

# The Flipped Classroom Method: Lessons Learned from Two Computer Science Courses

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# Structure

- Flipped Classroom - what is it?
- Research Goals
- Research Setup and Applied Methods
- Research Results: Pros and Cons
- Guidelines for Applying Flipped Classroom
- Conclusions

# Flipped Classroom – what is it?

- Flips the traditional elements of lecture teaching:
  - (Video) lectures or textbook as homework
  - Exercises done together in class
- Point: Optimizing the time spent together.
- Has been gaining traction recently with several studies with positive results being published

# Research Goals

- RQ: Which parts of flipped classroom teaching method are best suited for programming courses at university level?
- Application area: Teaching of programming
- Planned outcomes: Guidelines for how and why the flipped classroom method should be applied.

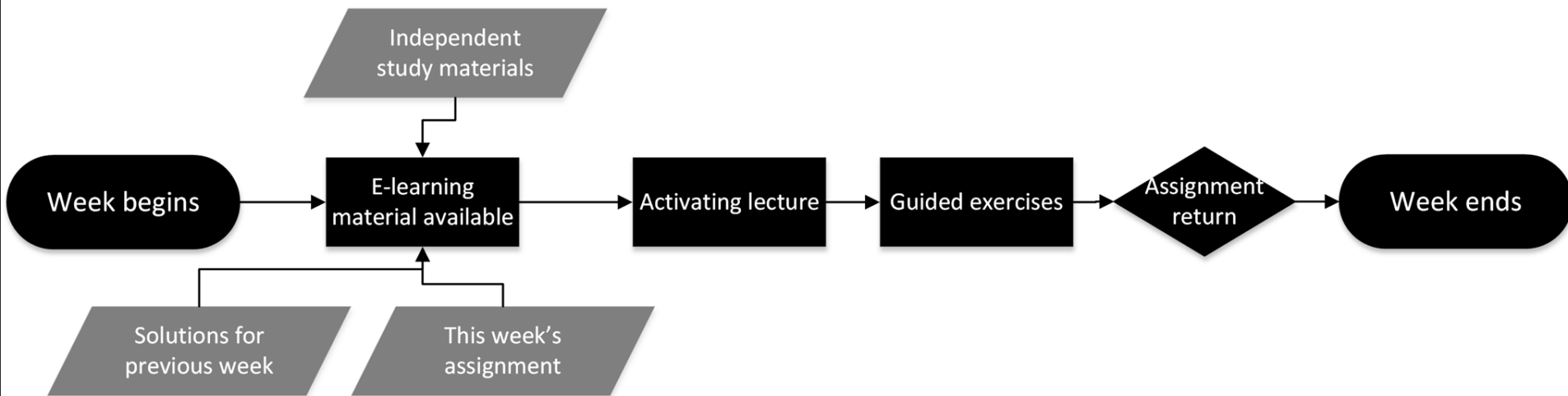
# Elements of Flipped Classroom, pt. 1 (Maher et al., 2015)

- Workflow
  - Temporal flow
  - (Student) preparatory work
- Video instructions
  - Creating / curating videos
  - Wrapping a MOOC
- In-class activities
  - (continued on next slide)

# Elements of Flipped Classroom, pt. 2 (Maher et al., 2015)

- In-class activities
  - Pair programming labs
  - Group problem solving activities
  - Flexible quiz activities

# Example: Weekly Structure (semi-flipped classroom)



# Research Setup

- Case 1: Object-Oriented Programming
  - Physical lectures dropped completely
  - Video material and programming manuals as independent learning
  - Exercises with graded programming tasks
- Case 2: Webbed Applications
  - Lectures replaced with interactive discussions and guided programming tasks
  - Occasional quizzes added to control learning in addition to exercises



# Applied Flipped Classroom Methods

- Independent studying – learning of theory before classes
  - Videos
  - Interactive online material
- In-class activities
  - Practical tasks, collaborative problem solving
  - Peer review
  - Cooperative work

# Research Results: Observed Pros

- Increased motivation
- Increased flexibility for students – lecture material reached wider audience (videos were watched also during final project)
- Increased student retention and pass rate because of increased collaboration and interactivity in solving exercises
- Highest evaluation grades from students for the courses this far

# Research Results: Observed Cons

- Unmotivated students are still unmotivated
- Some students (still) consider lectures on theory less important than programming exercises
- Creation of video material takes more effort in the first year
- Using outside material (video links, tutorial sections) can lead to perceived lack of consistency in the material

# Our Guidelines for Applying Flipped Classroom

- Create or curate videos (in addition to text)
- Use weekly quizzes to evaluate / control the level of understanding
- Strictly integrate the theory and material in the course – constructive alignment in teaching!
- Encourage peer learning, collaboration and peer review (with individual evaluation and grading)
- Require students to start weekly tasks early

# Conclusions

- We can recommend anyone to try flipped classroom in suitable courses
  - All about optimizing the time students and educators spend together
- All courses converted at LUT have had positive feedback and outcomes
- Future work: More research in order to get stronger, statistically valid quantitative results to support the guidelines

# Thank you! Questions, comments?

Let's continue the discussion online – I will also tweet a link to these slides soon

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