Experience on International Masterclass at UNSA

FEHIMA UGARAK

Content

High Energy Physics

Achievements

ALICE

Results

Conclusion

HITRI
Heavy Ion Therapy Research Integration

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008548
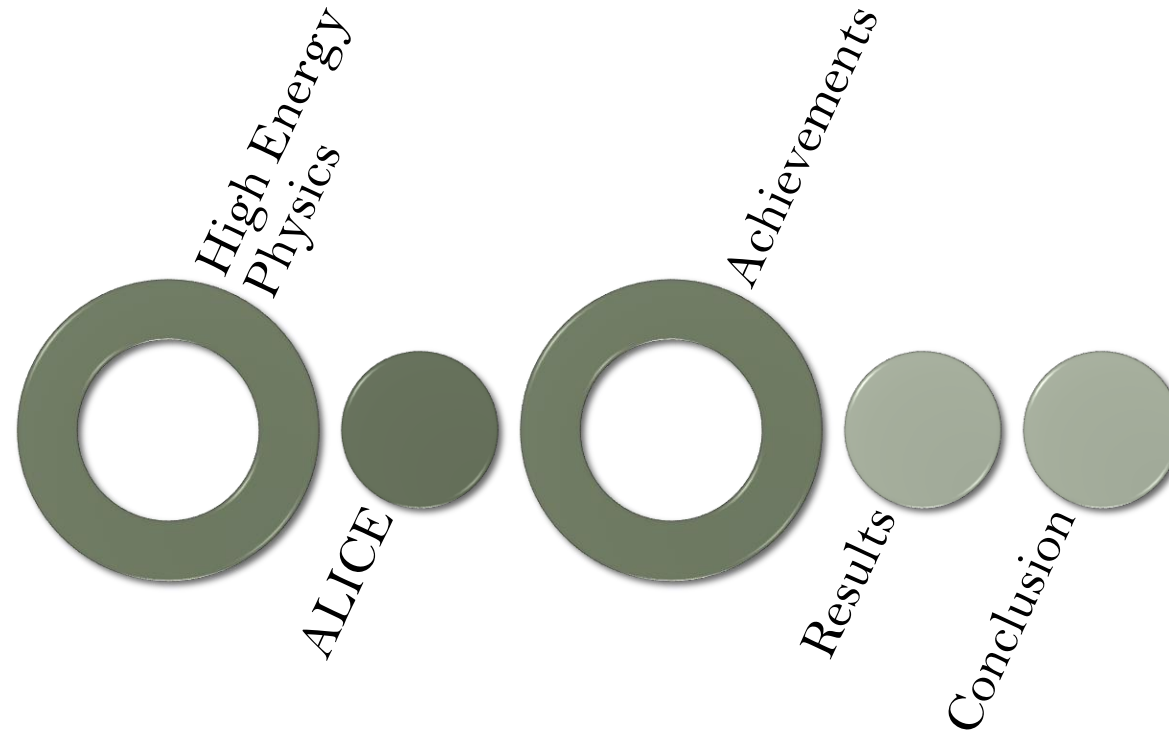
Purpose of the investigation

Teaching units- elementary particles, the structure of matter, the origin and structure of the Universe and the interaction of particles.

Difficulties in processing these units - are too abstract and occur at a level that is not accessible to the human senses.

In order to better understand these teaching units and bring science closer to young ages, we organized ALICE (A Large Ion Collider Experiment) masterclass.

The main purpose of this research is to examine the effectiveness of teaching high energy physics in an online environment as well as to examine the importance of science for students.

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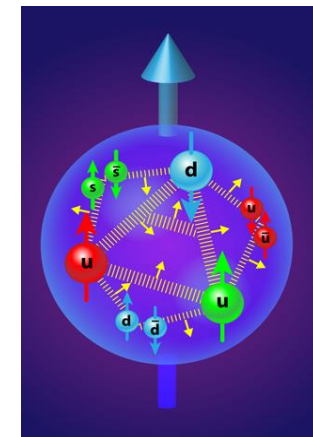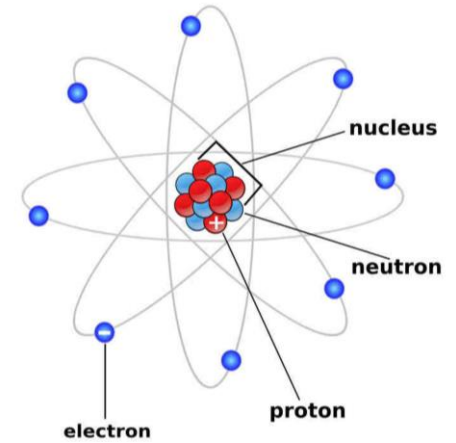
Searching for „strange" particles with your friends

A Large Ion Collider Experiment
- ALICE masterclass -

3D View

Detector

$$K_s^0 \to \pi^+ + \pi^-$$

$$\lambda \to p^+ + \pi^-$$

$$\overline{\lambda} \to \overline{p}^- + \pi^+$$
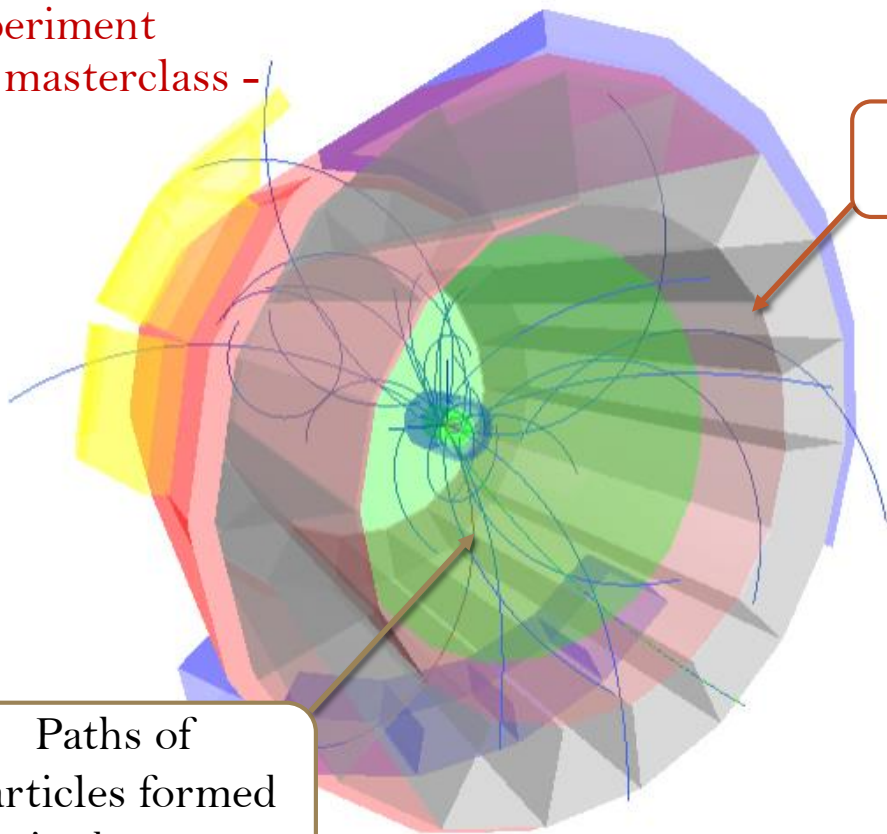
Paths of particles formed in decays

strange quark

Mesons

Lambdas

$\overline{ds}, \overline{ds}$

K^0
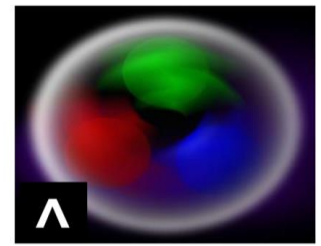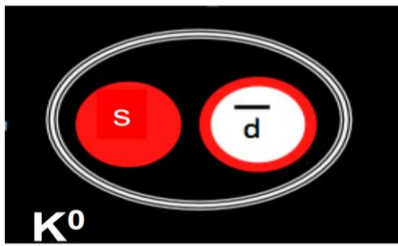
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Who was involved?

While using the software you need:

Direct students' attention

Ask students questions

Give instructions

14 tutors (professors and students)

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166 high school students from Sarajevo, Tuzla, Konjic, Kakanj, Travnik and Kalesija.

Tests, surveys and participants

Hypothesis

Cognitive achievement test:

improve students' knowledge of high energy physics.

Hypothesis

Affective achievement test:

improve students' interest in science.
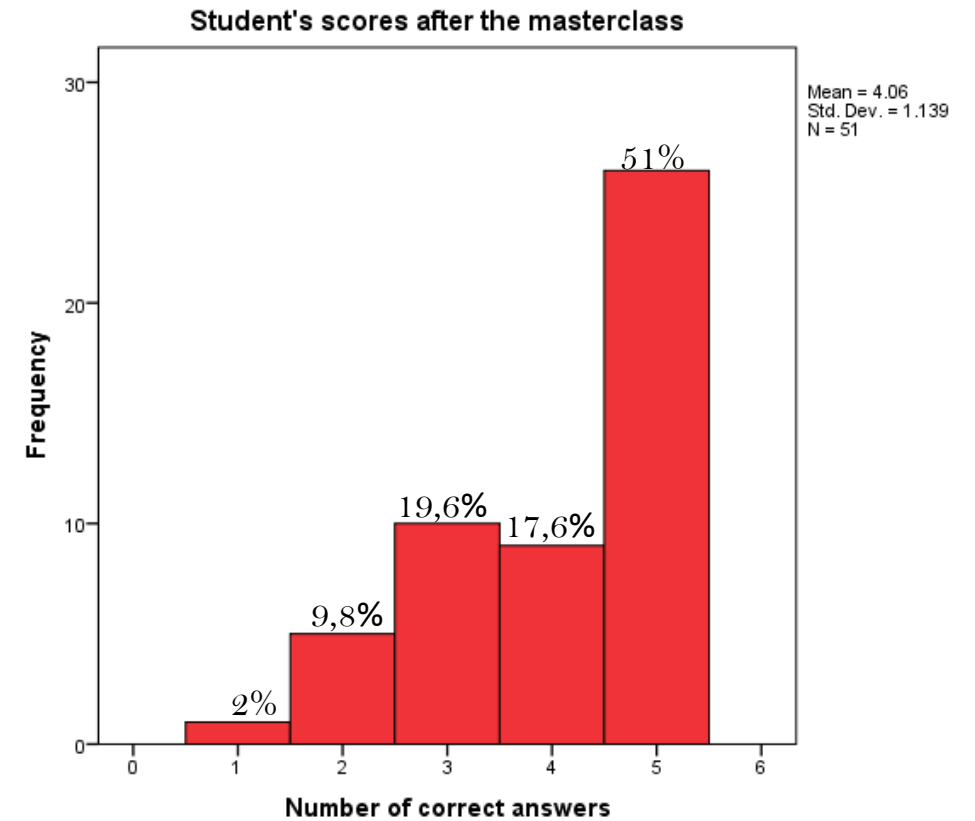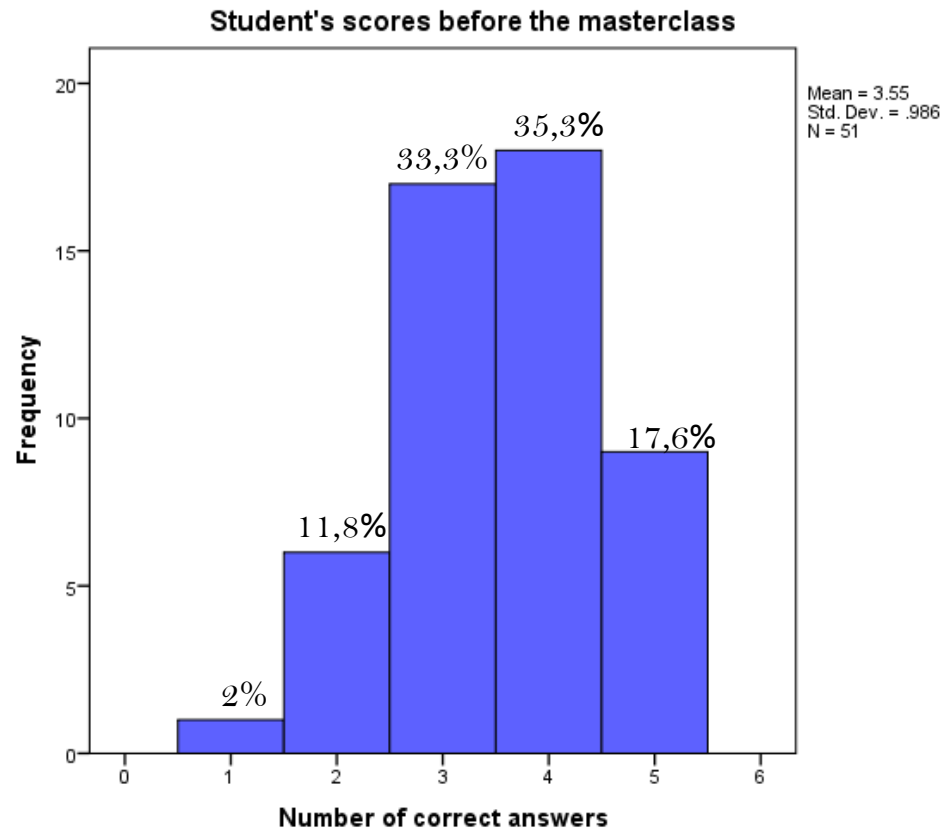
Population

The ideal population would be all high school students in Bosnia and Herzegovina who study units related to high energy physics.
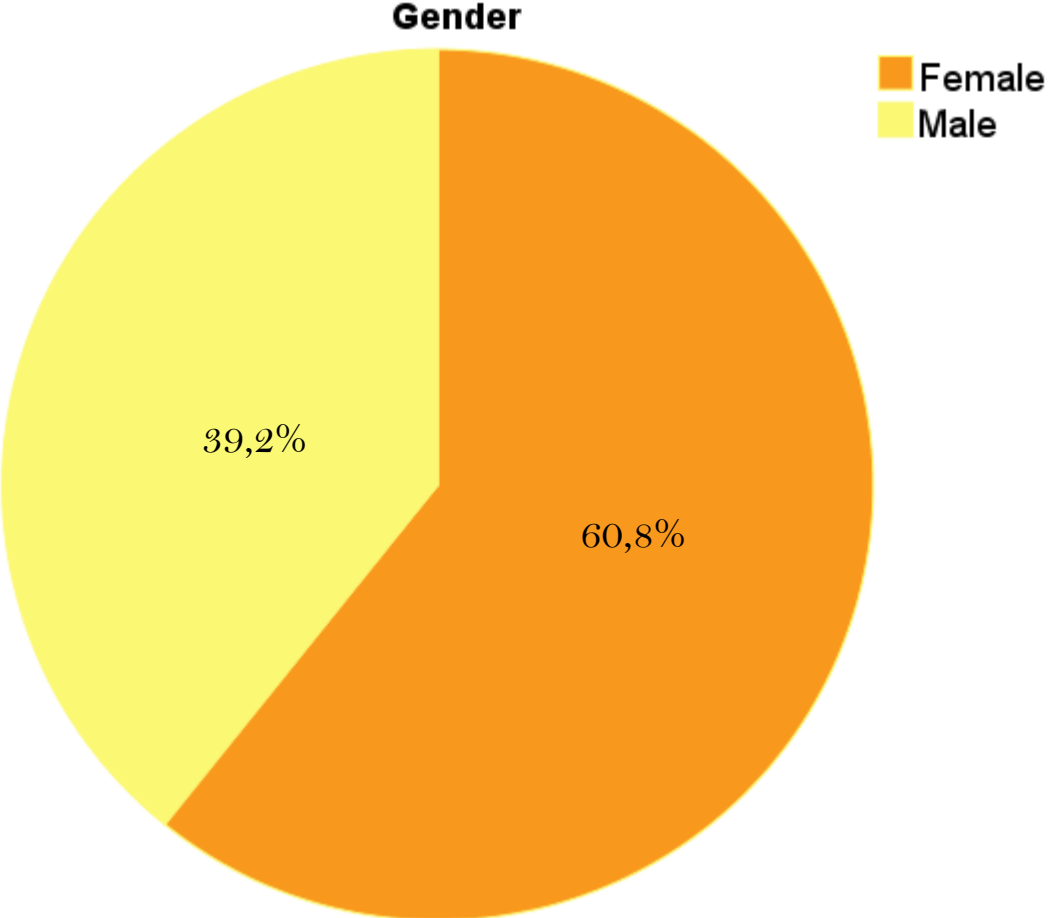
Sample

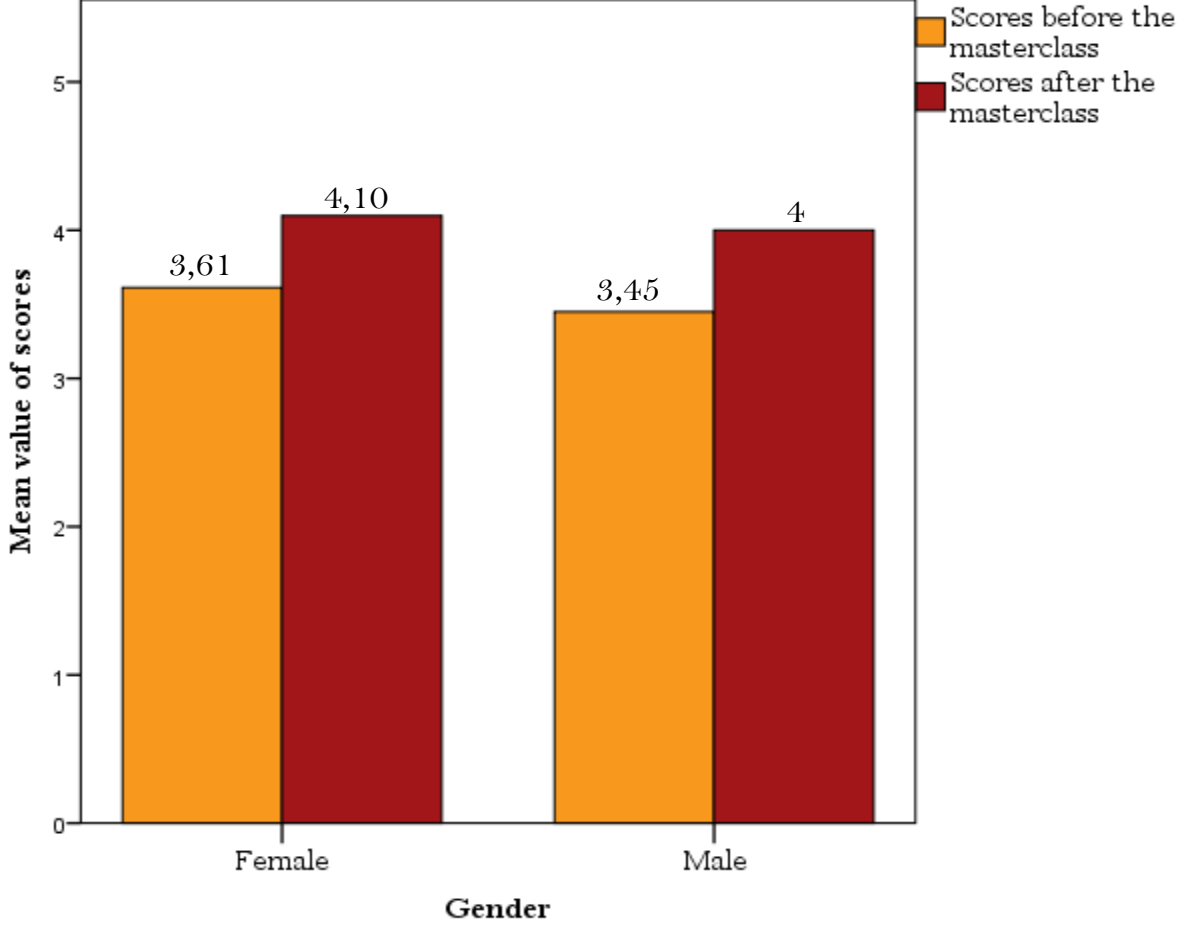We took as a sample all school students who have participated in the ALICE masterclass.

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Results of cognitive achievement

Student's scores before the masterclass

Mean = 3.55
Std. Dev. = .986
N = 51

35,3%
33,3%
17,6%
11,8%
2%

Frequency

Number of correct answers

Student's scores after the masterclass

Mean = 4.06
Std. Dev. = 1.139
N = 51

51%
19,6%
17,6%
9,8%
2%

Frequency

Number of correct answers

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Percentage of female and male students involved in this survey

Gender

- Female
- Male

39,2%

60,8%

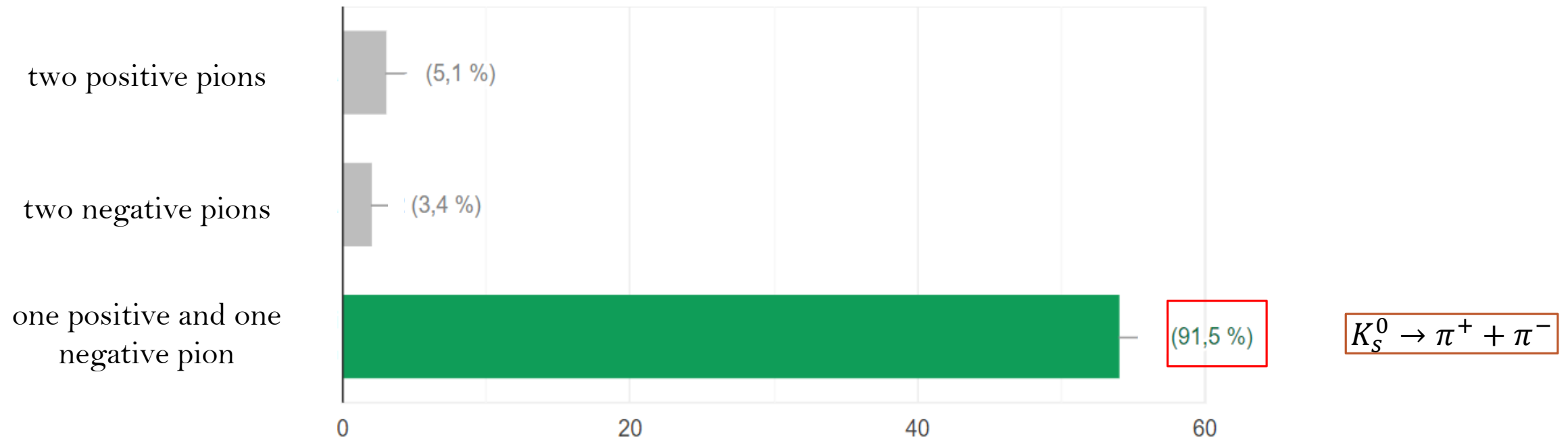## Results of cognitive achievement before and after the masterclass depending on gender

- Scores before the masterclass
- Scores after the masterclass

Mean value of scores

3,61   4,10   3,45   4

Female   Male

Gender

Are means of scores results before and after masterclass significantly different?

[1] Null hypothesis: There is no significant difference between the two mean scores.	[2] p=0.05 (level of significance)
Our result gives: p=0.002 < (0.05)	Difference between means of scores before and scores after the masterclass is statistically siginificant.

Paired samples t-test

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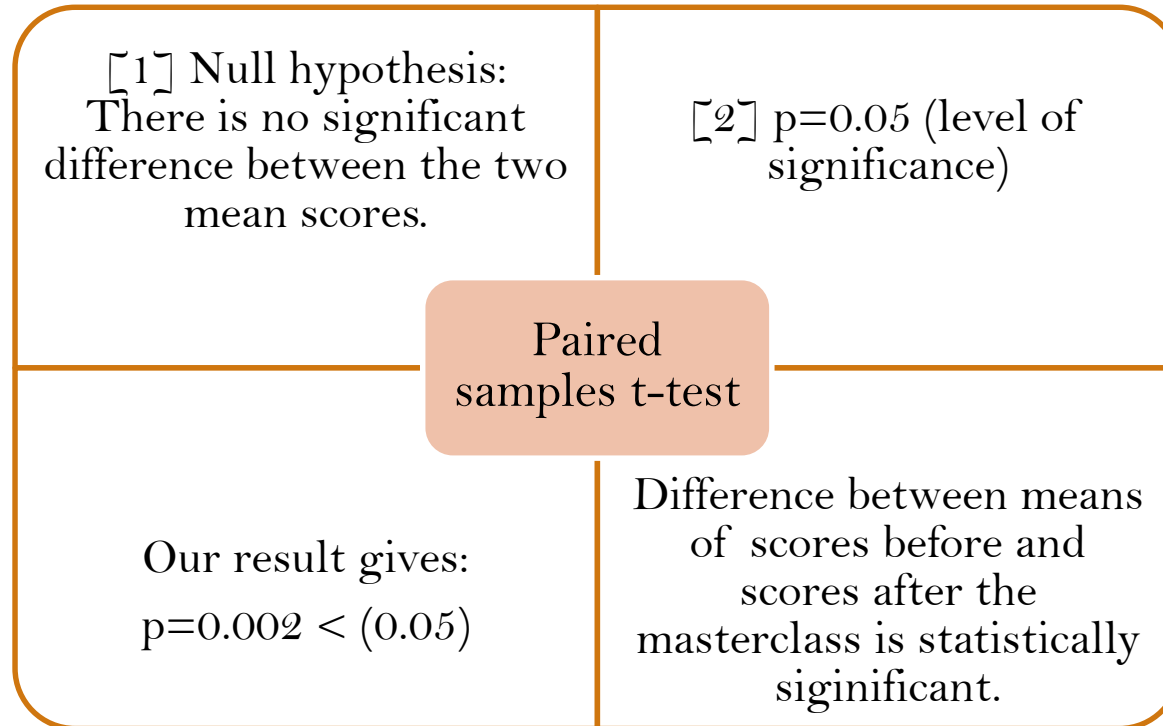
The neutral particle kaon (K0) decays on:

two positive pions — (5,1 %)

two negative pions — (3,4 %)

one positive and one negative pion — (91,5 %)

$K_s^0 \rightarrow \pi^+ + \pi^-$

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Results of affective grades before (blue) and after (green) the masterclass
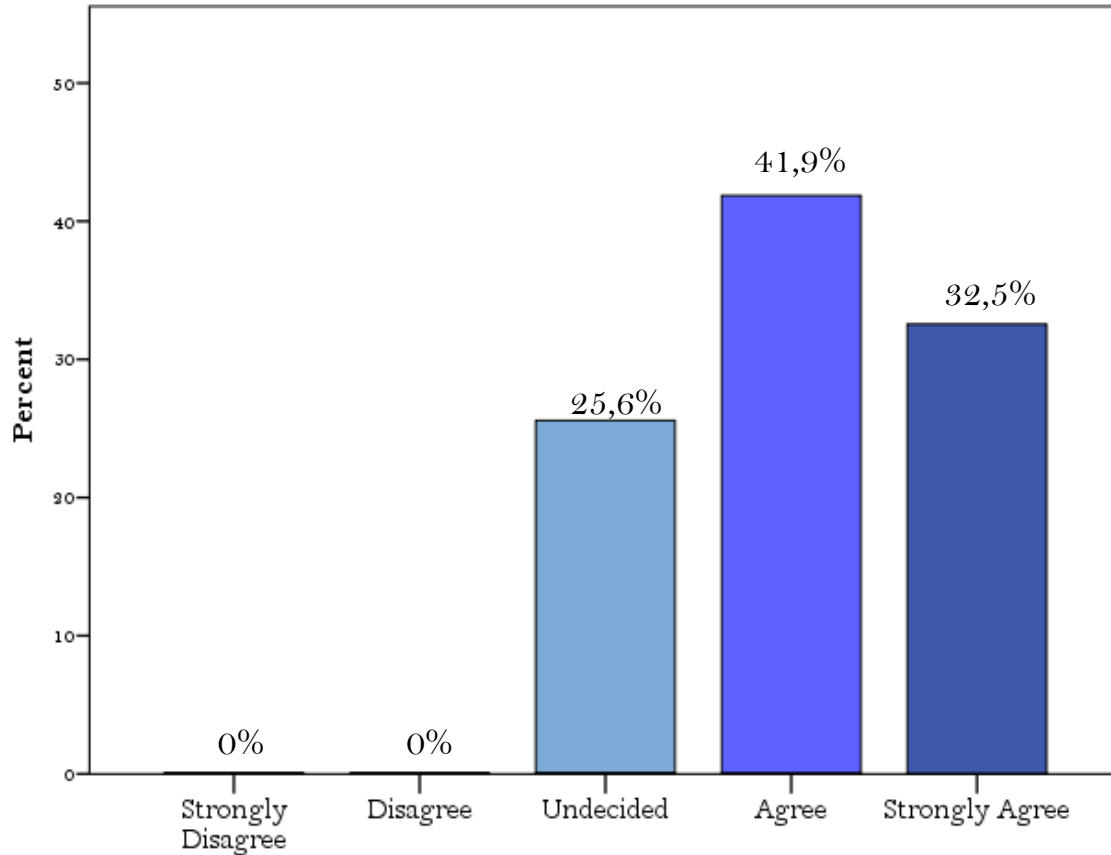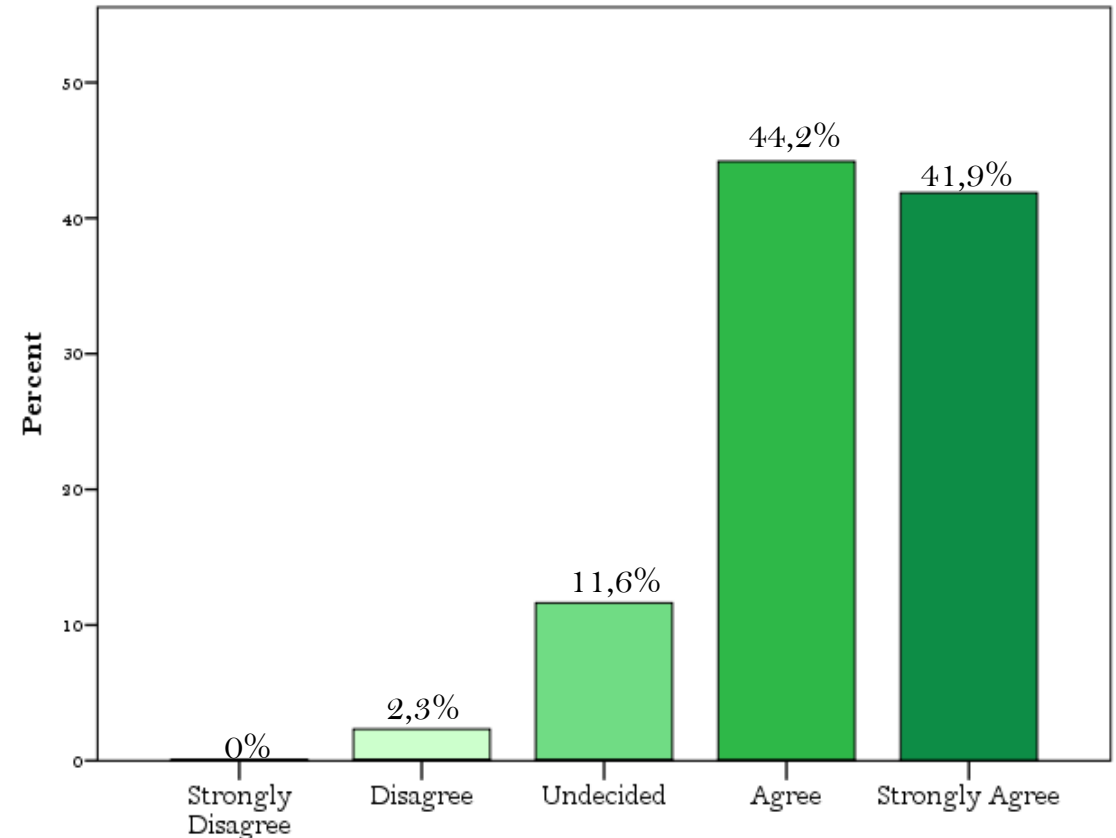
Results of affective grades before and after the masterclass
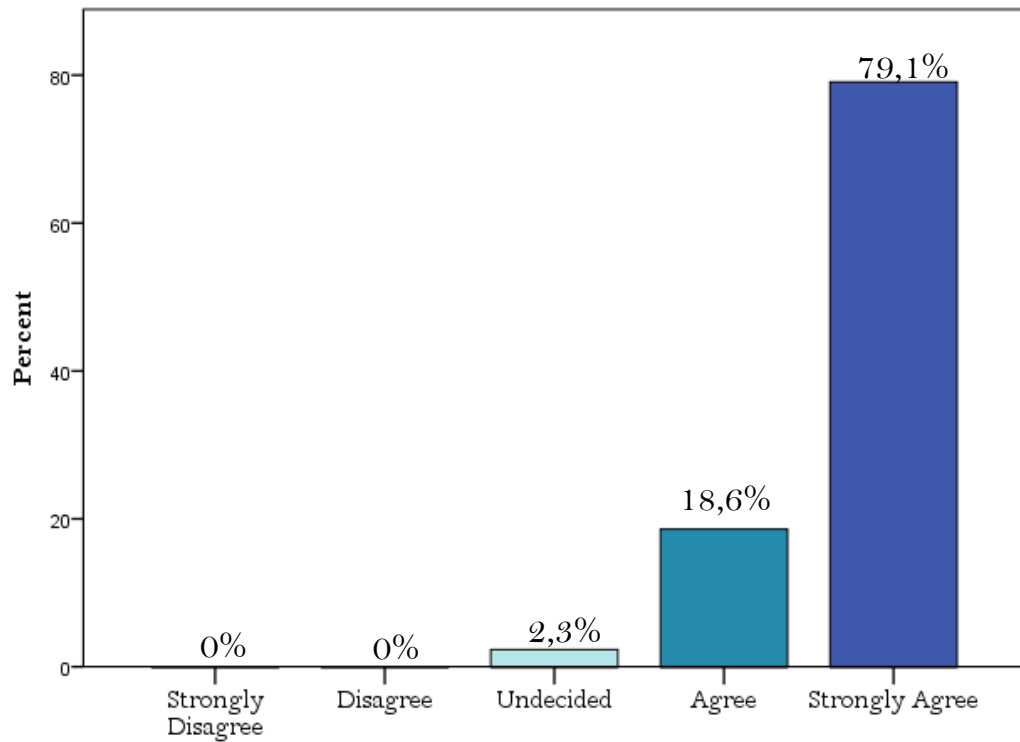
I consider CERN (Physics generally) to be very important for the development of society and technology.
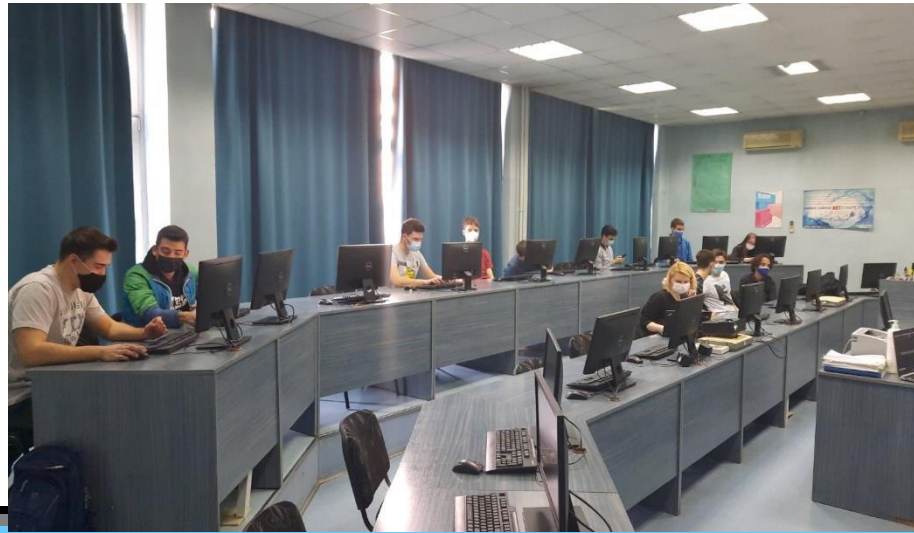
Results of affective grades after the masterclass
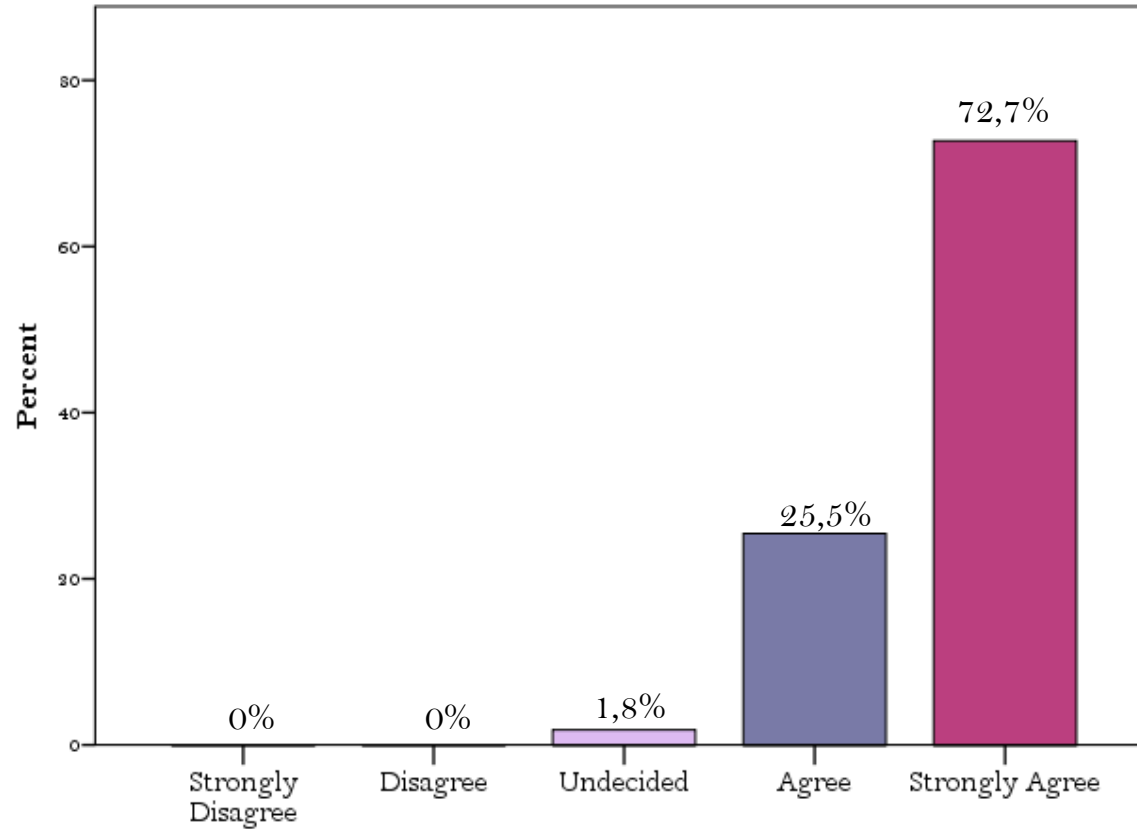
I really liked the whole organization as well as the masterclass itself.

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Photos from the ALICE masterclass (5th March, 2021.)

Conclusion

Positive

Positive feedback from students and professors.

It can be observed an increase in understanding of the importance of physics.

The development of a deeper understanding. Progress in cognitive achievement.

Interactive learning, interesting and fun for students.

Negative

Maybe, the masterclass would be more interesting, if could be organized in class, not in online version.

An interactive research learning environment can be very demanding and can create cognitive overload for beginners.

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Thank you!

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