

Digital Tools in Teaching and (e)Learning

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TAMPERE UNIVERSITY
OF APPLIED SCIENCES



Pedagogical R & D

- Learning analytics
- Learning experience
- Learning outcomes



Sami Suhonen

Principal lecturer in engineering Physics

- Flipped Learning
- Online studies
- Educational videos
- Development of teaching methods

Digimentor

- Teacher's digital tools
- Helping colleagues
- Training, workshops
- Pedagogical point of view

Agenda:

Presentation and general discussion:

- Tools for teaching and learning online
- Educational videos:
 - Why videos?
 - How can anyone easily produce educational videos to support teaching and learning: different methods to produce educational videos.
 - How to add interactivity to any video.
- Activating students in classroom and online:
 - Examples of online teaching in TAMK: Synchronous Asynchronous
 - Polling apps
 - Presentation of some Apps & Methods

Break (10 min)

Workshop: Hands-on training with the presented apps and tools

Digitalization in teaching and learning

Teacher tools and actions to increase:

- Student activity
- Accessibility of the studies
- Interaction



Pedagogical level:

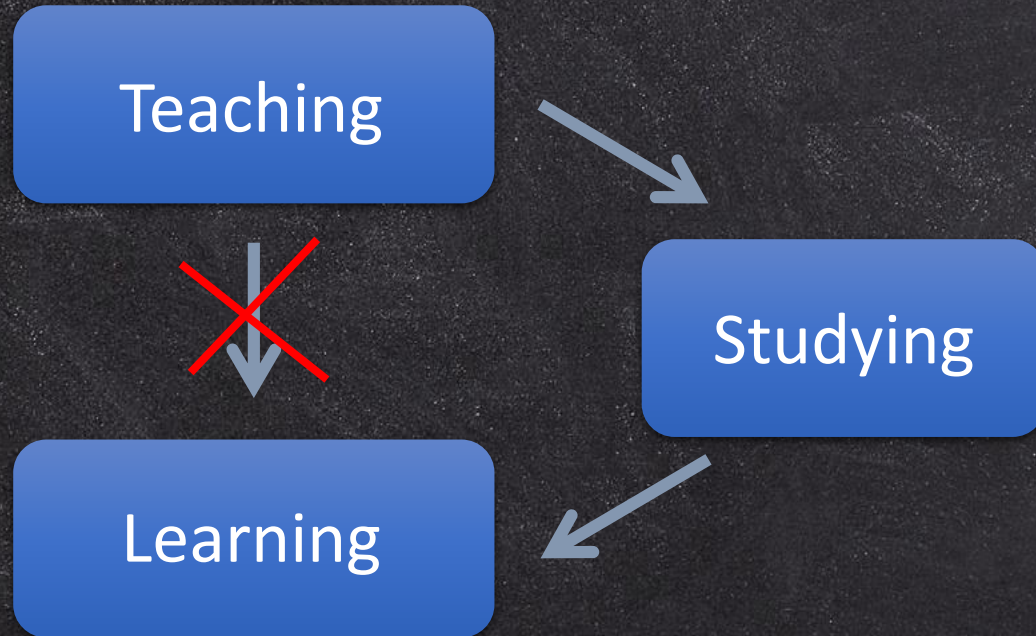
The pedagogical level box contains several digital tools and logos: Google Docs (blue, green, and yellow document icons), Playposit (a white dog on a blue background with the text 'playposit' and 'fka eduCanon'), Padlet (a colorful paper airplane logo with the text 'padlet'), Poll Everywhere (a blue circle with a white bar chart and the text 'Poll Everywhere'), PRISM (the word 'PRISM' in a stylized font with a colorful underline), and YouTube (the red and white YouTube logo).

System level: Learning management system 

Administration level: "Production control system", annual planning etc.

Digitalizaion projects

Background



“Learning by doing”
“Assessment as learning”

Pedagogical solutions:

| | |
|--------------------|--|
| Activating methods | Measurement assignments |
| | Educational videos |
| | Continuous assessment |
| | Group work Peer instruction Flipped learning |

- | | | | |
|---|--------------------------|-----------------------------|----------------------------------|
| 1. YouTube (1) | 26. Audacity (28) | 51. Movie Maker (77) | 76. iMovie (69) |
| 2. Google Docs/Drive (5) | 27. Evernote (17) | 52. Google Classroom (80) | 77. Piktochart (85) |
| 3. PowerPoint (4) | 28. Office Mix (42) | 53. Adobe Captivate (39) | 78. GoAnimate (89) |
| 4. Google Search (2) | 29. Trello (43) | 54. edPuzzle (81) | 79. TodaysMeet (94) |
| 5. Twitter (3) | 30. iSpring (44) | 55. Easygenerator (51) | 80. OneDrive (103) |
| 6. Dropbox (10) | 31. Google Maps (49) | 56. Uduu (61) | 81. eXe (114) |
| 7. Prezi (14) | 32. Khan Academy (52) | 57. Scoopit (72) | 82. Animoto (115) |
| 8. Kahoot (15) | 33. Quizlet (53) | 58. Edmodo (86) | 83. Blackboard Collaborate (123) |
| 9. Powtoon (22) | 34. Wikipedia (11) | 59. Weebly (88) | |
| 10. Word (16) | 35. Snagit (26) | 60. ThingLink (90) | 84. Zoom (65) |
| 11. Moodle (27) | 36. Socrative (55) | 61. Clarify (92) | 85. Turnitin (126) |
| 12. Screencast-O-Matic (31) | 37. iPad & Apps (58) | 62. Explain Everything (95) | 86. Grammarly (128) |
| 13. WordPress (9) | 38. Sway (59) | 63. Google Sites (96) | 87. Pixton (130) |
| 14. Google Chrome (33) | 39. Google Hangouts (41) | 64. Blackboard (99) | 88. Sakai (131) |
| 15. Facebook (6) | 40. Google Plus (45) | 65. Mahara 100 | 89. BigBlueButton (146) |
| 16. Google Forms (34) | 41. Blogger (56) | 66. Webex 36 | 90. Schoology (150) |
| 17. Skype (7) | 42. Adobe Connect (62) | 67. Desire2Learn (D2) (108) | 91. Notability (152) |
| 18. Padlet 35 | 43. Whats App 13 | 68. Jing (109) | 92. Kaltura (155) |
| 19. Google Apps for Education (GAFE) (40) | 44. Articulate 25 | 69. SharePoint (38) | 93. Moovly (156) |
| 20. Camtasia (24) | 45. Excel 46 | 70. Nearpod (110) | 94. Explaindio (157) |
| 1. Slideshare 18 | 46. Diigo 54 | 71. Outlook (50) | 95. Zeetings (158) |
| 22. OneNote (19) | 47. Google Scholar 60 | 72. Wix (112) | 96. ILIAS (159) |
| 23. Pinterest 29 | 48. Canvas 67 | 73. Canva (57) | 97. Remind (160) |
| 24. Gmail (32) | 49. Poll Everywhere 68 | 74. Keynote (64) | 98. WeVideo (161) |
| | 50. SurveyMonkey 70 | 75. Firefox (65) | 99. Showbie (162) |
| | | | 00. PlayPosit (165) |



Background

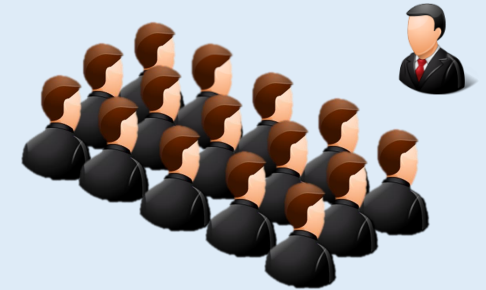
Improved Learning in a Large-Enrollment Physics Class

Louis Deslauriers,^{1,2} Ellen Schelew,² Carl Wieman*†‡

We compared the amounts of learning achieved using two different instructional approaches under controlled conditions. We measured the learning of a specific set of topics and objectives when **taught by 3 hours of traditional lecture given by an experienced highly rated instructor** and **3 hours of instruction given by a trained but inexperienced instructor using instruction based on research in cognitive psychology and physics education**. The comparison was made between two large sections (N = 267 and N = 271) of an introductory undergraduate physics course. We found increased student attendance, higher engagement, and more than twice the learning in the section taught using research-based instruction.

Deslauriers, L., Schelew, E., & Wieman, C. (2011). Improved learning in a large-enrollment physics class. *science*, 332(6031), 862-864.

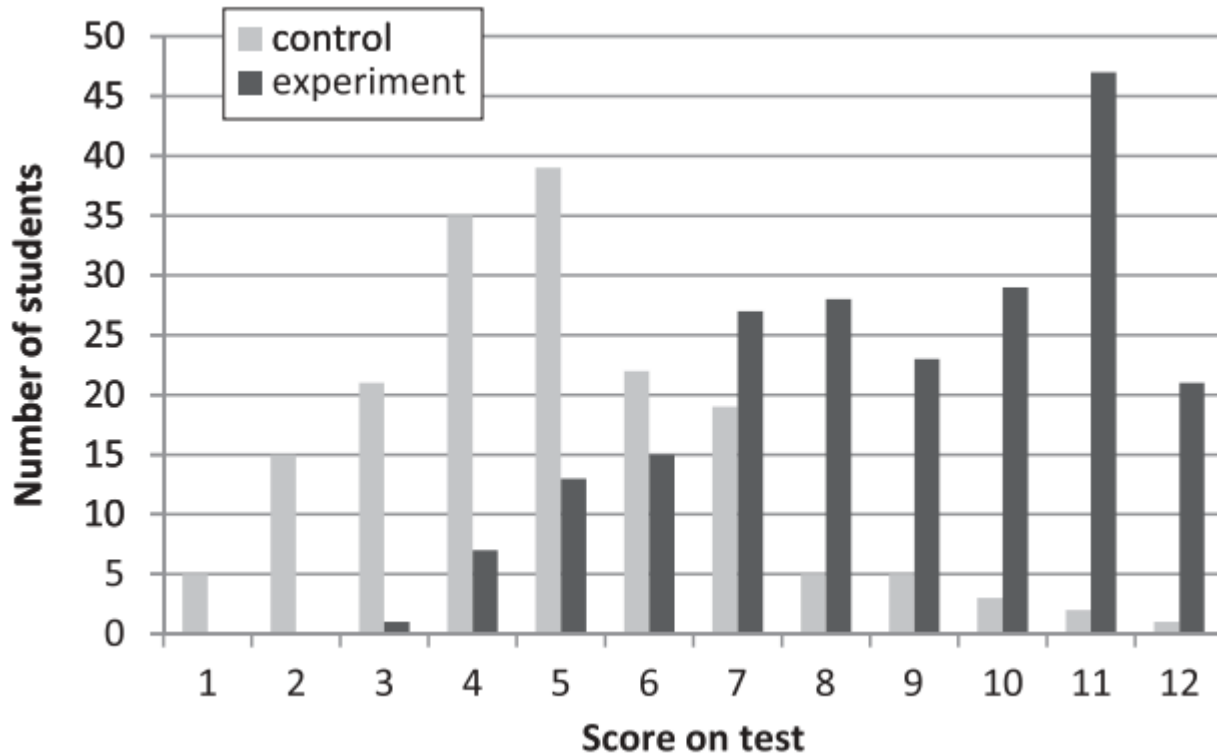
Lecturing



Activating methods



Background



The design goal was to have the students spend all their time in class engaged in deliberate practice at “thinking scientifically” in the form of **making and testing predictions and arguments about the relevant topics, solving problems, and critiquing their own reasoning and that of others**. All of the activities are designed to fit together to support this goal, including moving the simple transfer of **factual knowledge outside of class as much as possible** and creating tasks and feedback that motivate students to become fully engaged. As the students work through these tasks, they **receive feedback from fellow students and from the instructor**. We incorporate multiple “best instructional practices,” but we believe the educational benefit does not come primarily from any particular practice but rather from the integration into the overall deliberate practice framework.

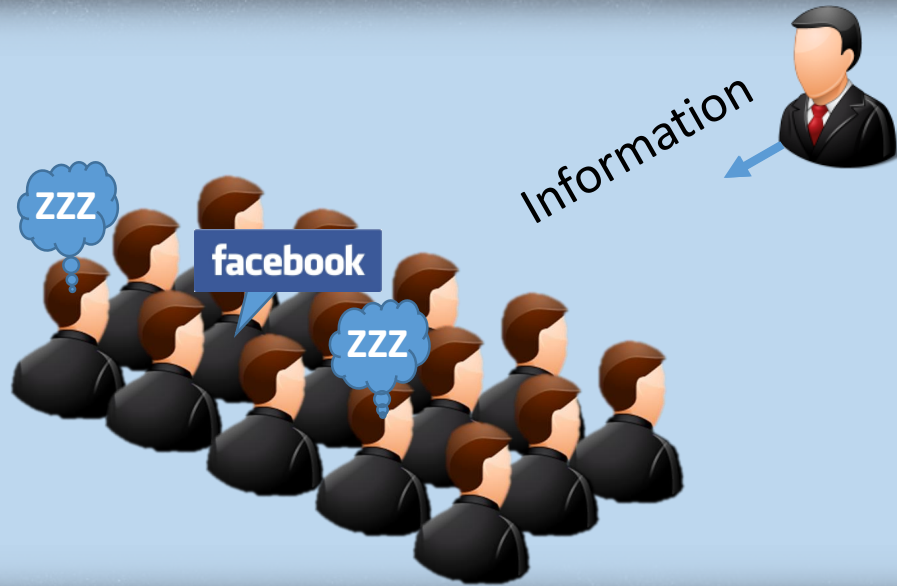
Deslauriers, L., Schelew, E., & Wieman, C. (2011). Improved learning in a large-enrollment physics class. *science*, 332(6031), 862-864.

Background

Classroom

Worst case:

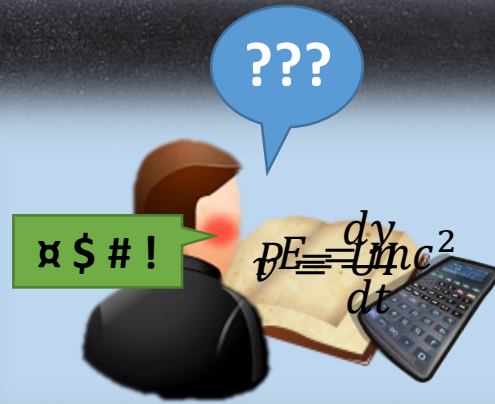
- Passive
- Alone
- Not engaged



At home:

Worst case:

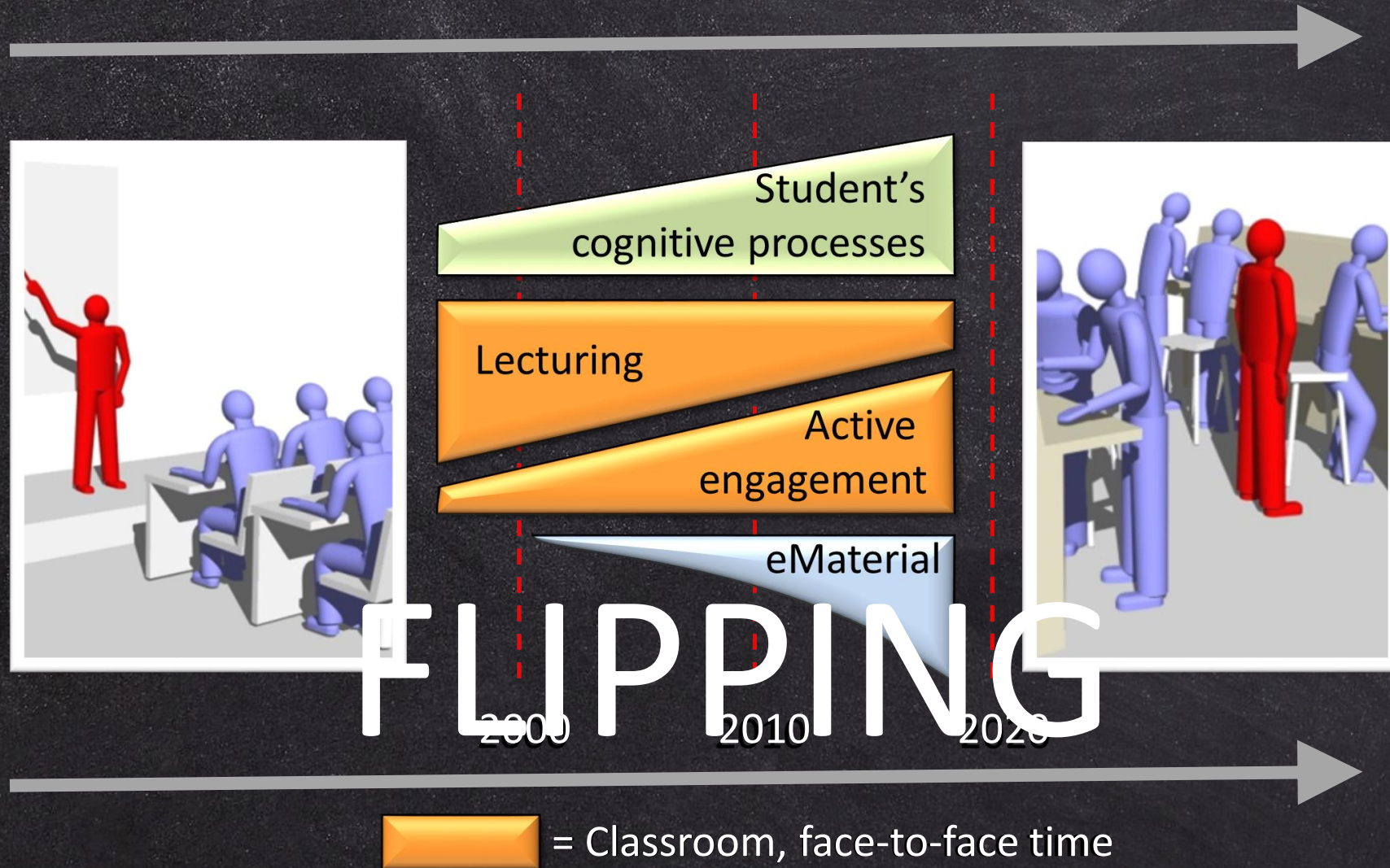
- Alone
- Stuck...



Homework
Assignments

Icons: www.icons-land.com

Flipped classroom/teaching



Flipped classroom/teaching

Educational videos

Face-to-face
teaching
(Blended learning
Flipped learning)



Videos



TAMK
Physics:

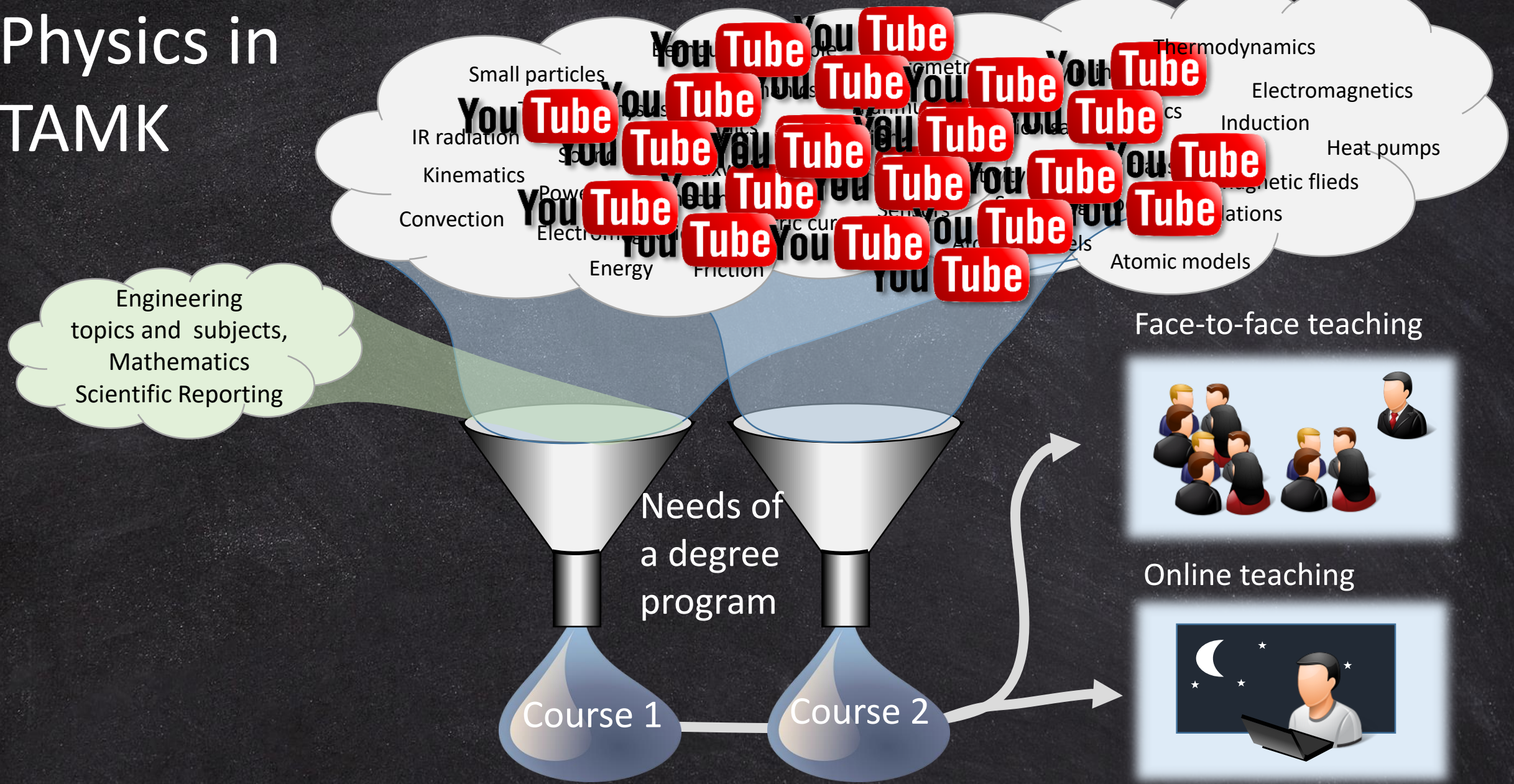
2000-3000
short videos

Online teaching and
studying



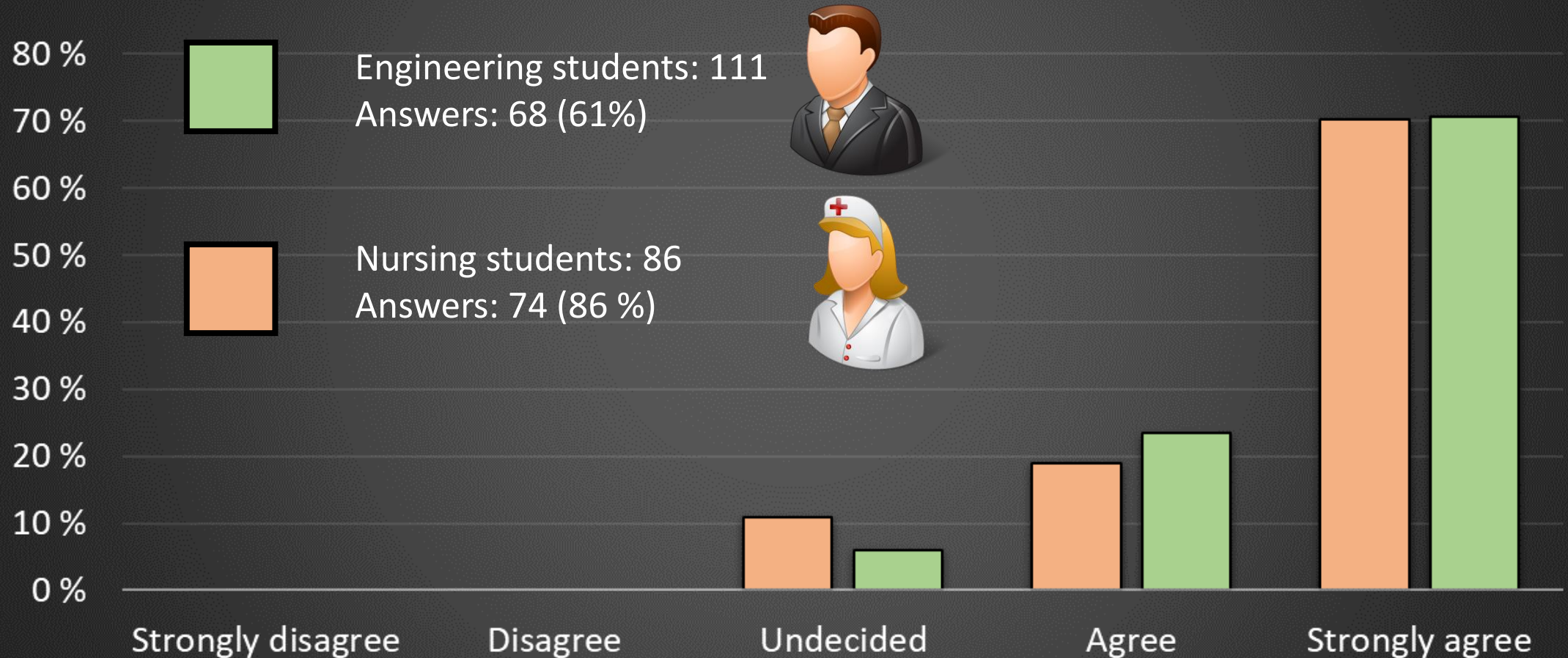
Icons: www.icons-land.com

Physics in TAMK



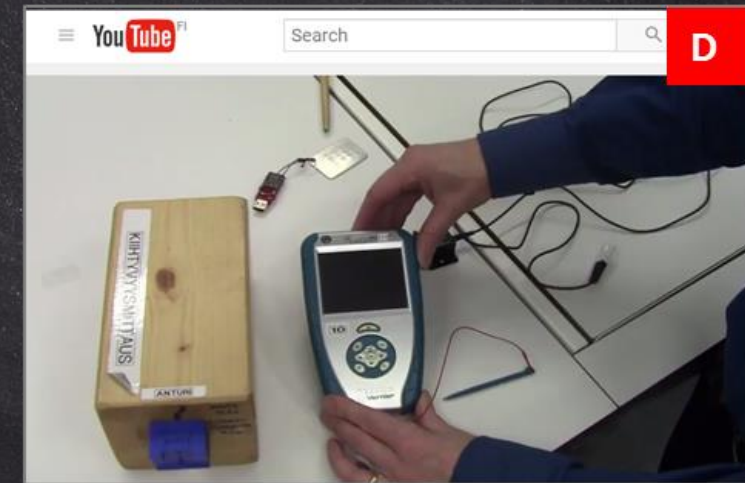
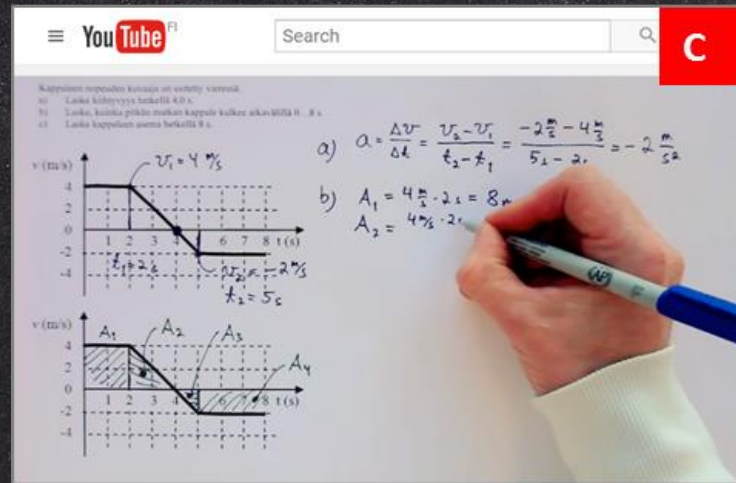
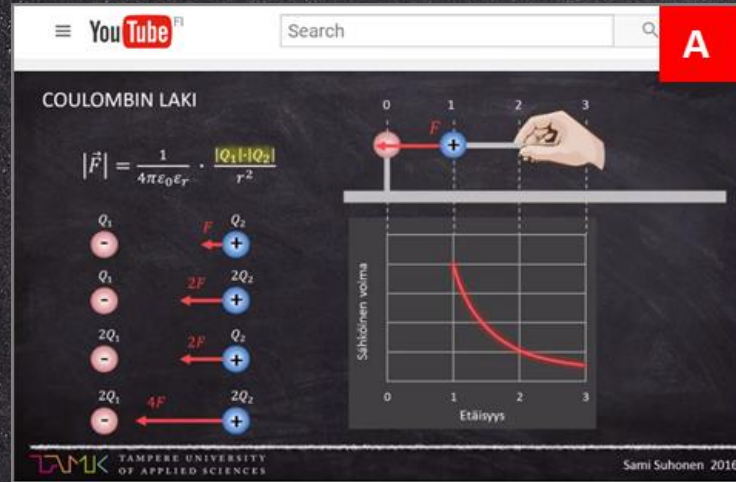
Educational video clips

"The videos have been useful for my learning."



Educational videos



- A) Theory videos to present the phenomena and formulas
- B) Demonstrations and measurements
- C) Homework solutions
- D) Instructions for equipment and laboratory work



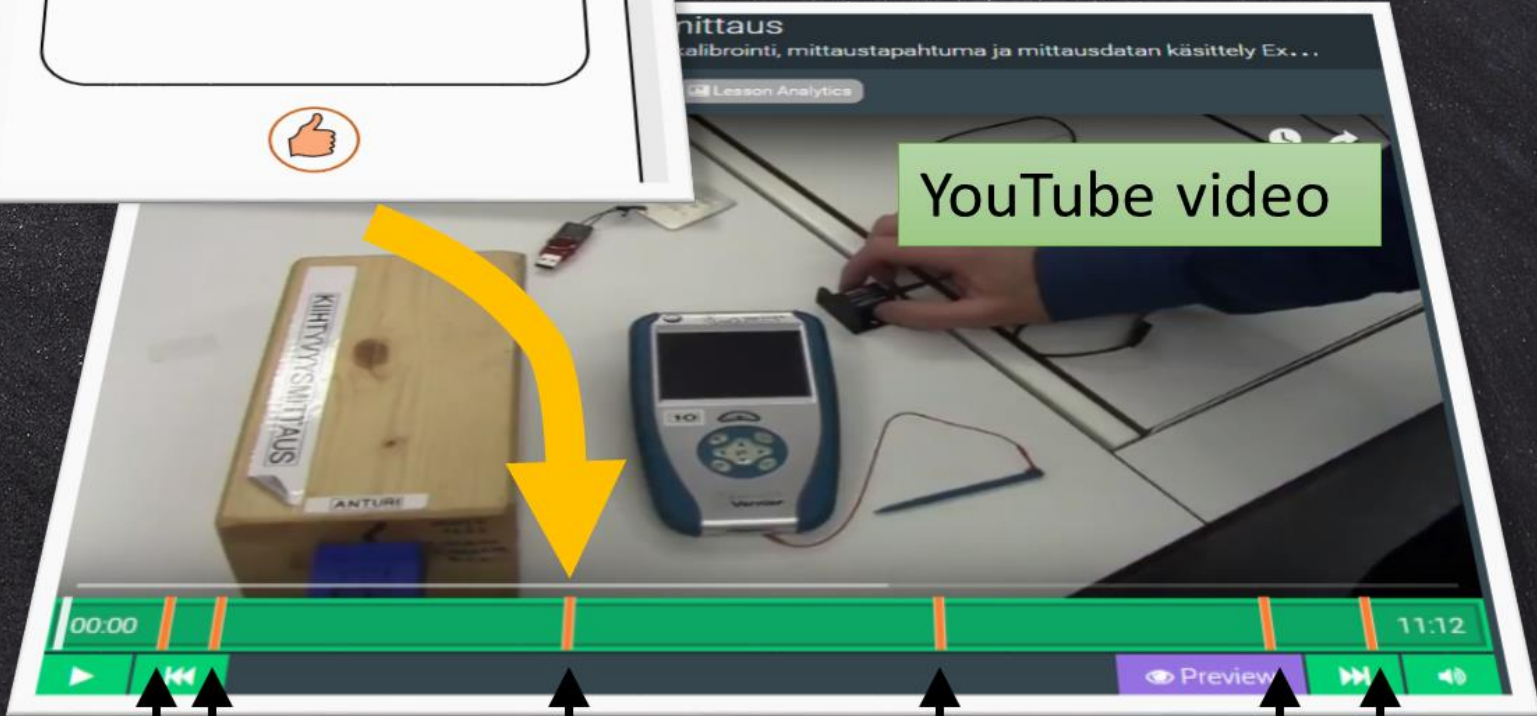
Educational videos

Interactivity to videos

Etsi (googlaa) kyseisen anturin datalehti ja selvitä, millä taajuusalueella anturi pystyy mittaamaan. Mitä tapahtuu, jos mittaat ilmiöitä, joiden taajuus on suurempi kuin anturin taajuusvaste?



Questions created with PlayPosit



YouTube video

Questions at certain time instants.

Methods for producing video clips:

1) Power Point → video clip

Suoraviivainen liike

1. Keskinopeus:

$t_2 = 14:03:21$ $t_1 = 14:03:12$
 $x_2 = -2,0 \text{ m}$ $x_1 = 10,0 \text{ m}$

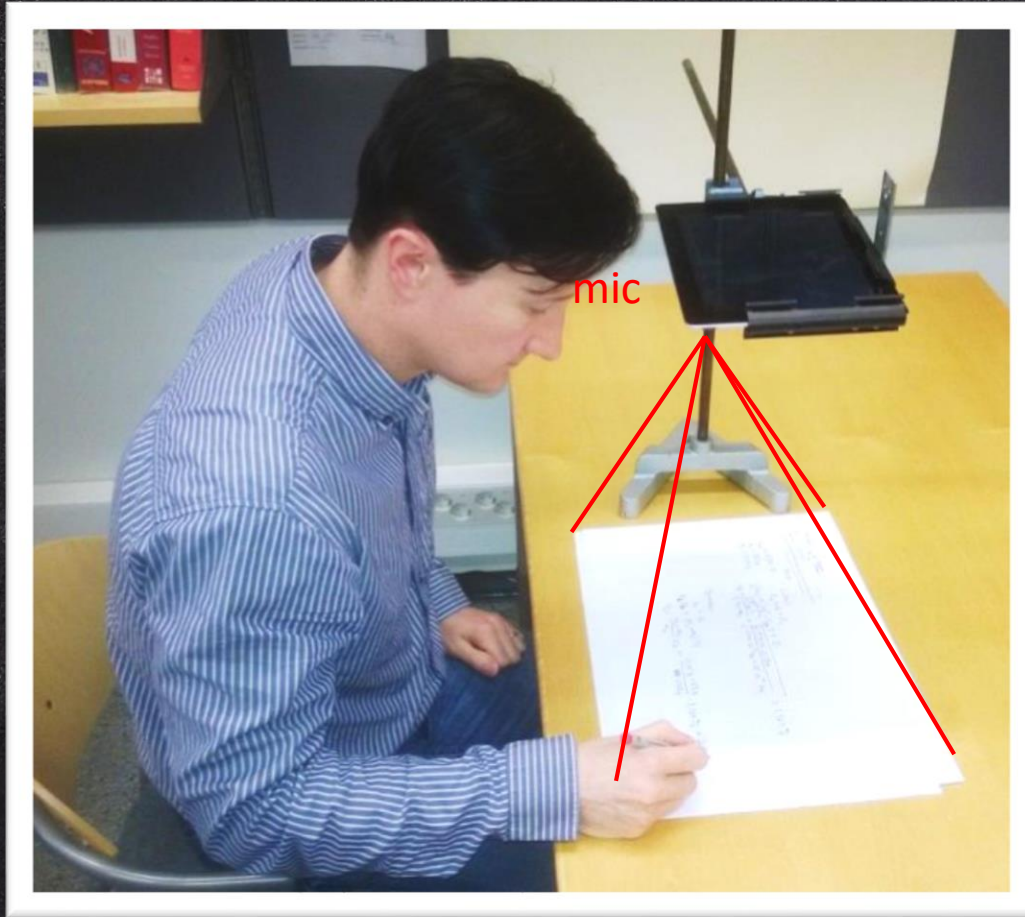
Keskinopeus v_K :
$$v_K = \frac{x_2 - x_1}{t_2 - t_1} = \frac{-2,0 \text{ m} - 10,0 \text{ m}}{14:06:21 - 14:03:12}$$
$$v_K = \frac{-12,0 \text{ m}}{9 \text{ s}} = -1,3 \frac{\text{m}}{\text{s}}$$

TAMK TAMPERE UNIVERSITY OF APPLIED SCIENCES
Mekanikka
www.facebook.com/tamkys

- Time-consuming
- Quite easy
- Rather large area
- Equations rather easy to present
- Good quality graphics
- Few animations
- Embedded video
- Easily editable in all ways
- We use this for theory video clips

Methods for producing video clips:

2) iPad (or any video camera) + paper

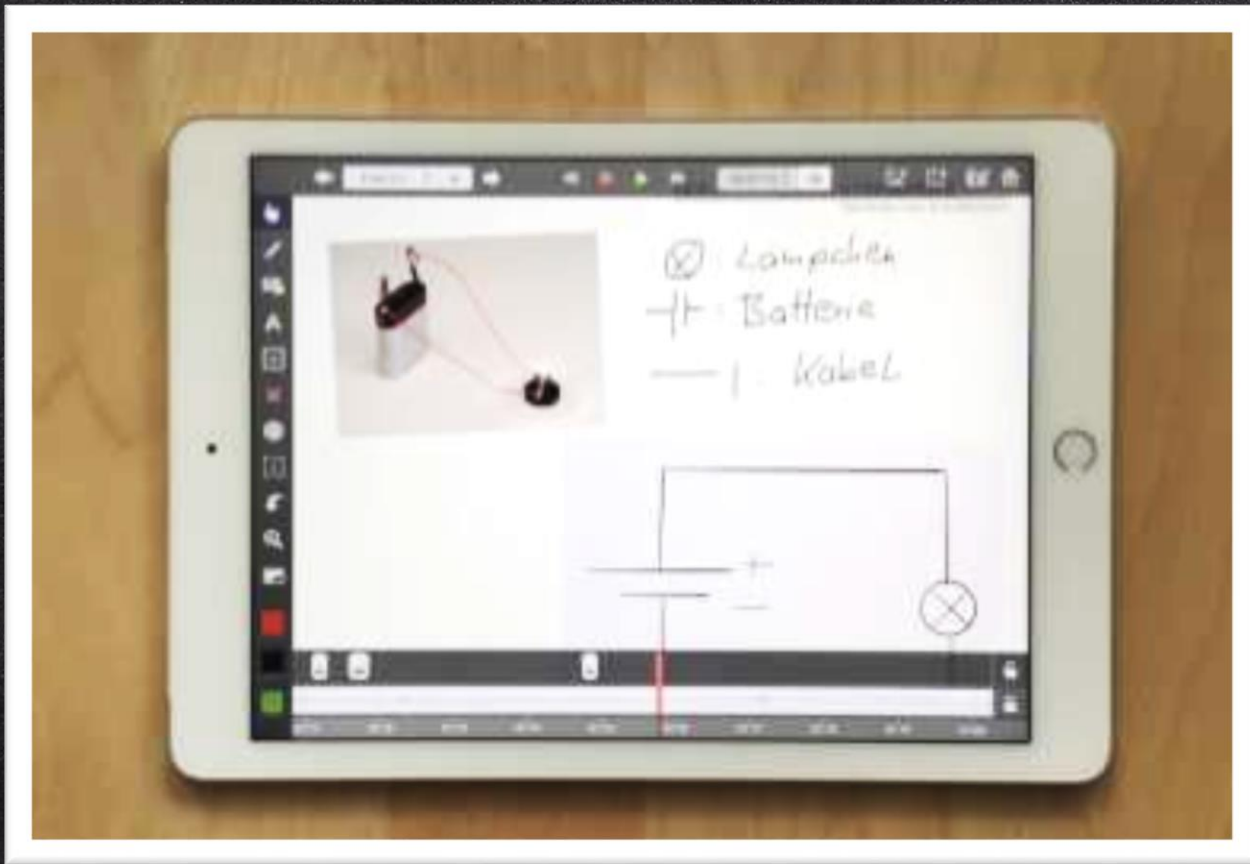


- Fast
- Easy
- Large area
- Equations easy to present

- Graphics quality depends on the person 😊
- Not easily editable (only clipping and voice-over)
- We use this for homework solution video

Methods for producing video clips:

3) iPad + Explain Everything



- Faster than PP
- Quite easy
- Unlimited area or slides
- Equations more difficult to present

- Good quality graphics
- Embedded video and pictures
- Easily editable in all ways
- We use this for theory videos + homework solution videos

Methods for producing video clips:

4) Screen Capture Videos

The screenshot displays the Microsoft Excel interface with a screen capture recording overlay. The recording panel is positioned on the left side of the spreadsheet, showing options for recording the screen, webcam, or both. The spreadsheet itself contains a table of data and a line graph.

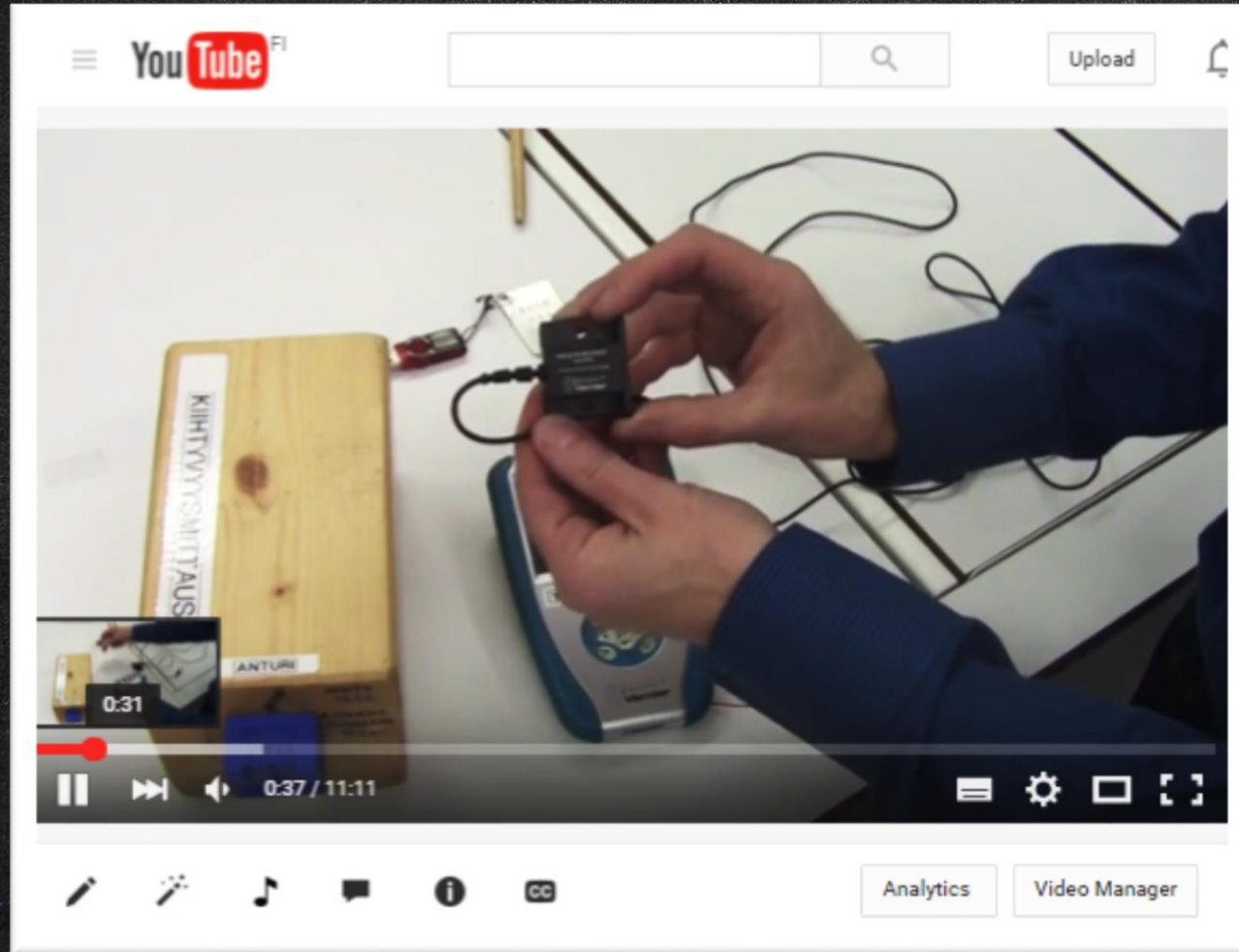
| Time | Acceleration |
|------|--------------|
| 0 | -0,06245 |
| 0,1 | -0,0079 |
| 0,2 | -0,0079 |
| 0,3 | -0,0079 |
| 0,4 | -0,0079 |
| 0,5 | -0,0079 |
| 0,6 | -0,0079 |
| 0,7 | -0,06245 |

The line graph on the right side of the spreadsheet shows a signal that starts at 0, dips to approximately -0.8 at 0.5 seconds, then rises to a peak of approximately 1.0 at 10 seconds, before settling back towards 0.

- Good for explaining the usage of different programs
- Possible to edit only with video editing software
- We use for Excel (signal processing etc.)

Methods for producing video clips:

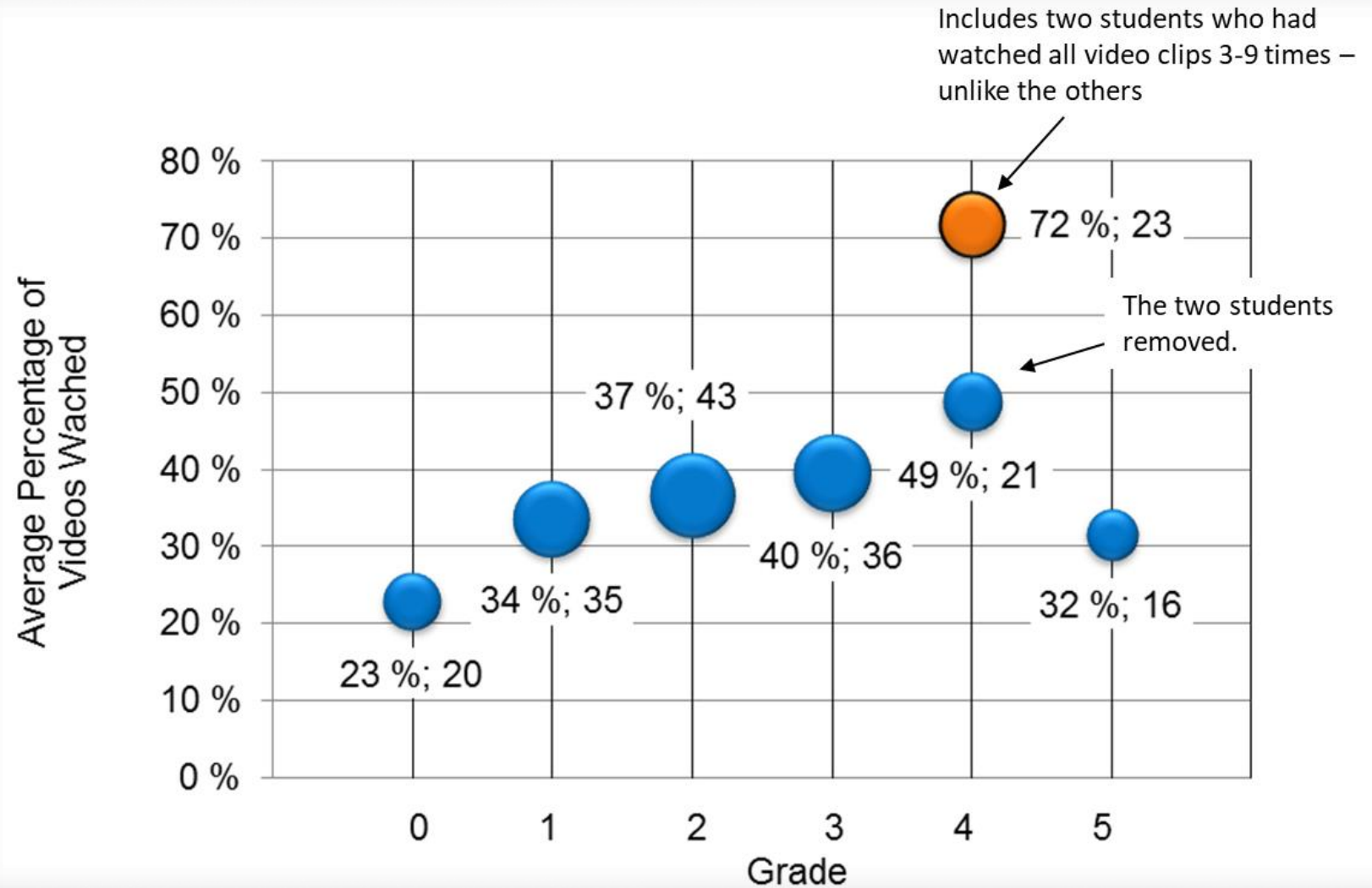
5) Video Camera + Cameraman



- Cameraman needed
- Good for explaining the proper use of laboratory equipment
- Usually video editor is needed (to add clips to one complete video)

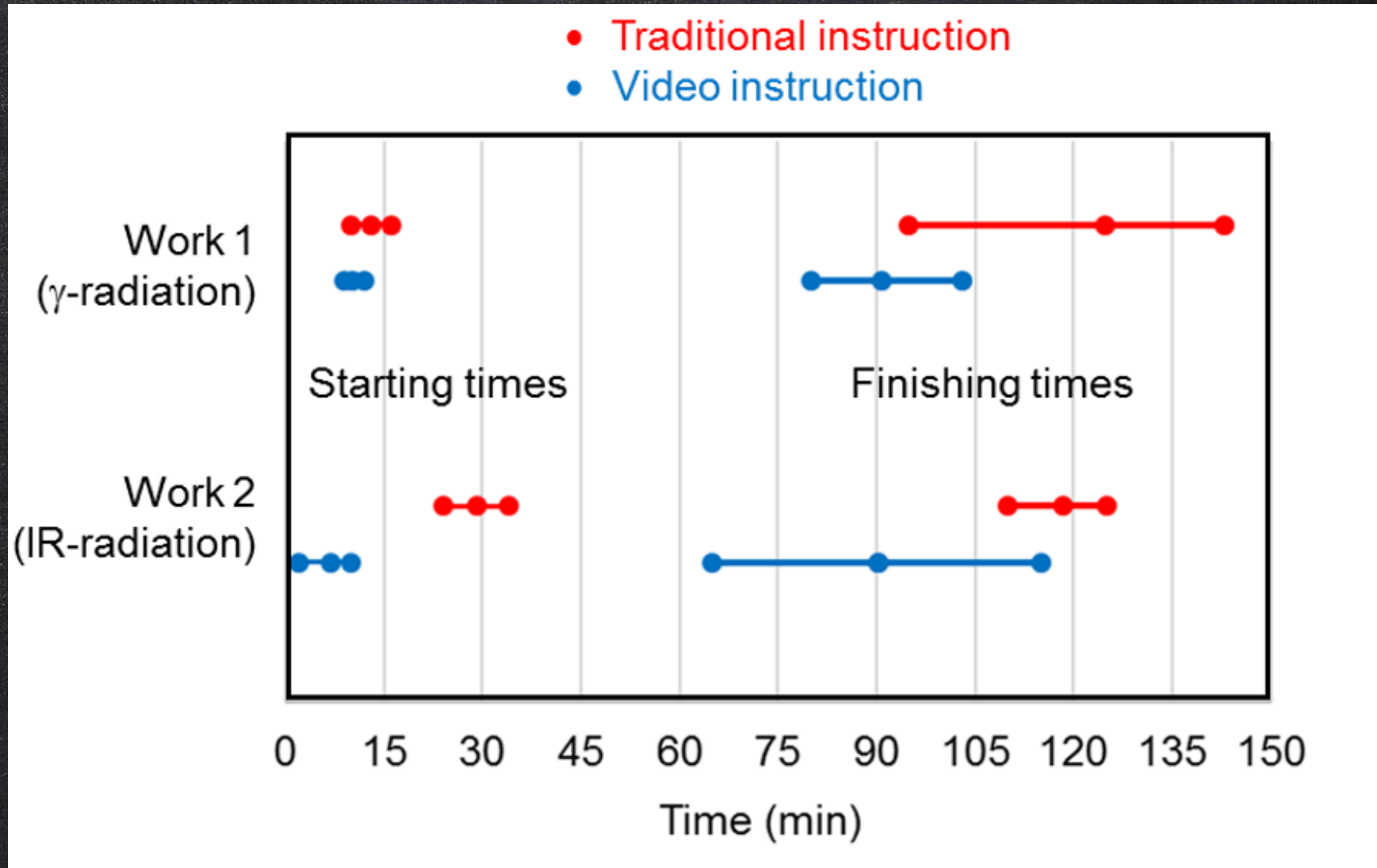
Educational videos

Impact?



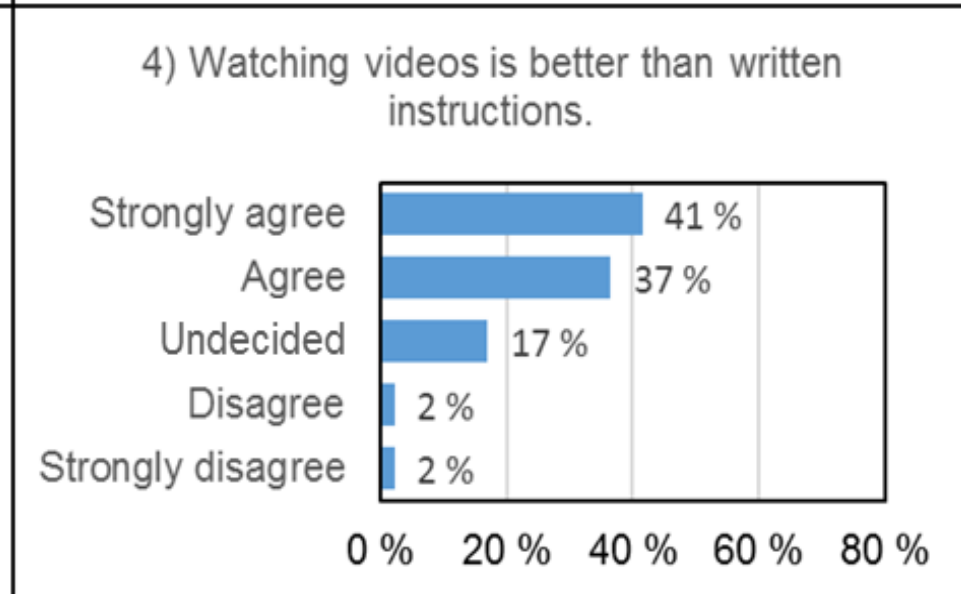
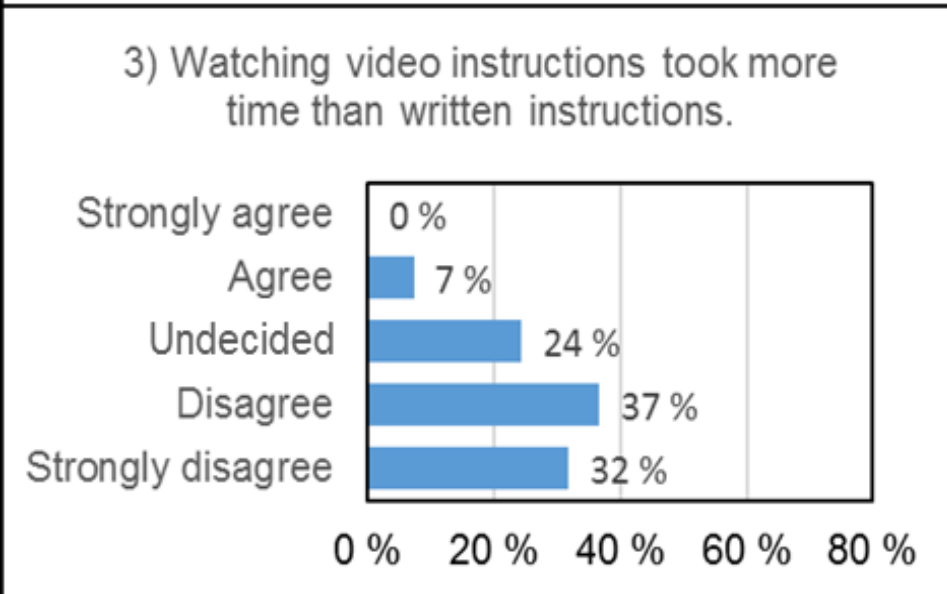
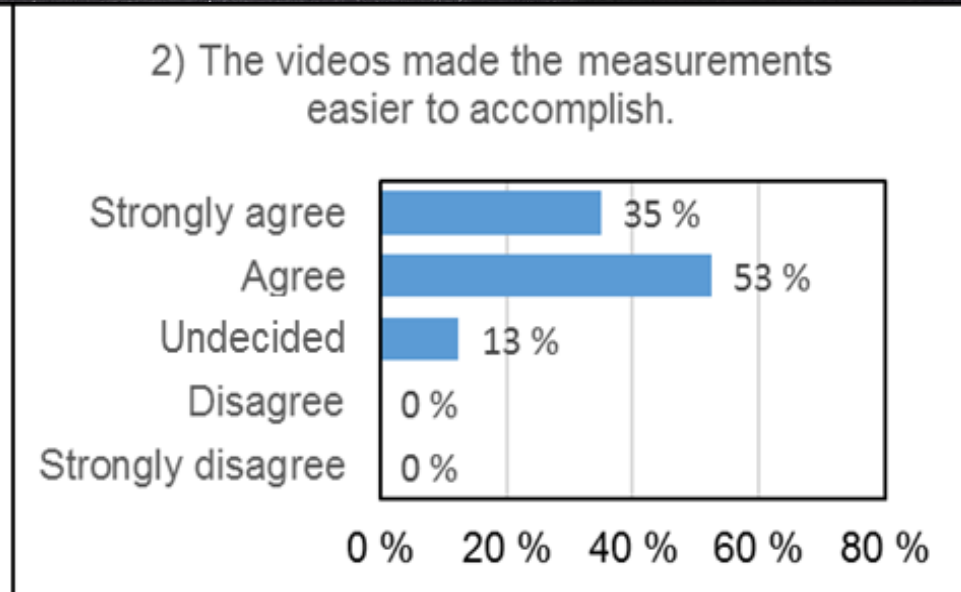
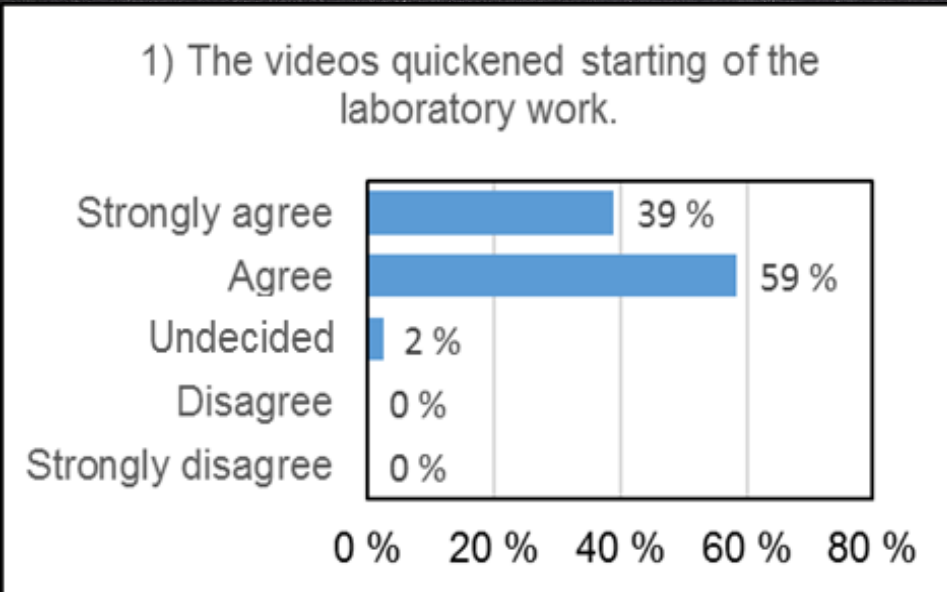
Educational videos

Impact?



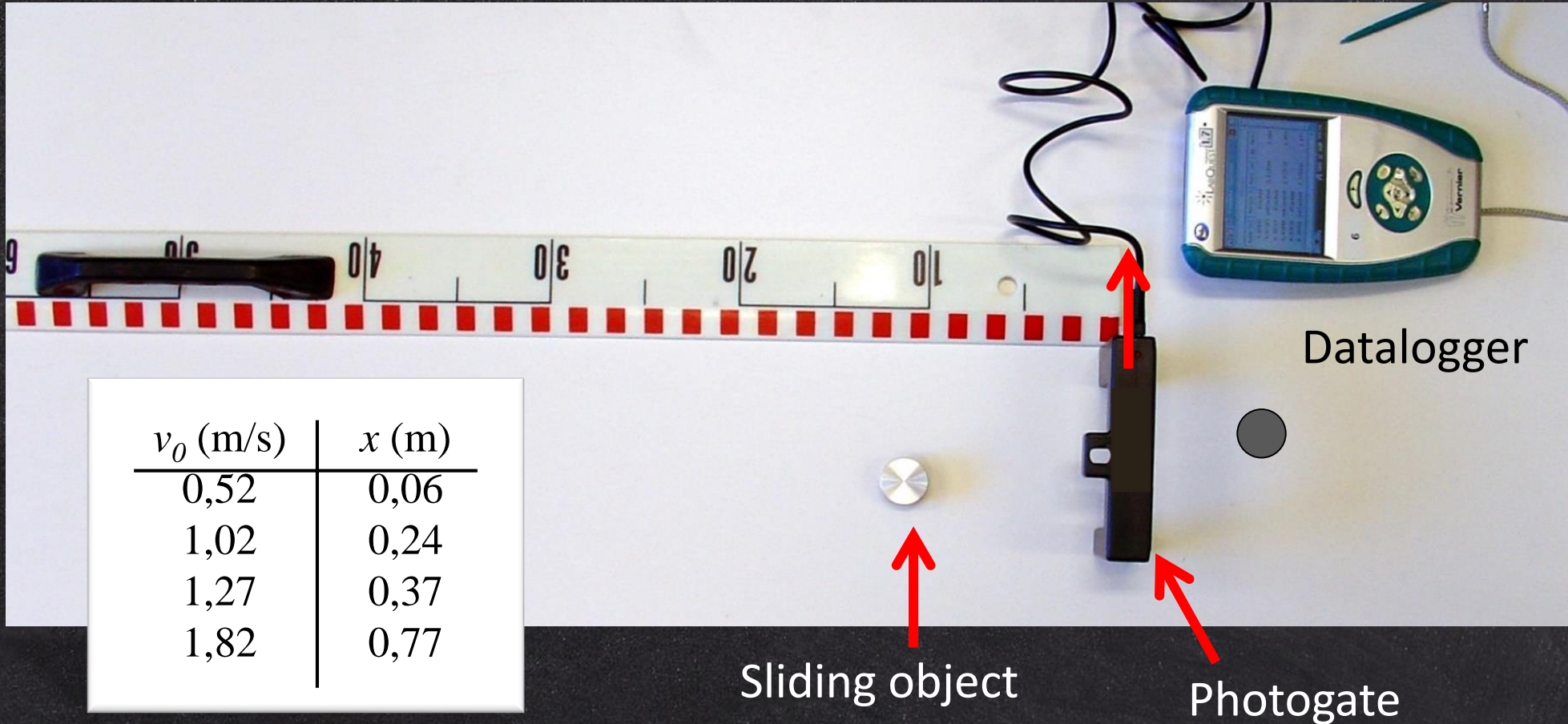
Educational videos

Impact?



Measurement assignments

Example: Coefficient of kinetic friction using energy principle:



Measurement assignments

”Learning by doing”



Physics, engineering and metacognition

Students:

- Discuss and argument their suggestions for the solution
- Evaluate peers' suggestions and solutions
- Evaluate themselves: Am I guessing or do I know?
- Find a joint solution to the problem (hopefully based on scientific thinking...)
- If it goes wrong, they evaluate WHERE it went wrong and why. Helps to make thinking visible.
- If it goes wrong, it is nobody's fault (it is the group...)

Measurement Assignments

The diagram shows a horizontal beam with a pivot point at the center. The beam is divided into two sections: a 10 cm section to the left of the pivot and a 10 cm section to the right. The right section is labeled "10 cm" and "1N = 5cm".

Forces and distances shown:

- At the far left end, a distributed load is shown with a resultant force $\bar{F}_s = 1.5\text{ N}$.
- At the midpoint of the 10 cm section (5 cm from the left end), a downward force $\bar{F}_s = 2.2\text{ N}$ is applied.
- At the pivot point, a downward force $\bar{F}_1 = 5\text{ N}$ is applied.
- At the far right end, a horizontal force $\bar{F}_2 = 5\text{ N}$ is applied to the right.

Below the diagram, a list of forces at different angles is provided:



- $\bar{F}_{90^\circ} = 1.5\text{ N}$
- $\bar{F}_{70^\circ} = 1.6\text{ N}$
- $\bar{F}_{60^\circ} = 1.7\text{ N}$
- $\bar{F}_{50^\circ} = 2.0\text{ N}$
- $\bar{F}_{40^\circ} = 2.5\text{ N}$

On the right side of the whiteboard, the text "RYHMÄ 3" is written. Below the diagram, the text "KAPPALE ON TASAPAINOISSA KUN:" is written, followed by the equations:

$$\sum \vec{M} = 0$$
$$M_1 = M_2$$
$$F_1 \cdot r_1 = F_2 \cdot r_2$$

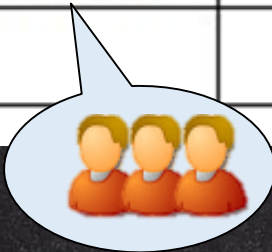
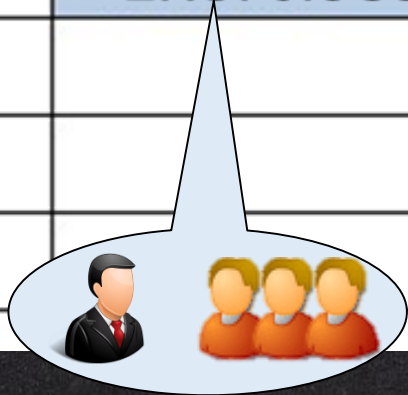
A hand is pointing at the diagram with a red marker.

Measurement Assignments

| Time | Mon | Tue | Wed | Thu | Fri |
|-------|-----|------------|----------|-----|--|
| 8-9 | | | | | |
| 9-10 | | Conceptual | | | |
| 10-11 | | Lecture | | | Instructions  |
| 11-12 | | Exercises | | | Meas. |
| 12-13 | | | Exercise | | Meas. |
| 13-14 | | | Exercise | | Results  |
| 14-15 | | | | | |



Every other week



~ 25 % of the classroom time

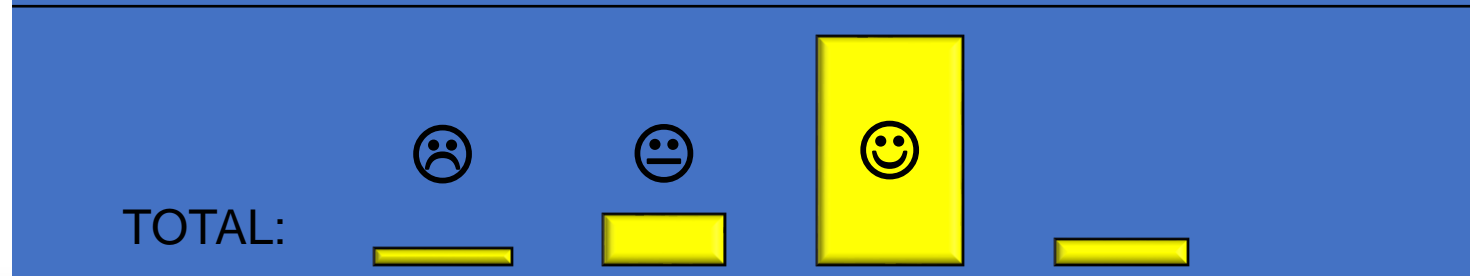
Measurement Assignments

| Week | Task | Weight | Assessed |
|-------------|-------------------|---------------|-----------------|
| 1. | Measurement | 5 % | Group |
| 2. | Week exam | 10 % | Individual |
| 3. | Measurement | 5 % | Group |
| 4. | Week exam | 10 % | Individual |
| 5. | Measurement | 10 % | Group |
| 6. | Week exam | 10 % | Individual |
| 7. | Final Examination | 50 % | Individual |
| | Total: | 100 % | |

Measurement Assignments

"Your opinion about measurement assignments."

| Group: | ☹ | ☺ | 😊 | n.a. | N |
|--------------|------------|-------------|-------------|------------|------------|
| M1 | 4 % | 13 % | 80 % | 2 % | 46 |
| M2 | 2 % | 13 % | 83 % | 2 % | 46 |
| M3 | 0 % | 16 % | 59 % | 25 % | 32 |
| TF | 21 % | 25 % | 50 % | 4 % | 24 |
| EC | 0 % | 22 % | 72 % | 6 % | 18 |
| TOTAL | 5 % | 16 % | 72 % | 7 % | 166 |



| Feature | Laboratory measurement | Measurement assignment |
|----------------------|---|---|
| Actor: | <ul style="list-style-type: none"> ▪ Pair of students | <ul style="list-style-type: none"> ▪ Student group |
| Subject matter: | <ul style="list-style-type: none"> ▪ Familiar from theory point of view | <ul style="list-style-type: none"> ▪ New(ish) |
| Equipment: | <ul style="list-style-type: none"> ▪ Complicated | <ul style="list-style-type: none"> ▪ Usually simple |
| Teacher's role: | <ul style="list-style-type: none"> ▪ Instruct, help, guide, evaluate | <ul style="list-style-type: none"> ▪ Briefing in the beginning, ▪ No interfering ▪ Evaluate, (assess) |
| Time scale: | <ul style="list-style-type: none"> ▪ Measurements: 3 h ▪ Reporting: 5-10 h ▪ Time ~ few weeks | <ul style="list-style-type: none"> ▪ Brainstorming: 0,25 h ▪ Studying the background: 0,5-1 h ▪ Measurements: 0,5 h ▪ Analysing and reporting: 0,5-1 h |
| Learning objectives: | <ul style="list-style-type: none"> ▪ Carry out organized measurements ▪ Plan measurements ▪ Evaluate uncertainty ▪ Importance of measurements ▪ Deepen the understanding | <ul style="list-style-type: none"> ▪ Construct and deepen the understanding of the topic. ▪ Peer work, team work. ▪ Evaluate own understanding of the subject matter. ▪ Evaluate peers' understanding of the subject matter |
| Sharing results | <ul style="list-style-type: none"> ▪ Usually only to teacher | <ul style="list-style-type: none"> ▪ Shared and presented to other groups |

Studying and teaching methods

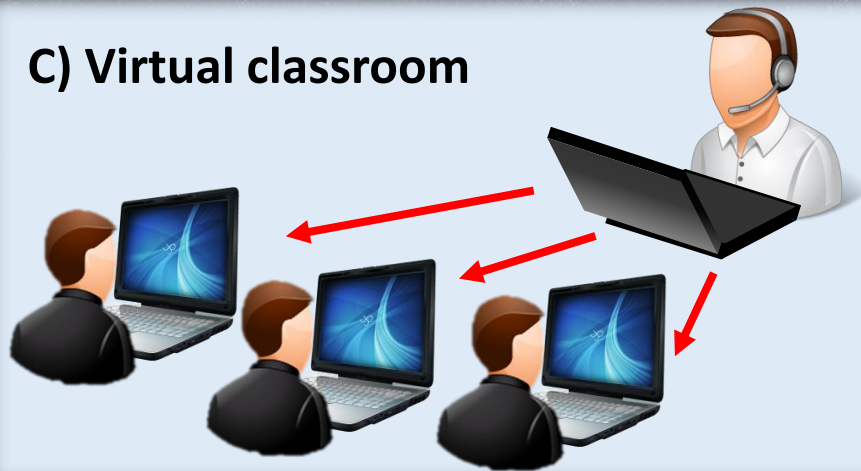
A) Face-to-face teaching



B) Face to face teaching streamed to distance learners (Adobe Connect)



C) Virtual classroom



D) Asynchronous online course




Icons: <http://www.icons-land.com>

Physics in TAMK

Physics online courses:

- All theory courses are also offered online.
- The first laboratory course “*Basics of measuring and scientific reporting*” is being converted
- Asynchronous
- Scheduled at week level



Elementary Engineering Physics: MECHANICS (3 ects)


Aloitussivu > Tutkintoon johtava koulutus > Tekniikan ja liikenteen ala > Elementary Engineering Physics: MECHANICS (3 ects)

Sivuston seuranta

Nykyinen kurssi

- Elementary Engineering Physics: MECHANICS (3 ects)
 - Osallistujat
 - Osaamismerkit
 - Yleinen
 - Kinematics
 - Force and Newton's laws
 - Work and Energy
 - Linear momentum and impulse
 - Circular motion
 - Rotational motion
 - Aihe 7
 - Aihe 8
 - Aihe 9
 - Aihe 10
- Omat kurssini

Kinematics, Week 2




This section provides you an introduction to one-dimensional kinematics, how motion can be analysed starting from the information of position in time.

The nature of the phenomena, the essential quantities and models used as well as the practical graphical interpretations are approached via conceptual questions, theory videos, video analysis techniques and exercises.

Verkko-osoitteet: 14 Tentin: 3 Tiedosto: 2

Force and Newton's laws, Week 3




This section deals with interactions between bodies, and different types of forces acting on them. Newton's Laws of Motion are the essential tools to describe and predict how objects move.

You will learn how to draw free body diagrams of the forces and how to form equations of motion based on the diagrams. The set of equations is then solved to find out, how the objects move (accelerations, forces etc). Friction and friction coefficients are also studied.

Verkko-osoitteet: 6 Tentin: 3

Work and Energy, Week 4



This section provides you the tools to use work and energy to solve problems in mechanics.

It starts with an introduction to the connection of work and energy, then introduces the definitions of work, power and efficiency with example calculations of different cases and ends up with the energy principles for mechanical energy.

Measurement assignments online?

- A) Smart phone sensors and apps
- B) Video analysis using smart phones
- C) Presenting measurements in video

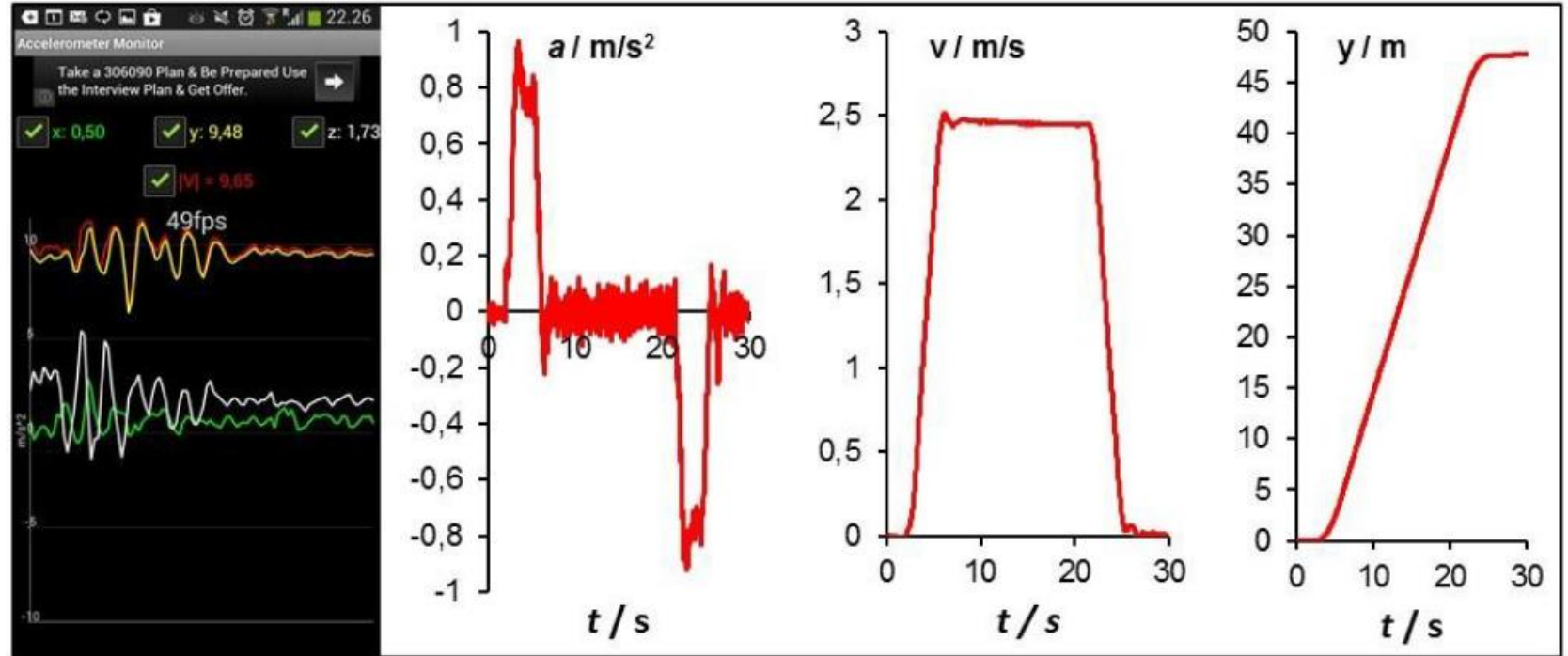
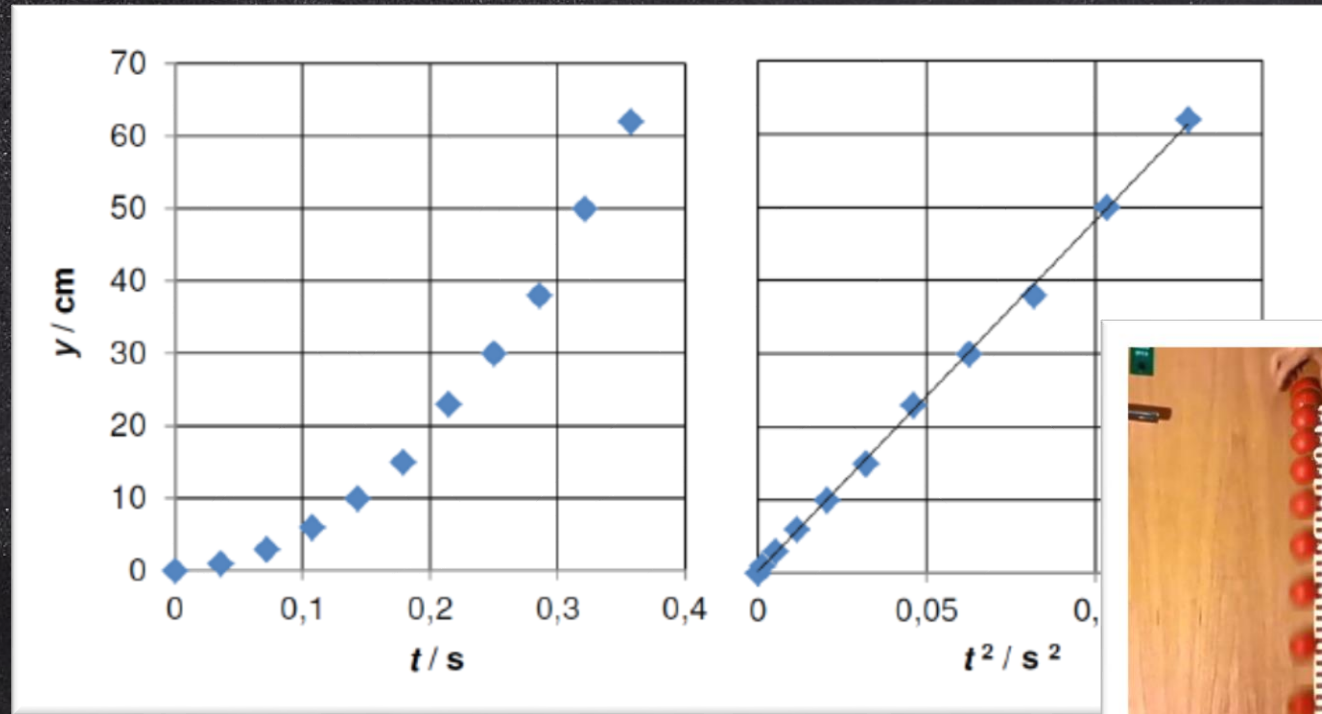


Fig. 5. An exemplary acceleration measurement of a lift and its analysis. Measured with Samsung Galaxy S4 Zoom and “Accelerometer Monitor” applet.

Measurement assignments online?

- A) Smart phone sensors and apps
- B) Video analysis using smart phones
- C) Presenting measurements in video



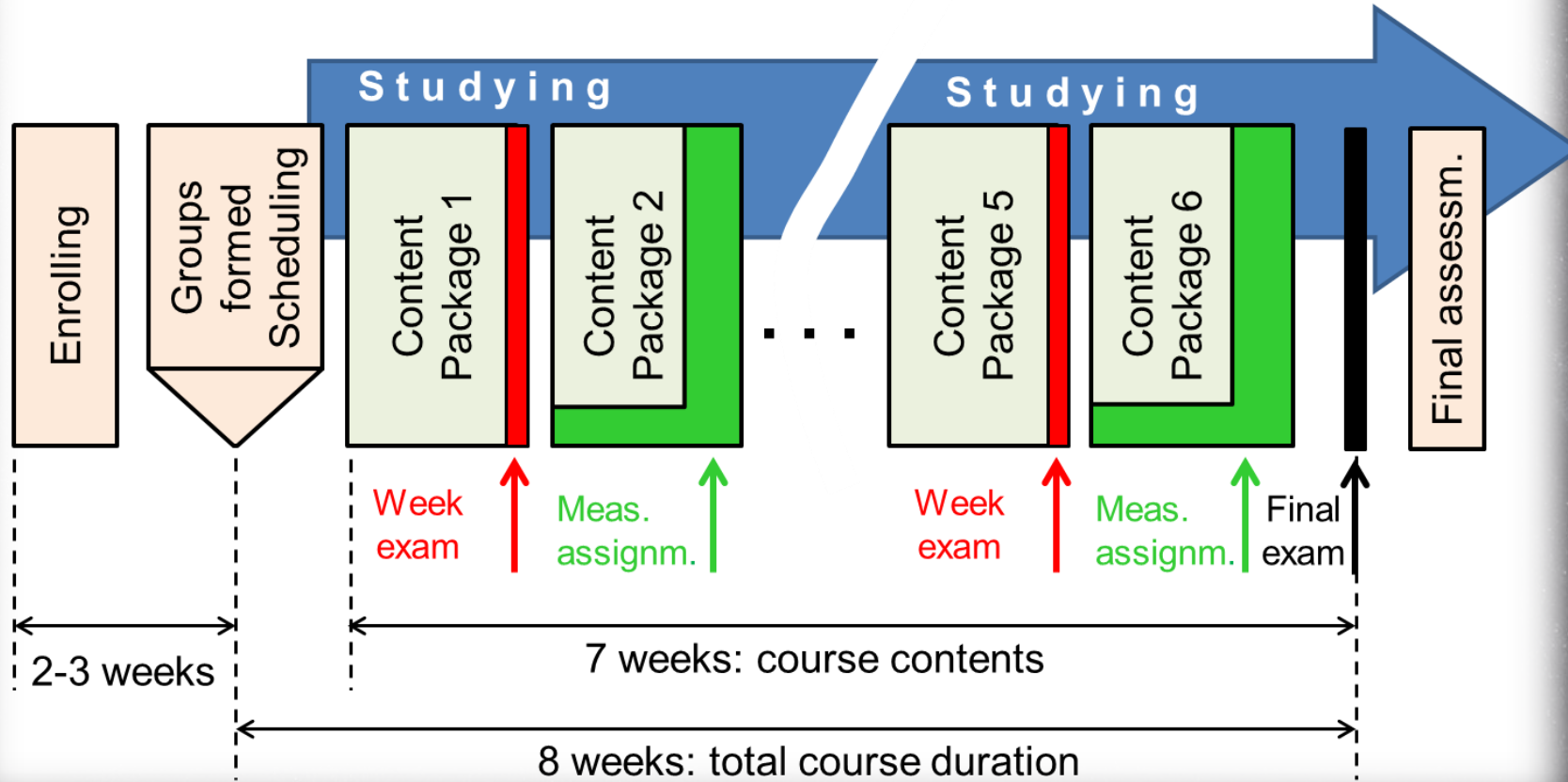
Measurement assignments online?

- A) Smart phone sensors and apps
- B) Video analysis using smart phones
- C) Presenting measurements in video



Asynchronous Online Physics Courses

Structure of the online implementation



Asynchronous Online Physics Courses

Structure of the online implementation

CONTENT PACKAGE 1

1. Conceptual multiple choice questions.

2. Lecture (Adobe Connect) and/or Lecture video recording.

3. Homework exercises supported by exemplary material with solutions.

4. Algebra-based group assignment.

5. Week exam.

CONTENT PACKAGE 2

1. Conceptual multiple choice questions.

2. Lecture (Adobe Connect) and/or Lecture video recording.

3. Homework exercises supported by exemplary material with solutions.

4. Algebra-based group assignment.

5. Measurement assignment.

| APRIL | | | | | | |
|-----------|---------|-----------------------|------------|------------|-----------------------------|-----------|
| MAANANTAI | TIISTAI | KESKIVIIKKO | TORSTAI | PERJANTAI | LAUANTAI | SUNNUNTAI |
| | | 1 | 2 | 3 | 4 | 5 |
| | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | KINEMATICS | | | 12 |
| | | | Chat 20-21 | Chat 20-21 | Measurement assignment open | |
| | 13 | 14 | 15 | 16 | 17 | 18 |
| | | | DYNAMICS | | | 19 |
| | | | Chat 20-21 | Chat 20-21 | Week exam | |
| | 20 | 21 | 22 | 23 | 24 | 25 |
| | | | DYNAMICS | | | 26 |
| | | | Chat 20-21 | Chat 20-21 | Measurement assignment open | |
| | 27 | 28 | 29 | 30 | | |
| | | WORK-ENERGY PRINCIPLE | | | | |
| | | Chat 20-21 | Chat 20-21 | Week exam | | |

Some of our latest publications:

1. Juho Tiili, Sami Suhonen (2017) Teacher's own instructional videos to support teaching - how and why? Proceedings of PTEE 2017 conference, Zilina, Slovakia
2. "S. Suhonen, J. Tiili (2017) Videos in physics theory and laboratory teaching: usage and retention analytics. Proceedings of SEFI 45th Annual conference, Azores, Portugal"
3. Sami Suhonen, Hanna Kinnari-Korpela (2017) Oppimisanalytiikka opetuksen ja oppimisen tukena. TAMK-Journal
4. Sami Suhonen, Hanna Kinnari-Korpela (2017) Learning Analytics to support learning and teaching. Proceedings of SEFI 45th Annual Conference, Azores, Portugal
5. S. Suhonen, J. Tiili (2017) The use of different physics learning environments: pros and cons. PTEE 2017 conference, Zilina, Slovakia
6. Suhonen, S. (2016) The use of different learning environments: pros and cons. PTEE 2016 conference, Rome, Italy
7. Suhonen, S., Tiili, J. (2015) The use of video instruction in laboratory teaching. Proceedings of SEFI 44th Annual Conference, Tampere, Finland.
8. Suhonen, S. (2016) Learning Analytics View to Students' Homework Activity in Engineering Physics. INTED2016 Proceedings, pp. 3998-4005.
9. Suhonen, S. (2016) Put Theory into Practice: Measurement Assignments in Physics Theory Courses. INTED2016 Proceedings, pp. 4478-4484.
10. Suhonen, S., Tiili, J. (2015) Students' Online Activity on a Fully Online Introductory Physics Mechanics Course, Proceedings of SEFI2015 43rd Annual Conference, Orleans, France
11. Suhonen, S., Puranen, J., (2015) Enhancing Learning in Integrated Physics Laboratory Course: Physics, Mathematics and Communications, 43rd Annual SEFI Conference June 29 -July 2, 2015 Orléans, France



12. Tiili, J., Suhonen, S. (2015) Students' Experiences on Modern Fully Online Introductory Mechanics Physics Course, Proceedings of SEFI2015 43rd Annual Conference, Orleans, France
13. Hockicko, Peter, and Juho Tiili. "Comparison of the Entering Students' FCI Results—Tampere UAS and University of Žilina", Proceedings of SEFI2015 43rd Annual Conference, Orleans, France
14. Tiili, J., Manninen, R., Puranen, J., Suhonen, S., (2015) Development of Simple Public Assessment Sheet and its Use in Elementary Physics Laboratory Course, Proceedings of SEFI2015 43rd Annual Conference, Orleans, France
15. Suhonen, S., Tiili, J. Combining good practices in fully online learning environment – introductory physics course. Proceedings of SEFI2014 42nd Annual Conference, Birmingham, UK
16. Tiili, J., Suhonen, S. (2014) Using pre-lecture assignments to enhance students' learning in introductory physics, PTEE2014
17. Suhonen, S., Tiili, J. (2014) Simple Measurement Assignments as Activators in Elementary Engineering Physics, INTED2014 Proceedings, pp. 4057-4066.
18. Tiili, J., Suhonen, S. (2014) Active Engaging Video Assisted Physics Studies - Preliminary Results, World Conference on Educational Multimedia, Hypermedia and Telecommunications Vol. 2014, No. 1 (Jun 23, 2014) pp. 1636–1644
19. Manninen, R., Tiili, J. Using pre-lecture assignments to enhance students' learning in introductory physics, PTEE2014
20. S. Suhonen, J. Tiili (2014) Simple Measurement Assignments as Activators in Elementary Engineering Physics, INTED2014 Proceedings, pp. 4057-4066.
21. Suhonen, S., Tiili, J. (2014), Active Engaging Video Assisted Physics Studies - Preliminary Results, World Conference on Educational Multimedia, Hypermedia and Telecommunications Vol. 2014, No. 1 (Jun 23, 2014) pp. 1636–1644
22. Tiili, J., Suhonen S. (2013) Combining Good Practices : Method to study Introductory Physics in Engineering Education, Proceedings of the SEFI annual conference 2013, Leuven, Belgium

Thank you!

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