Comparing learning outcomes in traditional and gamified lecture formats

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The Future of Education Conference

| Course characteristics | | | Conclusions |
|------------------------|-----|------|-------------|
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1 Course characteristics

2 The current solution

3 New solution

4 Conclusions

| Course characteristics | | |
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| Number of student | S | |

- 1 st term Informatics part-time studies 60 people
- 2 nd 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.

| The current solution | Conclusions |
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2 The current solution

3 New solution

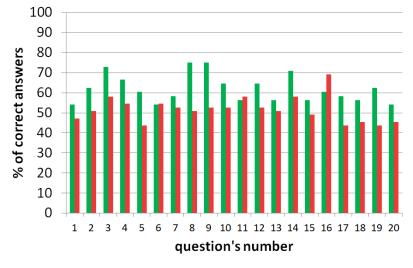


| | The current solution | |
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| Verification of leas | rning outcomes | |

- 1 end-semester colloquium, min. 2 weeks after the last lecture
- est: 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.

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| Results | | |



2022/2023 2023/2024

| | New solution | Conclusions |
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Goals:

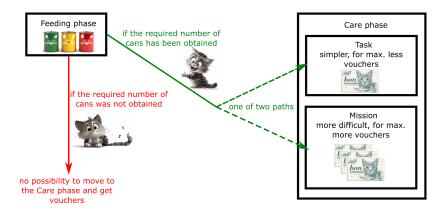
- mobilizing students to study regularly
- introducing practical, computational tasks related to literature and the work of an engineer
- introduction of the possibility of choosing the path of completion
- introducing an interesting background
- arousing emotions by choosing a more difficult/easier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

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Verification of learning outcomes



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| Verification of lea | arning outcomes | | |



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Verification of learning outcomes

| | Care Phase - one of two options | | | one of two options |
|--|---------------------------------|---|---|---|
| | Feeding phase | | The task is easier - getting a voucher | A more difficult task - completing the mission |
| Subject | 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 |

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| Verification of l | earning 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).

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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 effe | ects of the conducted | gamification | |
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• factual knowledge questions – "All or nothing" questions

| Multiple choice question - you must marked exactly the right answer(s). |
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| Example: |
| Wild boars feed on |
| a. people b. electronic equipment c. apples d. plant shoots e. insects |
| a. people b. electronic equipment c. apples d. plant shoots |

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• factual knowledge questions – "Missing Words" questions

| In this type of question, you select a matching word fr | om 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 🗢 k | nown fish. The largest |
| reliably measured individual of this species was 18.8 r | n long. The body weig | ht of the whale shark |
| reaches 13.6 t (unconfirmed rumors speak of individu | als even 20 m long, we | eighing over 30 tons). In |
| many areas, however, the maximum recorded length of | loes 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 s | nark lives to be over 7 | 0 years old. It is |
| commercially fished, and its meat commands high price | es. | |

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 factual knowledge questions – "Drag and drop onto text" questions

| In this type of question, you have to grab the string that you want to put in a given gap, move it there and drop it. | | | |
|---|--|--|--|
| Example: | | | |
| Long before patented first in 1879 and then a year later in 1880 and began | | | |
| commercializing his incandescent light bulb, British inventors were demonstrating that electric light | | | |
| was possible with the arc lamp. In 1835, the first constant electric light was demonstrated, and for the | | | |
| next 40 years, around the world worked on the incandescent lamp, tinkering with the | | | |
| (the part of the bulb that produces light when heated by an electrical current) and the | | | |
| bulb's atmosphere (whether air is vacuumed out of the bulb or it is filled with an inert gas to prevent | | | |
| the filament from oxidizing and burning out). These early bulbs had extremely short lifespans, were too | | | |
| expensive to produce or used too much energy. | | | |
| Max Planck Thomas Edison Albert Einstein Johannes Gutenberg | | | |
| traders scientists politicians journalists | | | |
| dog fang air filament ceramic rod | | | |
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| Ana | lysis of the effec | cts of the conducted | l gamification | |
| | Construction of task: • factual knowled | s ge questions – "Matchinş | g" questions | |
| | Match categories to objec | ts | | |
| | colour | Drag answer here | bottle | |
| | plant | Drag answer here | bamboo | |
| | vehicle | Drag answer here | jar | |
| | | | red | |
| | | | hat | |

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| Analysis of the eff | ects of the conducted | gamification | |

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

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| Comparison of | achieved results | | |

If there was pass threshold: above 50%:

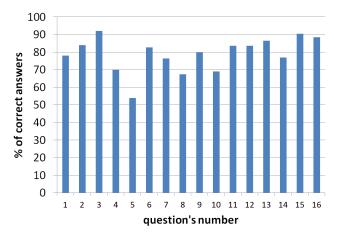
• 48 people would passed gamification (82,76% of 56)

In previous years:

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

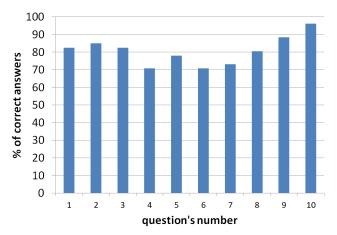
| | | New solution | |
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| Comparison of a | chieved results | | |

Basing on on factual knowledge questions



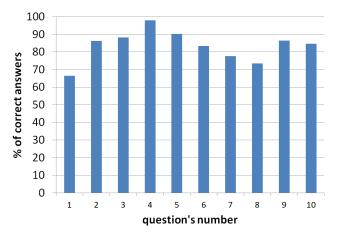
| | | New solution | |
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| Comparison of achie | eved results | | |

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



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| Comparison of achieved results | | | | |

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



| | | | Conclusions |
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| 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 |
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| 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.