

GIREP 50th Anniversary

ENJOY PHYSICS CLASSES

WITH YOUR OWN DEVICES

Beata Jarosievitz Dr. PhD.

College professor





Institute of Basic and Technical Sciences, Budapest, Hungary

E-mail: jarosievitz@gdf.hu

August 30 – September 3, 2016 (Kraków, Poland)



TABLE OF CONTENT

- 1. History, objectives, raising questions
- 2. The issues to be examined
- 3. Hypothesis
- 4. Participants
- 5. Applied research methods
 - **5.1. Collection of information**
 - **5.2. Skills Survey (TEST)**
 - **5.3. Measurements (BYOD)**
- 6. Results
- 7. Summary and Conclusions
- 8. References



1. History, objectives, raising questions

- use of portable devices has been increased,
- the traditional physics classes are not good enough for attracting the students' focus to the lectures,
- students use their devices for the following purposes :



Made by: <u>https://tagul.com/cloud/2</u>



- 2. The issues to be examined
- use of own devices helps to learn physics more efficiently,
- how to use more efficiently own mobile devices, to perform the experiments,
- are students more active, if they use their own devices during the lectures,
- □ are physics classes considered more valuable by the students, if they use their own mobile devices during the lectures?





3. Hypothesis

- \Box using mobile devices the physics education will be more effective,
- □ students' groups who take part in the experiment can reach better grades in the examination period, than students who had learnt without using their own devices,
- □ students will become more motivated.

Made by: <u>https://tagul.com/cloud/2</u>





4. Participants. Students of:

- ✤BSc in Computer (IT) Engineering
- BA in Business Administration and Management ____

from Dennis Gabor College, whose study includes courses like: **Physics**

- Nr. of students enrolled to Physics course (yearly in II. semester):
- total: 188; Full training (FT): 68; Distance training (DT): 120
- In the first year of BSc studies all students study the same modules.
- Credits: 5 (first year, II. semester) Written exam
- Full training education (FT) L (lecture): 30 hours, S (seminar): 15 hours
- Distance training education (DT): L (lecture): 6 hours, S (seminar): 3 hours
- Course description: Mechanics; Thermodynamics; Optics; Nuclear Physics

ENJOY PHYSICS CLASSES WITH YOUR OWN DEVICES

5. Applied research methods

5.1. Collection of information(General Questions, pre-training)

before starting the course,

- with own devices (BYOD),
- individually,
- using:
- EvaSys Education Survey Automation Survey
- 31 questions (different types).

5.2. Skills Survey (**TEST**) (From various chapters of Physics)

- during the semester, 5 times,
- with own devices (BYOD),
- TURN TO YOUR NEIGHBOUR!
- using Socrative









5.1. Collection of information (*results*)

Survey filled by: 82 students = 46,80 %



Example:

Did you have any hands-on activities or measurements in laboratories, during the Physics classes, in your previous studies?





5.1. Collection of information (results)



5.1. Collection of information (*results*)





5.2 Skills Survey (TEST) Results with

88:	socrative
	by MasteryConnect

Date of the survey	Total participants during the lectures	Survey filled by participants	Results reached by the group
23. 02.2016.	45 (66,17 %) FT	27 (39,70 %) FT	35 %
08.03.2016.	24 (35,29 %) FT	20 (29,41 %) FT	48,5%
05.04.2016.	18 (26,47 %) FT	14 (20,58 %) FT	25%
26.04.2016.	21 (30,88 %) FT	19 (27,94 %) FT	41,6 %
13.05.2016.	16 (23,59 %) FT	14 (20,58 %) FT	40,8 %
13.05.2016.	30 (25 %) DT	25 (20,83%) DT	49,9 %



5.2 Skills Survey (TEST) (results)





Quiz name: Teszt4_aprilis19 Question with Most Correct Answers: #4 Question with Fewest Correct Answers: #6 Date: 04/26/2016 Total Questions: 10

Egyik autó kötéllel vontatja a másikat. Óvatos indulással a vontatott jármű akármilyen sebességre gyorsítható. Hirtelen indulásnál a kötél mégis elszakad. Miért? (A súrlódástól tekintsünk el.)
3/19 A vontatott kocsi csak kis gyorsulással indulhat, mert viszonylag nagy a tömege.
5/19 B Adott impulzusváltozást rövidebb idő alatt csak nagyobb erő képes létrehozni.
7/19 C A vontatott autó adott sebességváltozásához hosszabb idő kell.
2/19 D A kötél szakítószilárdsága függ a vontatás sebességétől.



- 5.2 Skills Survey (TEST) (results)
- Which statement is true for a perfectly inelastic

collision?

a) only the momentum is conserved

- b) only the energy is conserved
- c) both the momentum and the energy are

conserved

d) none of the momentum and the energy is conserved





5.2 Skills Survey (TEST) (results)

A compressed spring is placed between two trolleys of masses 200 g and 400 g respectively. They are in equilibrium at this stage. When the spring is released, the 200 g trolley starts moving with a speed of 6 m/s. At what speed will move the other car?

a) 1 m / s

b) 2 m / s

c) 3 m / s

d) 6 m / s





5.2 Skills Survey (TEST) (results)

In which group are units of the SI system exclusively?





- 5.2 Skills Survey (TEST) (results)
- Which statement is true?

If some further quantity of the same temperature ideal gas is added to a container, then...

- a) the pressure is increased.
- b) the temperature is increased.
- c) the pressure and the temperature increas
- d) the temperature is reduced.





- 5.2 Skills Survey (TEST) (results)
- The frequency of a vibrating mass is 2 Hz.
- After displacing it 0,2 cm from its equilibrium state we release it.
- What is the displacement after 0,125 s?
- a) 0,1 cm
- b) 0,2 cm
- c) 0,0 cm





- **5.3. Measurements (BYOD)**
 - Aim of the measurements:
 - Determining the value of the gravity acceleration (g)
 - How? Teacher Student demonstration (experiment, during the course)

Measurement methods:

- □ recording and analysing the sound of the ball rolling and free falling
- □ video recording and analysing the movement of the free falling ball

$$h = \frac{g \cdot t^2}{2} \qquad \Longrightarrow \qquad g = \frac{2 \cdot h}{t^2} \qquad g = 9,81 \frac{m}{s^2}$$





- **5.3. Measurements (BYOD)**
 - **Necessary materials:**
 - steel ball
 - table
 - ruler
 - laptop + microphone
 - Audacity free program

(<u>http://www.audacityteam.org/</u>)







5.3. Measurements (BYOD)

See the video:





5.3. Measurements (BYOD)

Analysis (after noise filtering) of the recorded sound file



Fajl Szerkesztés	Nézet Vezérlők Sávok Generálás Effekt Analizálás	Súgó	
	IZI	B	
00		4) 🚽 -36 -24 -12 0 🎤 🚽 -36 -24 -12 0	
MME	🔹 🕩 Hangszórók (High Definition AL 🔹 🎤 Mikrofon (High De	finition Audic 💌 2 (Stereo) Input C 💌	
- 0,30 - 0	10 0,00 0,10 0,20 0,30 0,40 0,50 0,60 0,70 0,80	P.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00	2,10 2,20 2,30 2,40 2,50 2,60 2,70 2,80 2,90 3,00 3,10 3,20 3,30 3,40 3,5
× Audio Sáv ▼ Sztereó, 44100Hz 32 bites lebegő		and the second sec	THIALWINU
Nema Szoło	0.0-	and the second	WAY WAY AND THE REAL PROPERTY OF THE REAL PROPERTY
	0,0-		
	[-0.5]		
	•		
Projekt ráta (Hz) 44100 -): Kijelôlés kezdete: ○ Vég Hozzáillesztés □ 00 ó 00 p 00.868 mp▼ 00 ó		



5.3. Measurements (BYOD)

Analysis (after noise filtering) of the recorded sound file

A 2	- 0 X
Fáji Szerkeszt <mark>v</mark> e Mírtee: Vezértők Sávok Generálás Effekt Analizalás Súgó	
الاستار المراجع من المراجع	
	13,0 14,0
X Audu Sax ▼ 1.0 Sdereb, 44'30Hz 0.5 News Sr/H	
1.0 0.5 0.0 -0.5 	-
R H	P
² ×jekt ráta (H∠) – Kijeliú ús kezdele	
Katt 🕨 żysiała kurzyst az audio kij cioloszkaz	
Marrow III Indume. Diegoret. Die Jobbe. Diegoret. Korwen II. Korwen II. 🕰 Vicrow. 🗛 / Hu	∎ 40 🛱 22:00 2016.03.10.



5. Applied research methods

5.3. Measurements (BYOD)

Measurement results:

Nr. of. meas.	h (m)	t (s)	t ² (s)	g (m/s ²)	$x_{a} = \frac{\sum x_{n}}{n}$	$(\Delta x)^2$	δ χ
1	0,73	0,383	0,15	9,95			
2	0,73	0,386	0,15	9,80			
3	0,73	0,398	0,16	9,22	9,67	0,2929/	20)
4	0,73	0,393	0,15	9,45			3%
5	0,73	0,383	0,15	9,95			
Average	0,73			9,67			
$\chi_{\dot{a}} = \frac{\sum \chi_n}{n} (\Delta x)^2 = \frac{1}{n-1} \sum_{i=1}^n (x - x_{\dot{a}})^2 \qquad \delta x = \left(\frac{\Delta x}{\chi_{\dot{a}}}\right) \cdot 100$							



5.3. Measurements (BYOD)

Necessary materials :

- Handball (any large, highly visible balls)
- ruler
- smart phone or tablet
- laptop
- Tracker free program



(<u>http://physlets.org/tracker</u>)

Source: <u>http://moodle.scientix.eu/course/view.php?id=179</u> Author: Carlos Cunha





5.3. Measurements (BYOD)

free video program suitable for analysis of the recorded video files





5.3. Measurements (BYOD)

Processing of the measurement results:

The general form of the a quadratic function:

• For free fall we have parabolic functions:

$$a = \frac{g}{2} \quad \Longrightarrow \quad g = 2 \cdot a$$

Read the "*a*" value from the graph

See the video:

 $y = a \cdot x^{2} + b \cdot x + c$ $y = \frac{g}{2} \cdot t^{2} + v_{0} \cdot t + y_{0}$





ENJOY PHYSICS CLASSES WITH YOUR OWN DEVICES

5. Applied research methods

5.3. Measurements (BYOD)

See the video:







5.3. Measurements (BYOD)

Measurement results:

Files	a	g (m/s ²)	$\chi_{\dot{a}} = \frac{\sum \chi_n}{n}$	(δx	
20160311_123159.mp3	4,630	9,260				
20160311_123217.mp3	4,620	9,240	\bigcirc		1%	
20160311_123235.mp4	4,720	9,440	(9,33)	0,07466619		
20160311_123253.mp4	4,670	9,340				
20160311_123316.mp4	4,691	9,382				
Average		9,33				
$\chi_{a} = \frac{\sum \chi_{n}}{n} \qquad (\Delta x)^{2} = \frac{1}{n-1} \sum_{i=1}^{n} (x - x_{a})^{2} \delta x = \left(\frac{\Delta x}{\chi_{a}}\right) \cdot 100$						



- **6. Results** (*derived from personal interviews, students' feedback*) Students who had joined the courses:
- took part in the research activity with enthusiasm,
- enjoyed the experiments made with smart phones and tablets,
- filled in the surveys with pleasure,
- cooperated with their neighbours ,,Turn To Your Neighbours" (Mazur, 2014; Le Roux, 2013),
- were motivated in problem solving, and thinking,
- used their own devices with expertise,
- students like to talk face to face with the teachers.



- 7. Summary and Conclusions
- Problems are the following:

Students:

- have not really attended the lectures (only: 20-30%),
- were confident (erroneously) that the material can be learnt in a short time,
- did not have enough basic knowledge from their previous study.

ICT + use of **OD** is not enough to study and learn Physics!

Future plans. Promotion of Physics, prepare and do more experiments, motivate students to use their own devices for study, measurements and experiments! **Students' attitude to Physics should be changed!**

ENJOY PHYSICS CLASSES WITH YOUR OWN DEVICES

8. References

- •Beáta Jarosievitz (2016): The impact of ICT and multimedia used to flip the classroom (Physics lectures) via Smart phones and tablets, In: Proceedings of the 20th International Conference on Multimedia in Physics Teaching and Learning, Edited by Lars-Jochen Thoms and Raimund Girwidz, Published by the European Physical Society; September 9–11, 2015; at LMU Munich, Germany; Volume number: 39 B.; pp. 357-363. ; ISBN: 978-2-914771-94-8
- •Kelly Miller, Julie Schell, Andrew Ho, Brian Lukoff and Eric Mazur (2015): Response switching and self-efficacy in Peer Instruction classrooms, Physical Review Special Topics, 11
- •Pearson. Suzaan Le Roux (2013): Mobile Learning as a paradigmatic mechanism to facilitate technology-based learning in a development country, Cape Peninsula Univ. of Technology
- •Mazur, E. (2014). Peer Instruction: Pearson New International Edition: A User's Manual.



"The future cannot be predicted, but futures can be invented".

DENNIS GABOR: Nobel prize winner for holography: 1971

Thank you for your attention!