPT00; BV13]
 - * In-class and at-home events flipped
 - * Individual computer-based instruction paired with in-class (group) activities
 - Individual learning shaped by individual background and preferences
 - Lectures to discuss questions and work on exercises

Feedback Cycles with JiTT

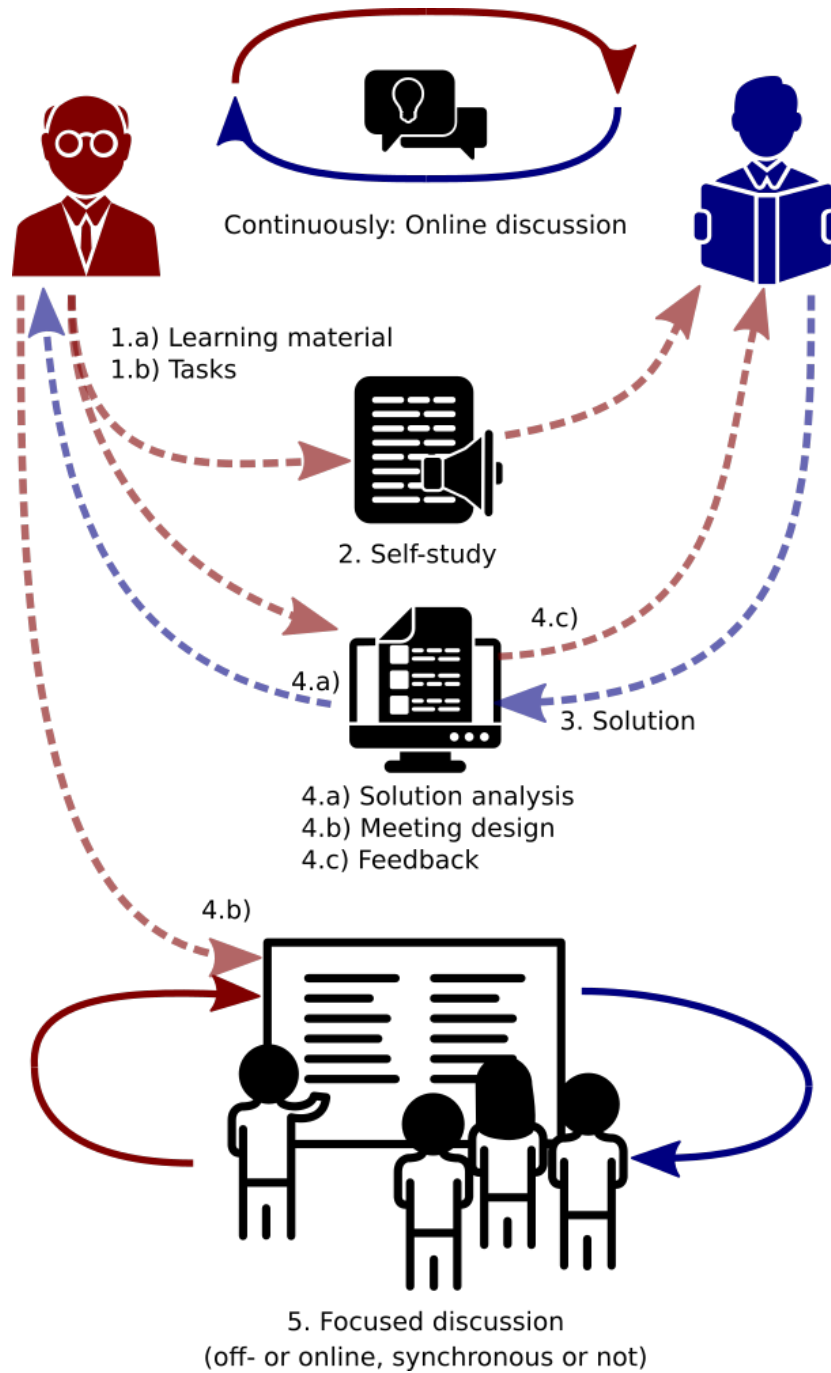


Figure 4: “Feedback cycles with JiTT” by Jens Lechtenböcker under CC BY-SA 4.0; from GitLab. Includes icons by The Noun Project under CC BY 3.0 US: Meeting by Ainsley Wagoner; knowledge sharing, professor, student, audio lesson, online task, online communication by ProSymbols.

Lessons Learned

Sample Feedback

- Misunderstandings
 - “JiT T destroys our freedom!”
 - “JiT T tasks are too difficult/open!”
- Encouragement
 - “JiT T is/was a very good idea and was very helpful to understand the course’s content”
 - “The JiT T-Assignment in combination with the lecture helped to understand the topics a lot!”
 - “Please continue with this type of lecture!”

Benefits and Challenges

- Benefits
 - Much more **fun** in meetings with prepared students
 - * Sometimes unbelievably good solutions
 - JiT T tasks helped **tremendously** to identify misunderstandings and improve self-study material
 - * From wording to new larger units
- Challenges
 - Regarding students
 - * Participation in class and in JiT T assignments
 - * Workload expectations
 - Regarding myself
 - * Increased awareness of hurdles for students

On Last Year’s CSOS Evaluation

- Only 23 students took part
 - Heterogeneous grade distribution
 - * (See notes; from 4*1.0 to 1*4.0, neither 2.3 nor 5.0)
 - Sample quotes
 - * Definitely my favourite Informatics module so far. I liked both parts, though I think the CS parts could use some reworking, either with HTML presentations aswell or with new videos.
 - * Definitely one of the best lectures I visited.
 - * I just don’t see the point of the “non-lectures”.
 - * I dont liked JiT T and the HTML5 presentations.

- Repeated issues
 - * English with positive (practice) and negative (additional complexity) comments
 - * Maybe too little material for CS, too much for OS

Grades: 1,1,1,1, 1.3,1.3, 1.7,1.7,1.7,1.7,1.7, 2,2,2,2,2, 2.7,2.7, 3,3, 3.3, 3.7, 4.0

Comments on Workload

- CSOS is worth 9 credits
 - Almost a third of your weekly workload, maybe 12 hours per week
 - 12 hours = 8 * 90 minutes
 - * 3 class sessions
 - * Time for 5 sessions remaining
 - Suggestion: Reserve self-study time in your weekly schedules
 - * Preparation of class topics
 - * Exercise work

Final Remarks

On Expectations

- [Des+19] Actual learning vs feeling of learning
 - “The effort involved in active learning can be misinterpreted as a sign of poor learning. On the other hand, a superstar lecturer can explain things in such a way as to make students feel like they are learning more than they actually are.”
 - Questions regarding statistical rigor
 - One conclusion: Explain approach to students

2017 paper that also indicates better learning outcomes but worse instructor ratings for blended learning in comparison to face-to-face learning: <http://dx.doi.org/10.1080/08832323.2017.1299082>

JiT in CSOS 2022

- Joint sessions shaped by you!
- Default plan
 - Tuesday sessions for first two tasks of exercise sheets
 - Wednesday session for general Q&A on exercises
 - Thursdays for Q&A on sample solutions
- Please use Learnweb for asynchronous discussions
 - MoodleOverflow worked well last year
- In addition, anonymous pads for synchronous and asynchronous Q&A

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