

Beyond the Classroom: Enhancing Physics Education Through Multimedia and Collaborative Learning

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MPTL

Multimedia in Physics
Teaching and Learning

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1. INTRODUCTION

Well known problems



- education of natural sciences is still in crisis
- the popularity of "physics" has decreased worldwide (OECD: 2000, 2001 201, 2005, 2023)
- literacy and numeracy proficiency in our country is also continuously decreasing
- PISA results:

	2006	2009	2012	2015	2018	2022
Science	504	503	494	477	481	486
Math	491	490	477	477	481	473
Literacy	482	494	488	470	476	473

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1. INTRODUCTION

Drastically reduced nr. of Physics classes

Number of lessons in a week /grade (part of the table)

Subjects	9 (age:14-15)	10	11	12
Hungarian	3	4	4	4
Mathematics	3	3	3	3
History	2	2	2	2
Chemistry	1	2		
Physics	2 ? 3	3 ? 2	4	2
Biology	3	3		
Science		2		
P.E. Sports	5	5	5	5
Geography	2			

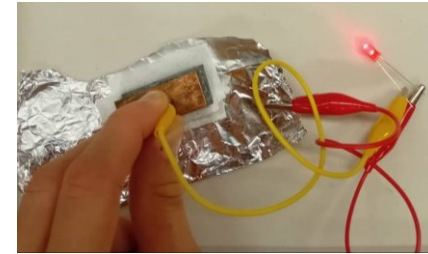
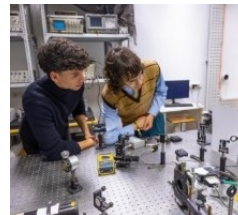
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2. AIM OF THE PROJECT

- to enhance students' motivation
- to raise students' interest in Physics
- to use ICT in Physics Education (where and how ?)

How: ? with the following activities

- hands-on experiments
- study visits
- Physics shows
- performances
- non-formal educational activities



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3. HYPOTHESES

- **Hands-on activities** engage students to form useful scientific concepts
- **Exercises with real-life scenarios** bring our students closer to Science
- Study visits **raise up the students' interest**
- **The use of ICT (mobile devices)** for experiments make the physics education **more effective.**
- **Collaborative learning** will enhance physics education
- Physics performances help students to understand better basic phenomena

OUR EXPECTATION: students will be more interested and involved

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4. METHODOLOGY

The following methods was used during the project

Inquired Based Learning

Hypothesis

Observation

Analyzing

Interpreting

Conclusion

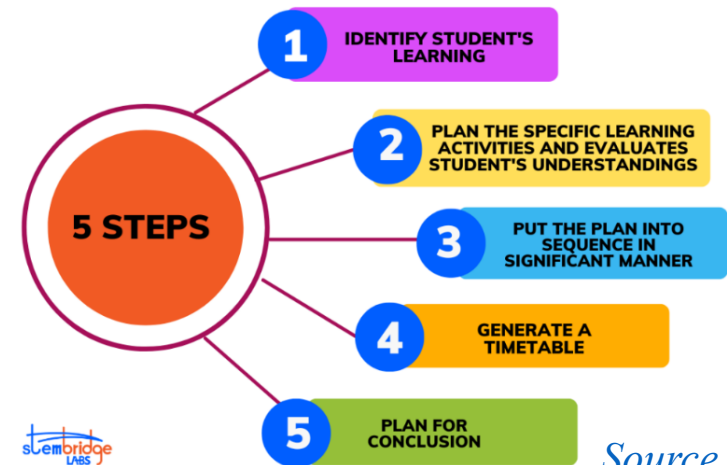
Cooperative learning



Source

Project method

PROJECT BASED LEARNING METHODOLOGY



Source

Source

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5. RECOMMENDATIONS

Physics education will be more effective and students' competence will improve if students:

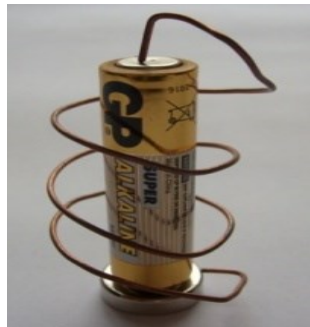
- **do experiments in pair**, discuss the outcome, do some calc.
- **learn how to use their mobile devices** for measurements
- follow invited university lecturer's talk
- participate in professional courses (in school, at university)
- **get involved in talent care activities**: research work at university
- take part in study trips: SEMILAB, Paks Nuclear Power Plant,
- **take part in project**: Physics and music, Researchers' night, etc.

See concrete examples what I did

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6. EXAMPLE OF EXTRA-CURRICULAR ACTIVITIES

EXPERIMENTS AND CALCULATIONS FOR MATURA EXAM (UNIQUE)

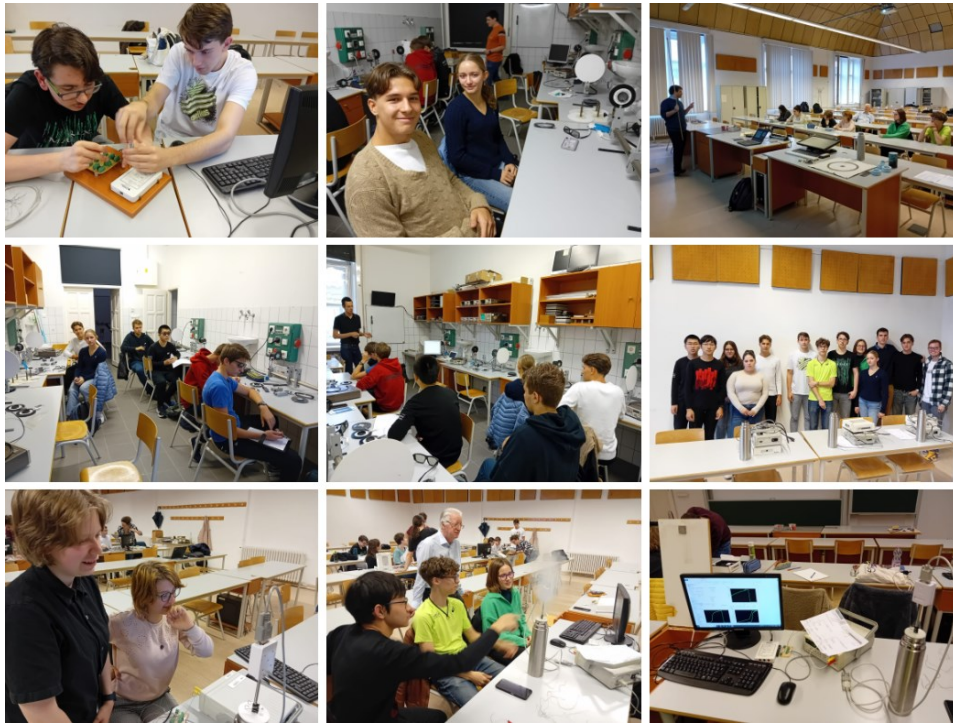


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6. EXAMPLE OF EXTRA-CURRICULAR ACTIVITIES

EXPERIMENTS AND CALCULATIONS AT UNIVERSITY (UNIQUE)

Collaborative learning



Each group completed one measurement

List of small group measurements

- Atomic nanowires
- **Holography**
- **Superconductivity**
- Ultrashort laser pulses
- Liquid crystals in polarized light - from LCD displays to malaria diagnosis
- From the photo effect to lasers and to quantum communication
- Control a nuclear reactor (simulation)
- Semiconductor technology from the first transistor to the smartphone
- Measurements with a Michelson interferometer

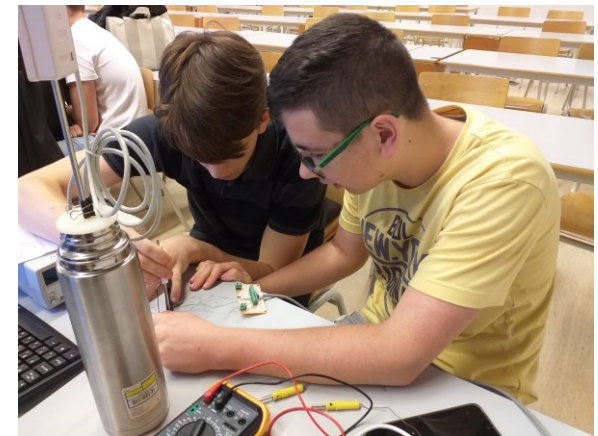
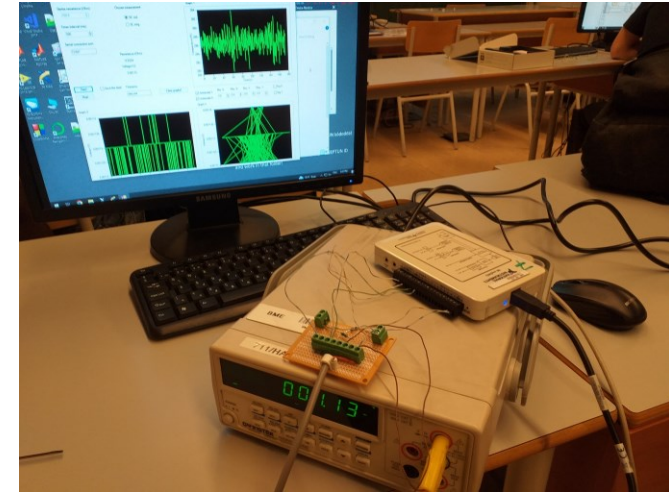


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6. EXAMPLE OF EXTRA-CURRICULAR ACTIVITIES

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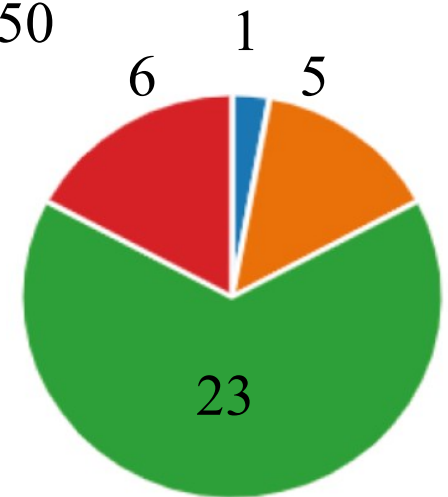
STUDY VISITS

Paks Nuclear Power Plant



Your opinion about characterization of nuclear power plants 28 answers from 50

- harmful
- non-renewable
- safe, important
- green



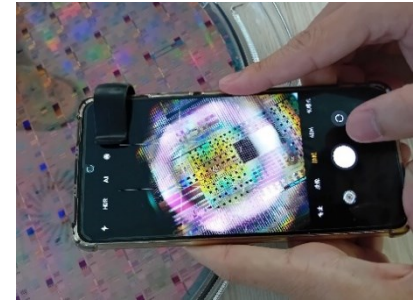
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6. EXAMPLE OF EXTRA-CURRICULAR ACTIVITIES

STUDY VISITS

SEMILAB

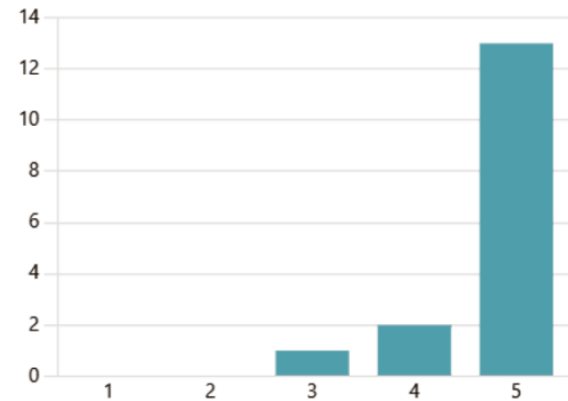
the 5th biggest pure semiconductor metrology company



Feedback from students (scale: 0-5)

Have you been satisfied with the visit?

4.75



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6. EXAMPLE OF EXTRA-CURRICULAR ACTIVITIES

STAGE PERFORMANCE - RESEARCHERS' NIGHT'S ACTIVITIES



ICIN-IZIC



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6. EXAMPLE OF EXTRA-CURRICULAR ACTIVITIES

STAGE PERFORMANCE - RESEARCHERS' NIGHT'S ACTIVITIES



Budapest XIV. Kerületi
Teleki Blanka Gimnázium

Kvantumshow



Boda Tünde Livia



Szepesi Szófia



Kertes Bálint



Kövesi Szabolcs



Czank Liza



Németh Réka



Endrődy Nagy

Jázmin

Tanárok



Iványi Adrienn

Emese



Nagy Anikó

Napsugár



Czufer András

Csaba



Vermes Zoltán



Dr. Jarosievitz Beáta



Szerzők

Dr. Sükösd Csaba



Öveges Tanár Úr Utódai

Fizikai kísérletek nem csak tudósoknak

Budapest, 2025.09.26.



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7. Conclusions

Applied research method – feedback, results

How to measure?

- Action research
- Interview - with students
- Questionnaire

Extracurricular activities play a crucial role in maintaining and enhancing students' interest in STEM subjects

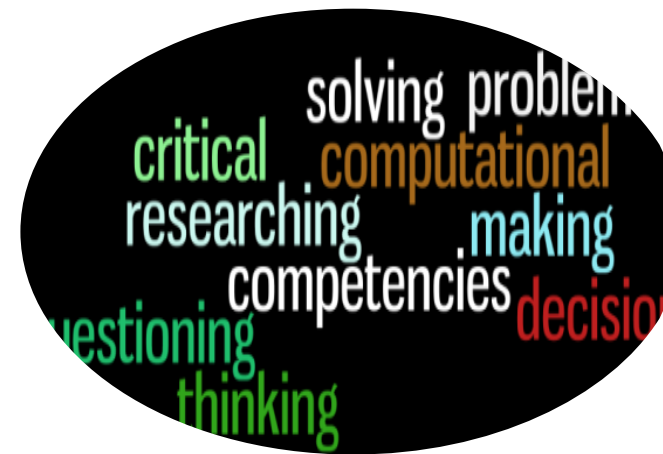
The specific examples and answers support the hypotheses.

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7. Conclusions

Students who had joined each activities

- took part in the activity with enthusiasm,
- Enjoyed the interactive activity,
- learned to make reflections,
- were motivated in problem solving, and thinking,
- used the advantages of cooperation,
- improved their core competencies
- changed their concept related to frightening questions



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7. Conclusions

- The personality of the teacher has a direct impact on the students
- We ourselves influence the students, we motivate them



„...ICT will affect the complete learning process today and in the future.”

(Yves Punie, Dieter Zinnbauer and Marcelino Cabrera, 2012)



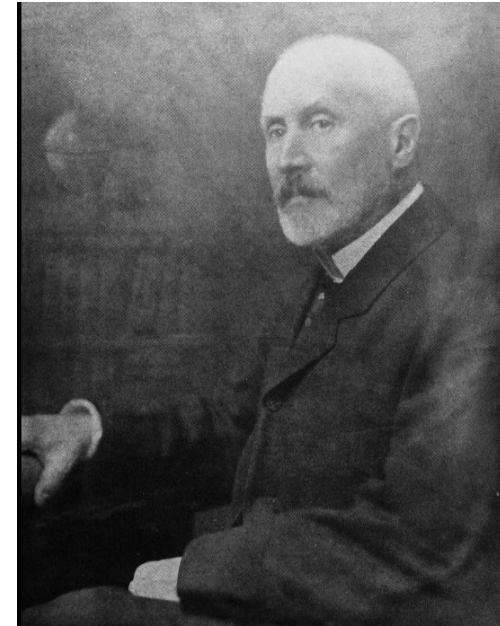
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*“Let us learn from each other so
that we can teach better.”
(Loránd Eötvös)*



Thank you for your attention!