Comparing learning outcomes in traditional and gamified lecture formats

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The Future of Education Conference

Number of students

1. **1st term Informatics part-time studies – 60 people**
2. 2nd term Informatics full-time studies – 230 people
3. 2nd term Automatics, Cybernetics and Robotics – 120 people
4. 2nd term Biomedical Engineering – 60 people
5. 2nd Electronics and Telecommunications – 220 people

Total: 690 people Lecture: 15 h
Analyzed term: 58 students of 1st term Informatics part-time studies.
The whole course contains two blocks:

- *Electronics* (totally 50%): 25% lecture and 25% laboratory
- *Metrology* (totally 50%): **25% lecture** and 25% laboratory

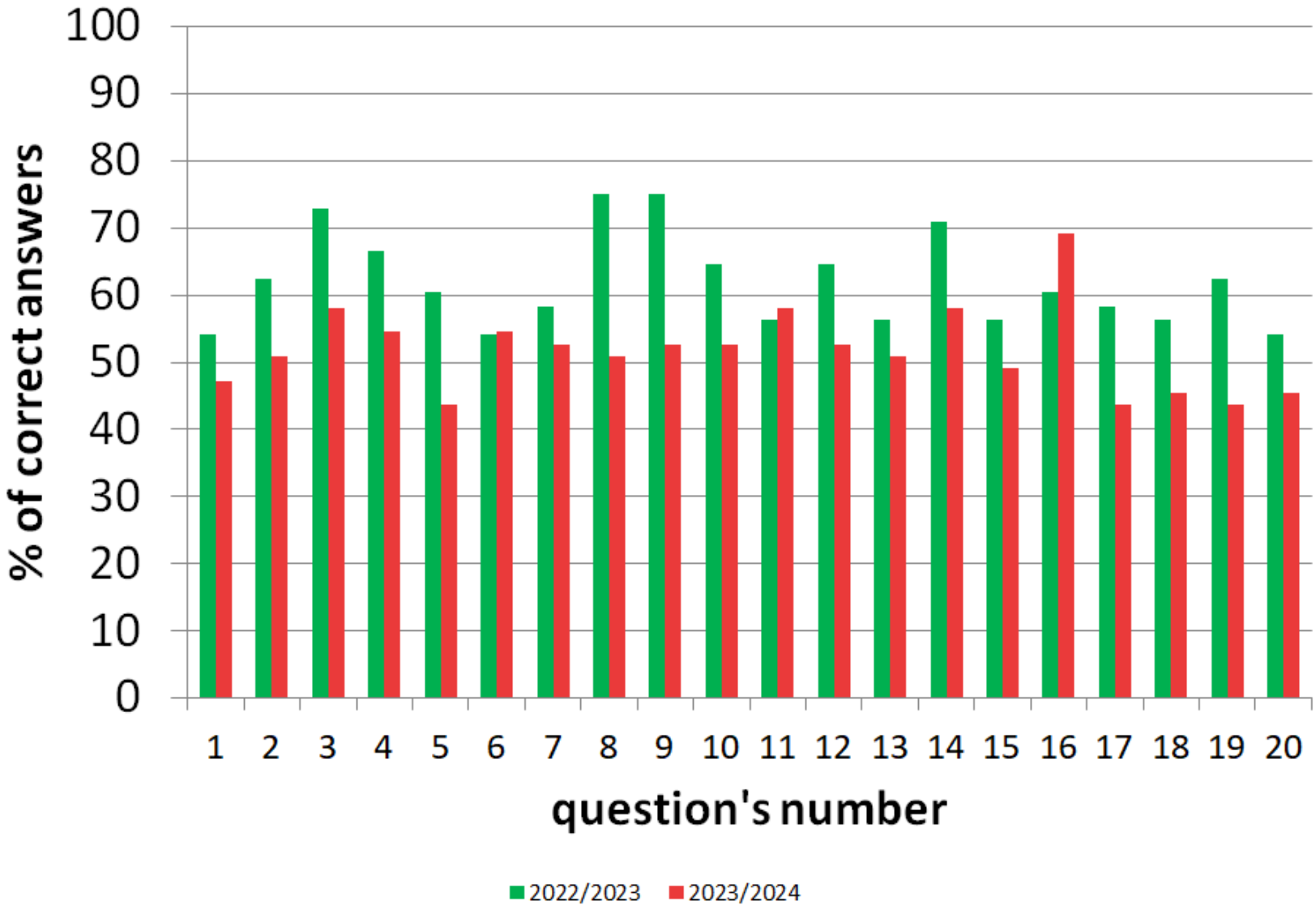
There is passing threshold for whole course: more than 50% of all points.

Verification of learning outcomes

1. end-semester colloquium, min. 2 weeks after the last lecture
2. test: 20 „All or nothing” questions on Moodle (only marking the correct combination results in awarding a point) - factual knowledge
3. time: 15 minutes

No passing threshold for the test.

Results

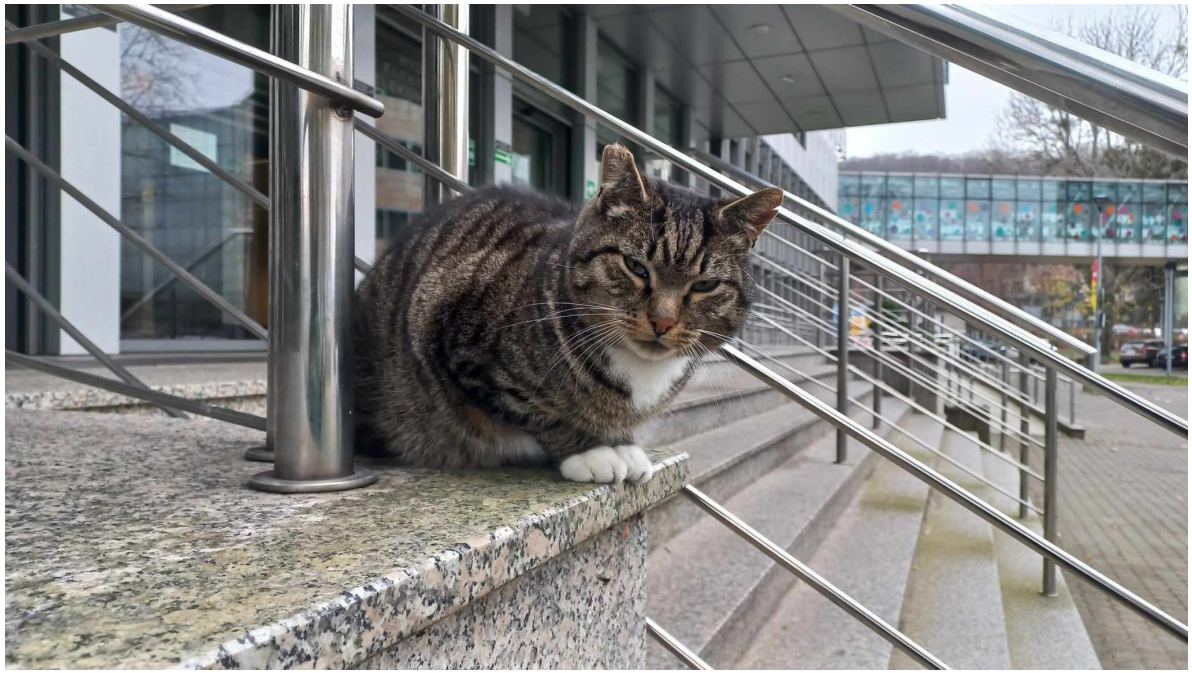

100
90
80
70
60
50
40
30
20
10
0
% of correct answers
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
question's number
2022/2023
2023/2024

Verification of learning outcomes

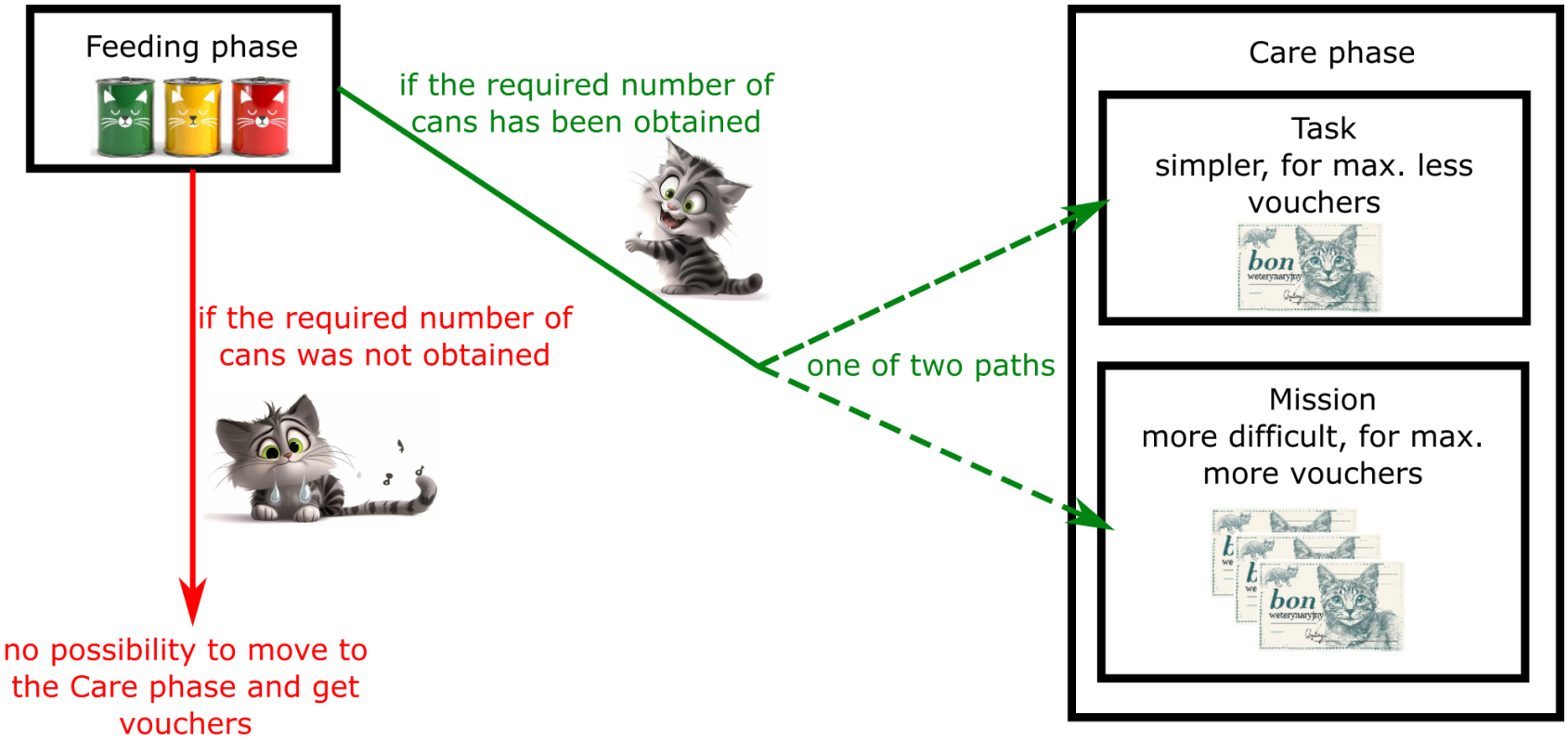
Goals:

- mobilizing students to study regularly
- introducing practical, computational tasks related to literature and the work of an engineer
- introduction of the possibility of choosing the path of completion
- introducing an interesting background
- arousing emotions by choosing a more difficult/easier test and actually feeding the cat Gabrys

Verification of learning outcomes



Verification of learning outcomes



Verification of learning outcomes

Subject	Feeding phase		Care Phase - one of two options	
			The task is easier - getting a voucher	A more difficult task - completing the mission
	Max number of cans	Number of cans to move to the care phase	Max number of vouchers	Max number of vouchers
Error Theory	3	2	1	3
Multimetrs	3	2	1	4
Oscilloscopes	3	2	1	3
Time, frequency and phase measurements	2	1	1	2
DC/AC voltages	2	1	1	2
AC/DC Converters	3	2	1	4
RLC and non-electrical measurements	3	2	1	3

Verification of learning outcomes

Game construction:

- cans: max. 19
- tasks: max. 7
- missions: max. 21

The result in % is scalled to 25% of whole course.
The maximum number of points is 40. Therefore, solving only the canned tasks gives less than 50% of 25% of whole course. It is recommended to do tasks or missions.
Number of people who chose gamification: 56 (97% of 58 people).

Verification of learning outcomes

New types of tasks

- read an industry article and answer the questions – reading comprehension skills
- analyze the catalog note and calculate – the ability to find information and use it

Limited time to do the homework with deadlines.

Analysis of the effects of the conducted gamification

Construction of tasks

- factual knowledge questions – „All or nothing” questions

Multiple choice question - you must marked exactly the right answer(s).

Example:

Wild boars feed on

- [ ] a. people
- [ ] b. electronic equipment
- [ ] c. apples
- [ ] d. plant shoots
- [ ] e. insects

Analysis of the effects of the conducted gamification

Construction of tasks

- factual knowledge questions – „Missing Words” questions

In this type of question, you select a matching word from a drop-down list.

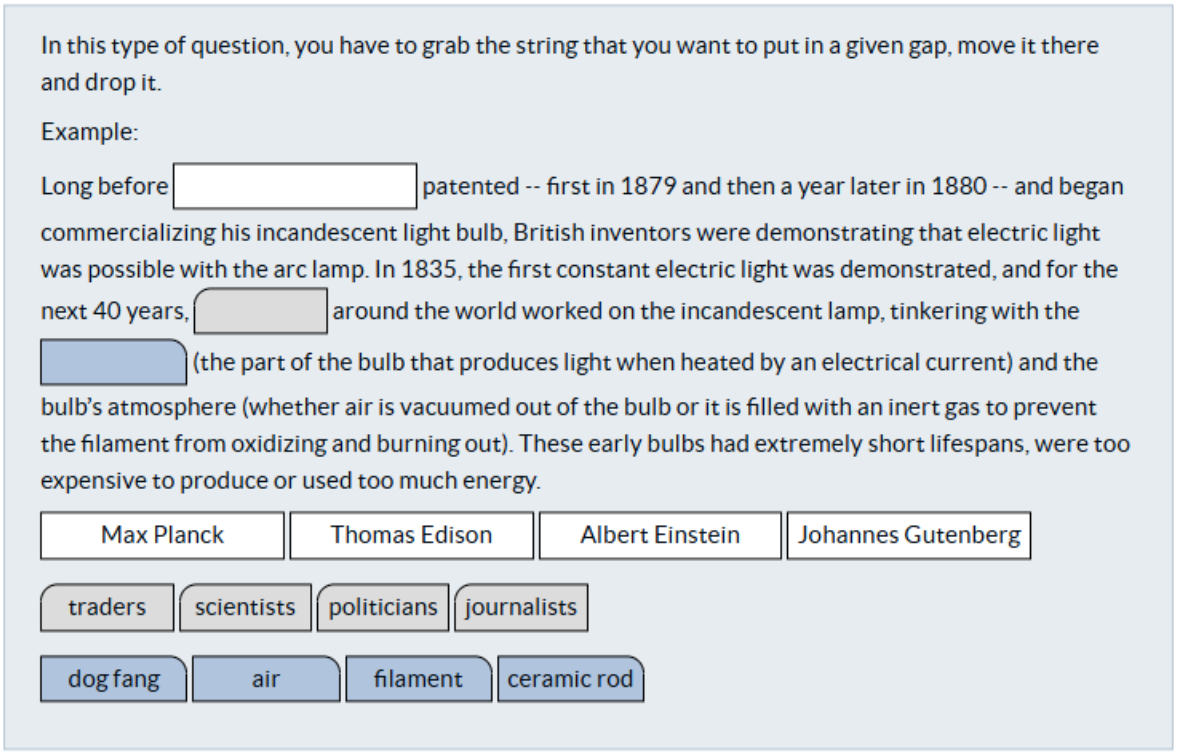
Example:

The whale shark is a species of cartilaginous [ ] fish, the largest representative of sharks, easily recognizable by its specific coloration. It is also the [ ] known fish. The largest reliably measured individual of this species was 18.8 m long. The body weight of the whale shark reaches 13.6 t (unconfirmed rumors speak of individuals even 20 m long, weighing over 30 tons). In many areas, however, the maximum recorded length does not exceed 10-12 m. Despite its impressive size and menacing-sounding name, the whale shark is a gentle fish and does not pose a threat to humans. It is one of three known sharks that feed on [ ]. The other two are the basking shark and the megamouth shark. The whale shark lives to be over 70 years old. It is commercially fished, and its meat commands high prices.

Analysis of the effects of the conducted gamification

Construction of tasks

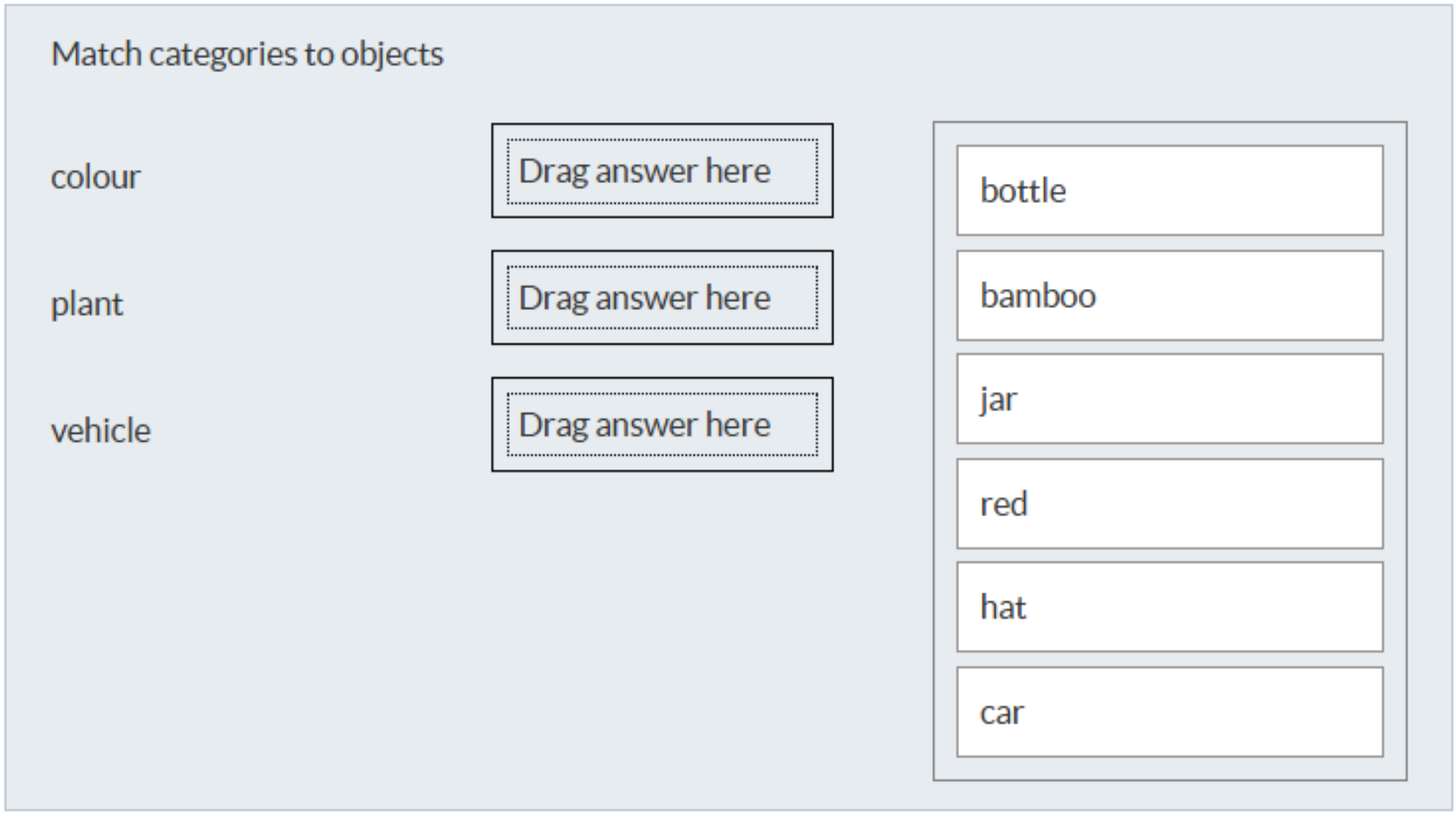
- factual knowledge questions – „Drag and drop onto text” questions



Analysis of the effects of the conducted gamification

Construction of tasks

- factual knowledge questions – „Matching” questions



Analysis of the effects of the conducted gamification

Construction of tasks

- calculation questions using the appropriate formulas
  - questions related to acquired skills
  - questions related to logical thinking

Comparison of achieved results

If there was pass threshold: above 50%:

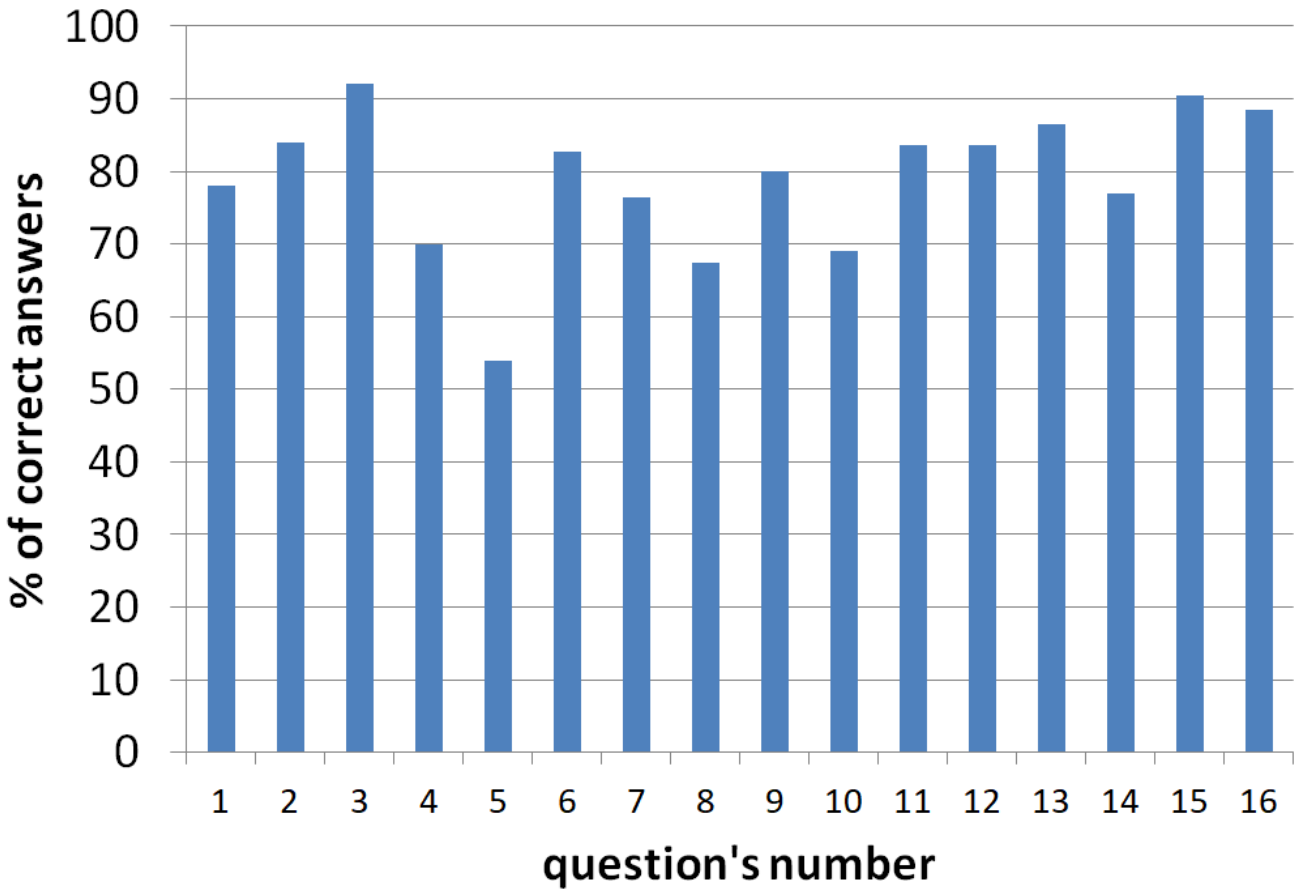
- 48 people would passed gamification (82,76% of 56)

In previous years:

- 25 people would passed (45,45% of 55) (2023/2024)
- 32 people would passed (66,67% of 48) (2022/2023)

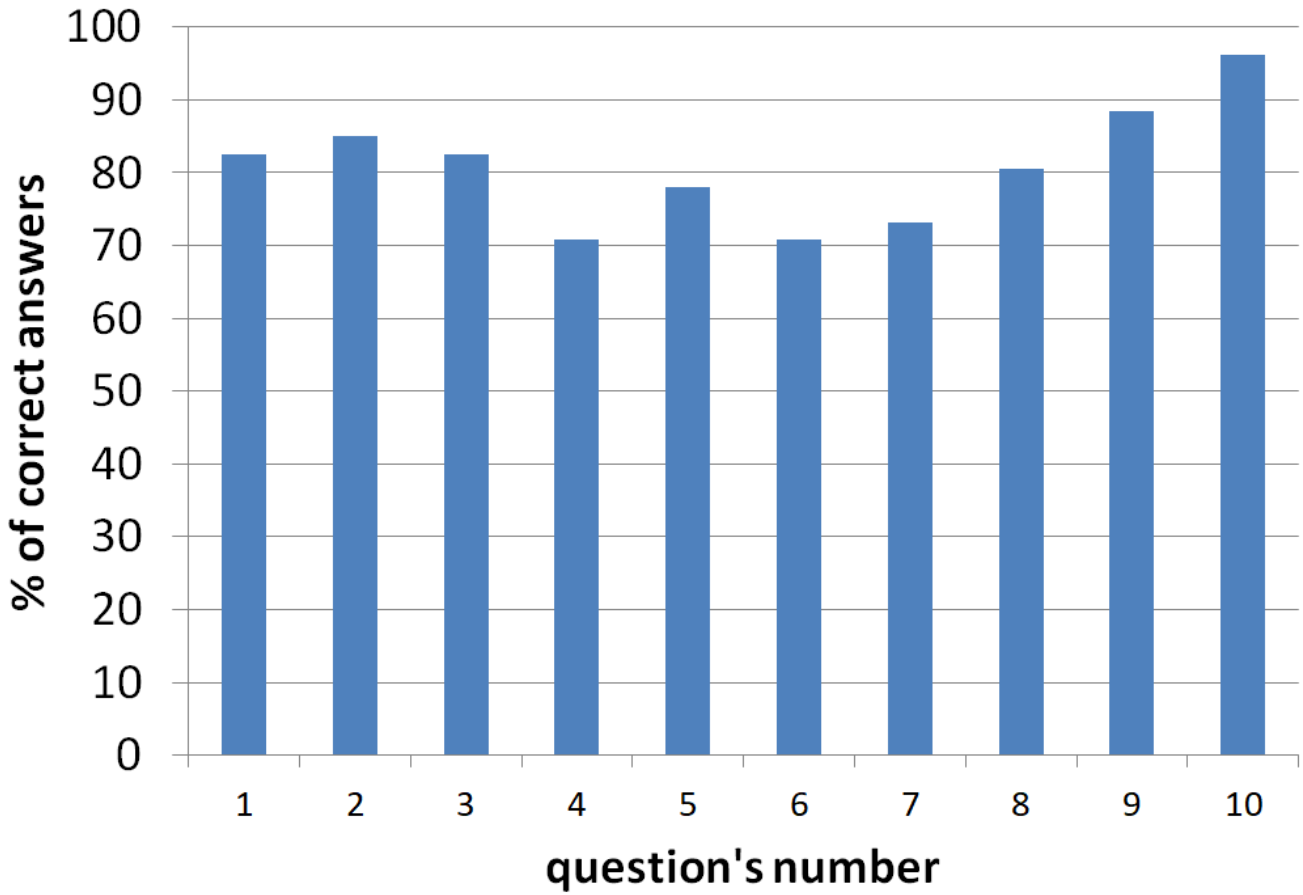
Comparison of achieved results

Basing on on factual knowledge questions



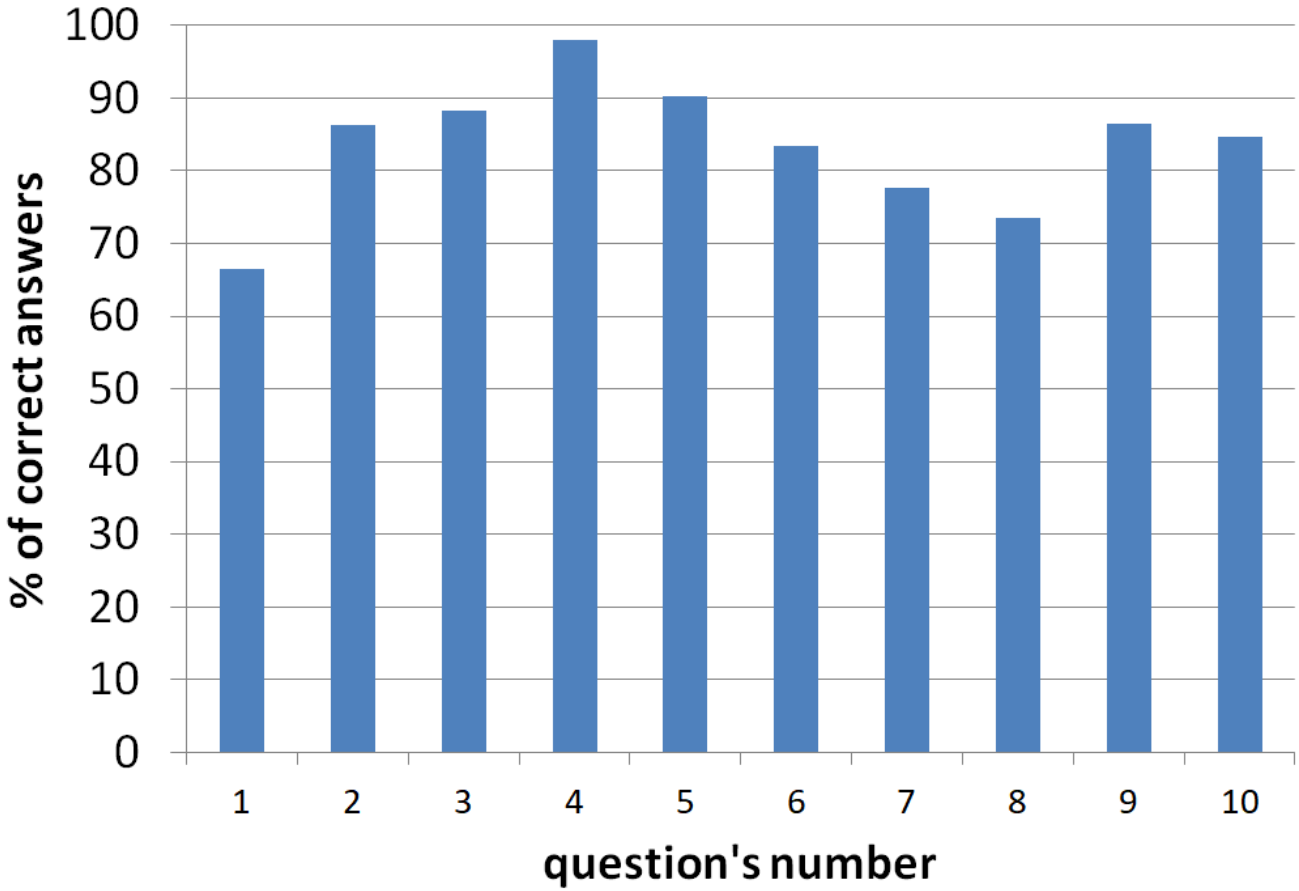
Comparison of achieved results

Basing on on non-factual knowledge questions (reading comprehension)



Comparison of achieved results

Basing on on non-factual knowledge questions (application of knowledge)



Conclusions

- The introduction of gamification significantly increased student engagement and participation. 97% of students chose this form of credit.
- Compared to traditional lecture assessment (based on theoretical questions only), gamification improved performance in nearly all topics, even though students had access to all resources.
- The structure of tasks -— especially those requiring reading comprehension, practical application, and information analysis -— promoted deeper learning and development of future-ready competencies.

Conclusions

- The results confirm that gamified methods, despite being more time-consuming to develop, offer measurable educational benefits.
- This was the first implementation of the gamified lecture. The results are based on approx. 60 students, but further analysis will cover the entire cohort of nearly 630 students, providing a broader base for conclusions.