QUEST: `Quizzes Utilizing Engaging StoryTelling`

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Abstract

The support of motivation and engagement during lectures holds significant importance in teaching. In this study, we introduce a gamified quiz-based classroom approach, denoted as *QUEST: Quizzes Utilizing Engaging StoryTelling*, to tackle these challenges. Our approach utilizes immersive quiz templates within a competitive environment. We conduct an experimental study, comparing the course evaluations of semesters with no quizzes, standard quizzes, and the QUEST approach. Consistent with theoretical expectations, the feedback demonstrates a positive impact of gamified in-class activities on intrinsic motivation and continuous learning. Our analysis of the feedback presents the initial evidence supporting the positive effects of QUEST in NLP teaching. All quizzes will be openly accessible for free usage[1].

1 Introduction

> Behold, the earth is attacked by an evil force of infernal, NLP energy: THE LEMMATIZER! If you want to know how unlemmatized catchphrases can save the earth, see Figure 1.

In recent years, the importance of high-quality teaching has escalated, and the emergence of generative AI tools has reignited the discussion on desired learning objectives for students across various educational levels. Moreover, the availability of hybrid or online-only courses has introduced numerous advantages for students, such as the flexibility to learn at their own pace, independent of time and location. However, this mode of instruction also amplifies certain inherent challenges in the learning process, including the maintenance of self-motivation and sustained engagement in continuous learning. To progress effectively through the course material, students must exercise significant discipline and overcome hurdles like self-motivation. While AI-driven tools have their benefits, it is essential to acknowledge that their use presents some pedagogical concerns. As pointed out in a relevant study (Churchill, 2023), utilizing such tools may diminish the depth of engagement with the subject matter. Engaged learning typically involves researching a topic, seeking information, summarizing knowledge, evaluating debates, considering different viewpoints, and forming one's own opinion—an immersive learning experience that may be forfeited when relying heavily on AI tools. In light of these observations, it becomes increasingly necessary to explore innovative approaches and concepts to effectively address the challenges brought about by this new educational landscape.

In the research literature, one concept that plays a significant role in promoting self-motivated and continuous learning is gamification. The idea is to incorporate elements of game design into a non-gaming educational context to enhance learning and intrinsic motivation (Bai et al., 2020). This concept can be applied to quizzes, serving as a starting point for implementing gamification in teaching. Quizzes can provide immediate feedback on tasks, contributing to intrinsic motivation through the use of points and leaderboards (Rigby and Ryan, 2011). Additionally, quizzes can enhance overall course activity by offering time-dependent quiz sessions that allow students to earn points and achieve a higher class rank (Sailer and Sailer, 2021). Quiz systems like Mentimeter (https://www.mentimeter.com) are built on these functionalities, offering live quizzes with points and leaderboards, encouraging participants

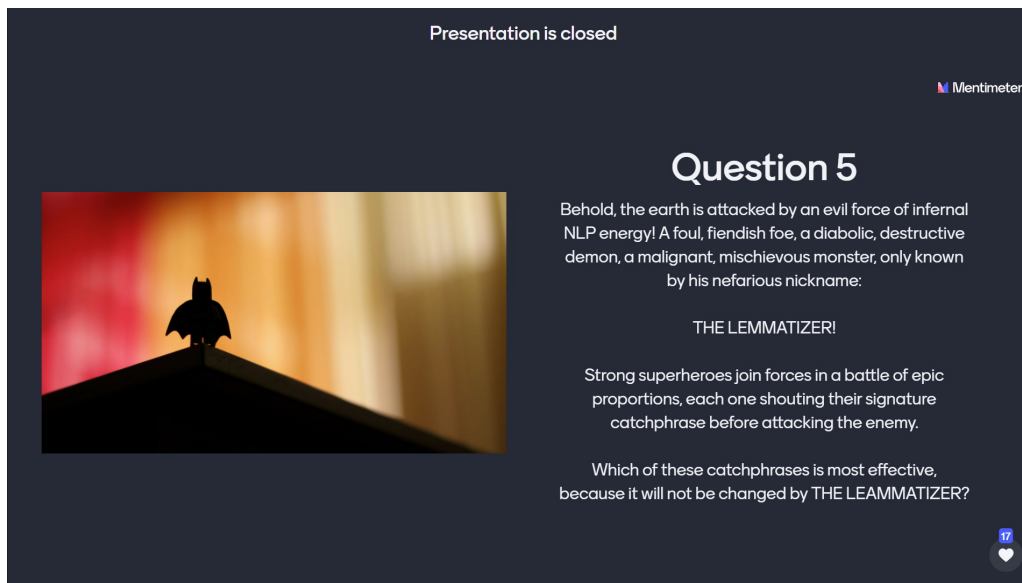[1]https://github.com/UKPLab/QUEST

Figure 1: An example question on the topic of lemmatization. Is it A: "I am Groot", B: "Up, up, and away!", C: "Avengers, assemble!" or D: "It's morphing time!"? Read the discussion section for the correct answer!

to earn points by being both correct and fast. Sailer and Sailer (2021) demonstrated that such gamified quizzes can enhance motivation and application-oriented knowledge.

Although these quizzes show promise in addressing the aspects of self-motivated and continuous learning, they are not yet widely utilized in NLP teaching. However, apart from these quiz elements, there is another aspect that can foster motivation and engagement: storytelling. Storytelling enhances learning and classroom engagement by capturing students' interest and immersing them in the narrative (Lugmayr et al., 2017). Arsenijevic et al. (2016) emphasized the importance of storytelling in understanding the content. Despite its relevance, storytelling remains relatively unfamiliar in the context of teaching.

To address these research and teaching gaps, we introduce QUEST, Quizzes Utilizing Engaging StoryTelling. The core idea of QUEST is to offer a method of intrinsically motivating students to stay actively engaged and develop multiple competencies in a gamified in-person or online learning environment. We utilize Mentimeter quizzes with immersive storytelling. In this study, we showcase the implementation of QUEST in two NLP courses and present the feedback we received from our students. Through our analysis of feedback, we compare the responses received over many years (2018 - 2022). In 2018, we did not employ quizzes at all. In contrast, we used quizzes without gaming elements and storytelling in 2019. Finally, beginning in 2020, we implemented QUEST. Our analysis of feedback reveals positive responses from students regarding self-motivation and continuous learning. Moreover, we find that students perceive the content as more comprehensible overall compared to previous years. Our results demonstrate an initial positive trend that will require further examination in the future. However, without a detailed systematic evaluation of QUEST across multiple semesters, we cannot conclude a universally positive effect. We provide all quiz templates and encourage the adoption of QUEST in as many in-person or online courses as possible, as this will help us gain a better understanding of its positive effects.

2 Related Work

QUEST integrates various learning elements to enhance the NLP learning environment. In this section, we will introduce the three fundamental concepts of QUEST: Gamification, Quizzes, and Storytelling.

Gamification. Gamification involves incorporating game design elements into non-game contexts (Deterding et al., 2011; Nieto-Escamez and Roldán-Tapia, 2021). It has been applied and studied in educational settings, showing positive effects on learning and motivation (Seaborn and Fels, 2015; Bai et al., 2020; Sailer and Homner, 2020). However, further research is needed to explore these

effects, particularly in higher education (Huang and Hew, 2018; Sailer and Sailer, 2021). The application of gamification in NLP teaching remains relatively unexplored (van Halteren, 2002).

Quizzes. Quizzes are often used as a starting point for implementing gamification in teaching and learning environments (Sailer and Sailer, 2021). They provide immediate feedback at the task level through point-based scoring, which has the potential to enhance performance and learning (Hattie and Timperley, 2007; Kulik and Kulik, 1988). Quizzes can also facilitate competitive or cooperative interactions among learners, typically through leaderboards, which aligns with gamification strategies (Sailer and Sailer, 2021).

The self-determination theory explains the motivational appeal of game design elements, and it has been applied in gamification studies (Sailer and Sailer, 2021; Mekler et al., 2017). This theory highlights three psychological needs crucial for intrinsic motivation and high-quality learning: competence, autonomy, and social relatedness (Ryan and Deci, 2000). In the context of gamified quizzes, competence and social relatedness are particularly relevant (Vansteenkiste and Ryan, 2013). Competence can be addressed through feedback mechanisms, such as point systems in gamified quizzes (Rigby and Ryan, 2011). Social relatedness can be fostered through shared goals, like team leaderboards in gamified quizzes (Sailer et al., 2017).

(Serious) Storytelling. Stories have long been used to communicate ideas and knowledge, serving both immersive and informational purposes (Davenport and Prusak, 1998; Arsenijevic et al., 2016). Serious storytelling, introduced by (Lugmayr et al., 2017), refers to storytelling with a purpose beyond entertainment. It has gained popularity as a method for formal education (Collins, 1999). Storytelling enhances understanding and overall in-class activity, aligning with Bloom's taxonomy of learning outcomes (Arsenijevic et al., 2016; Lugmayr et al., 2017).

Story-Telling Gamified Quizzes in NLP Teaching. The integration of these concepts presents a novel approach to NLP teaching. To the best of our knowledge, no existing approach combines these elements. QUEST serves as a starting point for implementing story-driven gamification elements in NLP teaching.

3 Course Background

We implemented QUEST in two courses from the curriculum offered by the Ubiquitous Knowledge Engineering Lab at the Technical University (TU) of Darmstadt:

The course titled *Natural Language Processing and the Web* primarily targets M.Sc.-level students in computer science. However, its interdisciplinary nature also attracts students from other fields such as linguistic and literary computing or psychology in IT. Since its inception in the 2008/2009 academic year, the course content has undergone regular revisions to incorporate current trends in NLP research and emerging web technologies, including Information Retrieval, Argumentation Mining, and Question Answering techniques. Additionally, the course provides a brief introduction to fundamental NLP analysis levels. Over the years, the course's enrollment has steadily increased, with the current iteration attracting up to 200 students.

In contrast, *Information Management* is a course for B.Sc. computer science students. It involves foundations of structured data processing through relational databases and managing unstructured, textual data sourced by utilizing basic methods of Natural Language Processing. Since this is a mandatory course in the computer science curriculum, the course size is much larger, with up to 700 students per semester.

4 Method

We started implementing QUEST, which involves thematic activities with story-driven tests, in our course Natural Language Processing and the Web during the past five winter semesters: 2018/2019 - 2022/2023. In the first year, we conducted simple interactive quizzes using the live feedback tool PINGO. PINGO allowed us to prepare sets of questions with various formats (e.g., single-choice, multiple-choice, numeric, textual) and display them to students during the lecture. Students could answer the questions using their own devices, and the results were presented to the audience. The purpose of these quizzes was to:

- activate the students
- reiterate knowledge from previous lectures
- emphasize important aspects of the current lecture
- provide example questions for exam preparation

Starting from the 2019/2020 semester, we introduced `QUEST` in this course as an advanced, gamified version of interactive quizzes with creative, story-driven scenarios. In the course Information Management, we started the implementation of `QUEST` in the summer semester of 2021 and used it in every session in 2022. We use the live feedback platform Mentimeter as an online tool, which enables the integration of interactive polls resembling modern quiz game shows. Participants are presented with up to five questions that they can answer using their devices. Each participant enters the quiz with a randomly assigned icon and alias. In this format, participants are not only motivated to provide correct answers but also to answer quickly, as points are awarded based on both correctness and response time. After each question, a leaderboard showing the top ten participants is displayed, creating a competitive and dynamic environment.

To further enhance student engagement, we present all questions in the form of narrations with story-driven scenarios. For instance, instead of directly asking about the advantages of Support Vector Machines, we frame the question within a fictional contest called "Machine Learning's Next Top Model," where the contestant "Support Vector Machine" is introduced and commented on by the jury. This approach aims to promote out-of-the-box thinking and provide an enjoyable learning experience. Figure 1 illustrates an example of such a question, and Figure 2 shows the core slide template used for these interactive quizzes.

This form of gamified, creative quizzes was created with regard to these additional goals:

- increasing student participation
- enhancing motivation through competition
- introducing gamification for the positive effect of fun on motivation
- enable out-of-the-box thinking by using story-driven scenarios

5 Evaluation

Quantitative Feedback. After each iteration of our courses, the participating students are asked to fill out anonymous evaluation questionnaires to express their opinion. These questionnaires are standardized for all lectures at the TU Darmstadt and were not conducted specifically for this study.
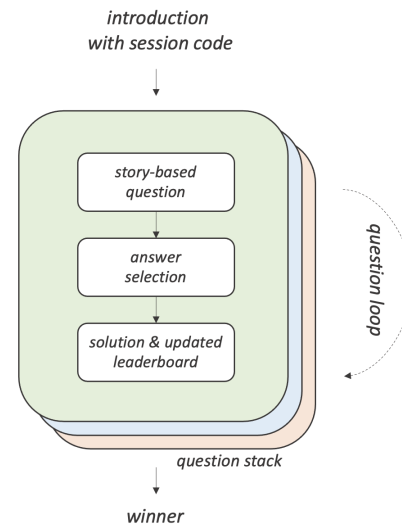

Figure 2: Overview of core slide template. The question loop is included once per question.

The evaluations include questions about the lecturer, the room, organizational issues, and the contents of the lectures. We include feedback from four years of the lecture - one year before interactive quizzes were introduced and the three years of our involvement. It is important to note that all numbers and written feedback depend on various variables, including the lecturing staff, slight changes in lecture content, or the actual cohort of students. Therefore, we present this feedback as a correlation with the effects of our method, rather than claiming causality.

In contrast to our Master's lecture, *Information Management* is much larger. As a result, the evaluation results are much more meaningful and representative, with about 70 - 100 evaluations submitted each semester compared to 10 - 20 in *Natural Language Processing and the Web*. Most of the questions in the standardized questionnaire are in Likert Scale format, where participants express their opinion on given statements on a five-level range. From all the questions in the questionnaire, only a small subset is relevant to this study. The distribution of the evaluation values from the last three years of our *Information Management* lecture can be seen in Figure 3. We tested the statistical significance of the effects using chi-square tests ($p < 0.05$).

The motivation to learn outside of the course shows a statistically significant increase with the integration of `QUEST`. As indicated by the qualitative feedback, students feel self-motivated by the

🚫 **w/o QUIZ**
👦 Could be improved by... Include a few quizzes in between. These help to prepare for the exam.
🧑 Could be improved by... More material for exam preparation. Largely unclear what the exam will look like.
🧕 Could be improved by... Adding interactive elements. Lecture is a bit dry.

🅿️ **PINGO QUIZ**
🧕 I liked ... Pingo sections were awesome and are a great way to feel more prepared for the exam
👦 I liked... The use of pingo, though it could be more ;)
🧑 I liked... Using pingo as an effective tool to deepen understanding, provide a fun little break from the lecture and give examples for the lecture
👳 Could be improved by... more pingo

📊 **`Quizzes Utilizing Engaging StoryTelling`**
👱 The lecturer was outstanding... use of novel technologies such as the quiz system with the score ranking - combines fun and educational purposes
🧑 I liked... Mentimeter even motivated me to prepare for the lecture so that I could answer the questions well.
🧕 I liked... The digital quizzes held by Thomas were really entertaining and educational
👲 I liked... The creativity Mr. Arnold probably spent on the surveys was very motivating and engaging. Also, the sometimes humorous examples/explanations often made algorithms or concepts very clear and easy to understand.
👳 I liked... The live lectures were very good. The quizzes made it easier to concentrate and focus on the later parts of the lecture. MentiMeter especially was really fun!
🧕 The lecturer was outstanding because... The quizzes are a good way to self-examine, and the stories and built-in jokes also build an emotional connection to the material.
👲 The lecturer was outstanding because... Online teaching is as dry as the Sahara, but Mr. Arnold did an amazing job to make the lecture more fun and provide opportunities for interaction and critical thinking.
👲 The lecturer was outstanding because... The interactive parts during the lecture were great and vastly improved my willingness to participate and attend the lectures, as well as the information gain.

Table 1: Feedback from the university evaluation addressing interactive elements and the quizzes.

regular quizzes, and some even go to great lengths to prepare for them, which indicates improved continuous learning. The perceived effective usage of interactive platforms also reached its peak when quizzes were first implemented. In addition, we observe positive trends in the perception of clear learning objectives and the integration of theory and practice for the years when interactive quizzes were implemented. This suggests the potential benefits of practical, interactive tests during the learning process. Overall, adding QUEST has had a statistically significant, positive effect on course evaluations, as evidenced by the higher overall grades and the increase in teaching award proposals.

Qualitative Feedback. While the questionnaires primarily focus on simpler Likert Scale evaluations, the set of questions allowing free-form answers is better suited to draw direct conclusions between our methods and the perceived sentiment. The included questions that can be answered in free textual format are: "About the course, I liked very much...", "Next time, the course could be improved by...", and "I would recommend the lecturer for a prize for outstanding teaching because...". Table 1 contains submitted feedback related to interactive unit usage (or lack thereof).

Prior to the implementation of interactive quizzes in the classroom, students expressed that quizzes could be helpful, especially for exam prepa-
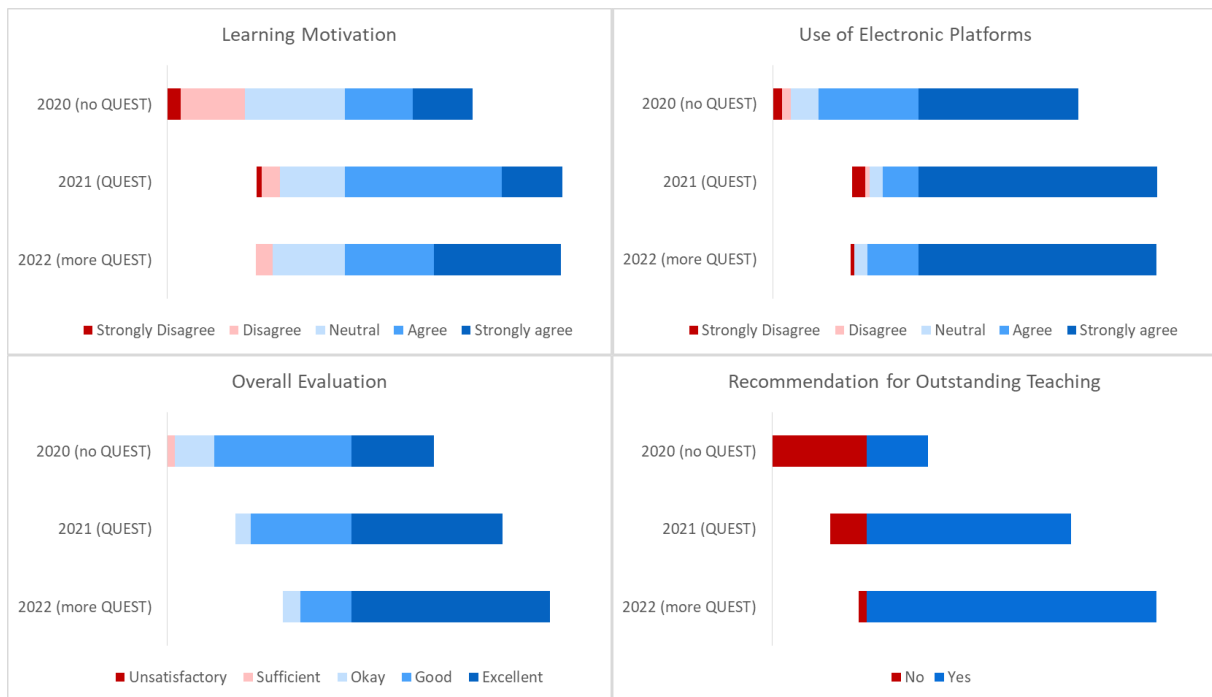
Figure 3: *Information Management* students' evaluations of three years to the questions "The learning objectives of the course were made clear", "The lecturer used electronic platforms effectively", "What total grade do you give this lecture?" and "I would recommend the lecturer for a price for outstanding teaching". `QUEST` was introduced to this lecture in 2021, and used in all sessions in 2022.

ration. This need is directly reflected in the feedback on PINGO quizzes, where students stated that they were "a great way to feel prepared for the exam". In addition, PINGO was perceived as an "effective tool to deepen understanding" and provide "fun little breaks". The majority of students appreciated the use of interactive quizzes, with Mentimeter quizzes receiving particular praise for their entertainment value and educational benefits. The quizzes were commended for making the lectures more engaging, motivating students to prepare and participate actively, and providing clear explanations of algorithms and concepts. Incorporating novel technologies and the creativity displayed in the quizzes were also highlighted as positive aspects. Students mentioned that these quizzes "combine fun and educational purposes" and "vastly improved my willingness to participate and attend the lectures, as well as information gain". One student mentioned that an announced quiz motivated them "to prepare for the lecture so I could answer the questions well". All this positive feedback indicates increased participation by students and enhanced motivation caused by our quizzes.

QUEST questionnaire. In the 2021 edition of our course *Information Management*, we developed a specialized questionnaire to assess the extent and perceived benefits of `QUEST`. Our aim was to determine which factor - the competitive aspect of quizzes, the storytelling element, or the gamified presentation - has the greatest influence on motivation and learning. Additionally, we wanted to investigate if there are students who have reservations about any of these aspects or feel distracted by them. The results of the evaluation offer valuable insights into students' opinions and experiences with the quizzes used in the lecture. An overview of the evaluation results can be found in Figure 4. The complete results of this evaluation are available in our shared repository.

Regarding the overall opinion on the quizzes, a substantial number of students expressed positive views. A majority of 103 students (out of the total 108 respondents) indicated that they were at least looking forward to the quizzes, demonstrating a high level of anticipation. Only a small number of students found the quizzes to be acceptable or disliked them. Similarly, only 1 student would have preferred to skip the quizzes.

When comparing the motivation during the quizzes to regular tests, a clear trend emerges. A total of 35 students felt more motivated during the quizzes, while an even larger number of 58 students reported higher motivation levels. On the
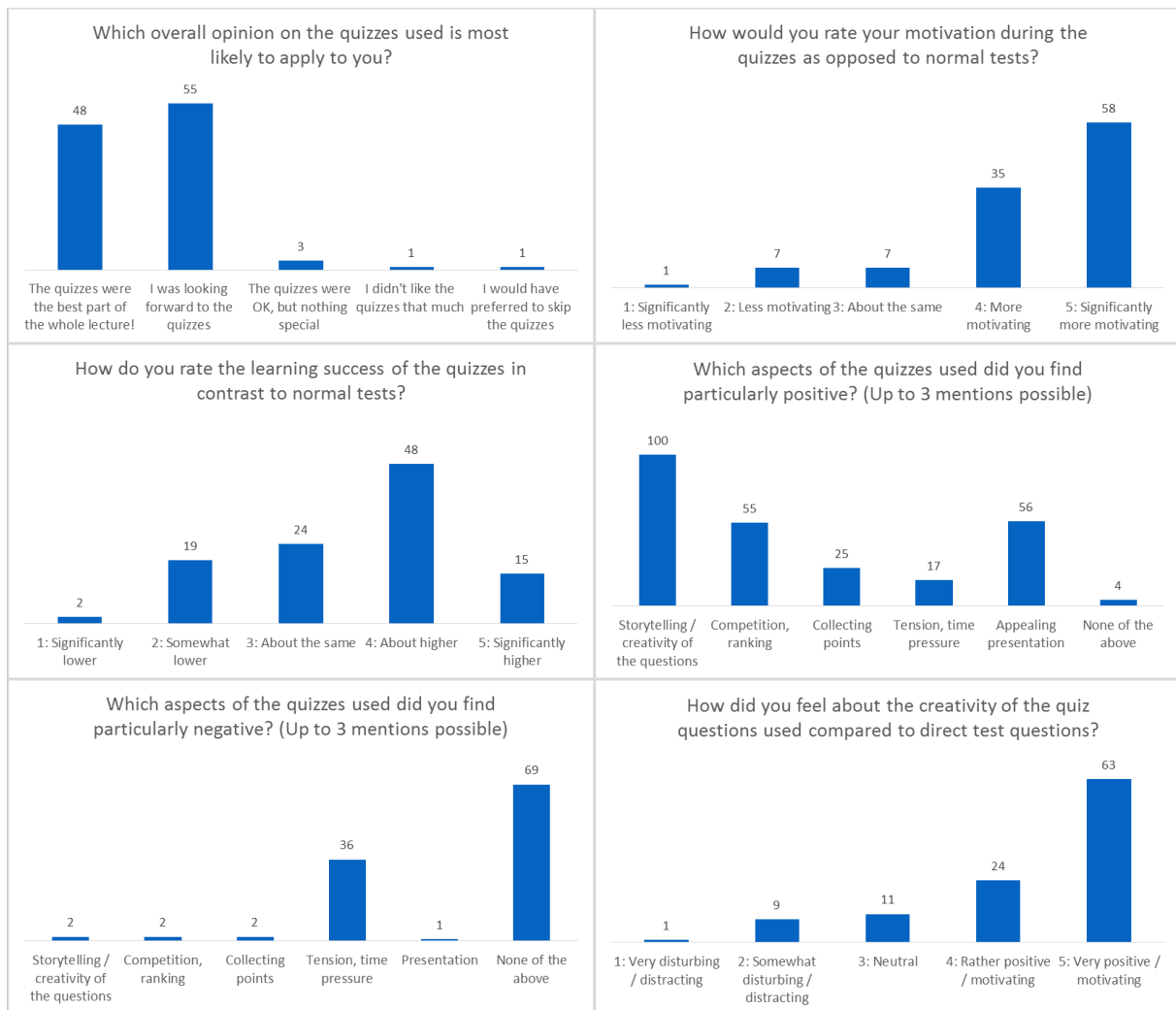
Figure 4: Results of the QUEST evaluation with 108 answers from *Information Management* students of 2021. All participants gave their consent to use and publish the anonymized data.

other hand, 7 students felt less motivated, and only 1 student stated a notable decrease in motivation during the quizzes.

In terms of learning success, the majority of students felt that the quizzes were effective. A total of 48 students believed that the quizzes resulted in higher learning success compared to regular tests, with 15 students even stating that the learning success was considerably higher. While 19 students felt the quizzes had somewhat lower learning success, only 2 students thought the learning success was significantly lower.

Analyzing the aspects of the quizzes that students found particularly positive, a few noteworthy factors emerged. The storytelling/creativity of the questions received the highest number of mentions, with 100 students appreciating this aspect. The competitive and ranking aspect was also well-received by 55 students. Additionally, 56 students

found the appealing presentation of the quizzes to be a positive aspect.

When considering the aspects of the quizzes that students found particularly negative, the tension and time pressure associated with the quizzes were perceived negatively by 36 students, making it the most frequently mentioned negative aspect. Remarkably, a majority of 69 students did not find any of the mentioned aspects to be negative.

Examining the students' perception of the creativity of the quiz questions compared to direct test questions, a considerable number of students expressed positive views. 63 students found the creativity of the quiz questions to be very positive and motivating, while 24 students had a generally positive perception. Only 1 and 9 students, respectively, found the creativity of the quiz questions to be either disturbing or distracting.

6 Discussion

We implemented and validated the use of our approach, called `QUEST: Quizzes Utilizing Engaging StoryTelling`, in two NLP lectures over a five-year period. Due to the number of factors that changed during this time, it is challenging to establish a direct correlation between our method and increased student motivation or learning success. However, the evaluation questionnaires indicate trends of enhanced self-motivation and clearer learning objectives. These trends are further supported by positive feedback from students, emphasizing the advantages of quizzes in terms of motivation, engagement, and exam preparation.

Based on the questionnaire results, several conclusions can be drawn regarding the use of quizzes in the lecture and the overall effectiveness of the `QUEST` method:

- **Positive reception:** The majority of students expressed positive opinions about the quizzes used in the lecture. A significant number of students considered the quizzes to be the best part of the whole lecture and looked forward to them. This indicates that quizzes can be an engaging and enjoyable component of the learning experience.

- **Increased motivation:** A substantial number of students reported higher motivation levels during the quizzes compared to normal tests. This suggests that the competitive aspect, storytelling element, and gamified presentation employed in the quizzes contributed to increased student motivation. The quizzes provided a more stimulating and engaging learning environment, motivating students to actively participate.

- **Improved learning success:** A significant proportion of students believed that the quizzes led to higher learning success compared to traditional tests. This indicates that the `QUEST` teaching method, with its emphasis on quizzes, facilitated effective learning outcomes. The combination of engaging elements such as storytelling and competition potentially contributed to a deeper understanding and retention of the course material.

- **Positive aspects:** The storytelling/creativity of the quiz questions and the competitive nature of the quizzes were identified as major positive aspects.

- **Negative aspects:** Some students expressed concerns about the tension and time pressure associated with the quizzes.

- **Varied preferences:** Individual preferences regarding the quizzes varied among students, emphasizing the importance of flexibility in teaching methods.

Overall, the evaluation results suggest that the use of quizzes, combined with elements such as storytelling, competition, and appealing presentation, can significantly contribute to student motivation and learning success. However, it's essential to consider the potential negative aspects, such as tension and time pressure, and tailor the quizzes to accommodate different student preferences and learning styles. These conclusions provide valuable insights for further refining and improving the `QUEST` teaching method in future iterations of our courses.

Moving forward, we aim to expand the application of `QUEST` to other lectures within our group, as well as adjacent courses. Additionally, we plan to explore the potential transferability of this method to other fields of study. To facilitate the implementation of quizzes in in-person or online classroom environments, we intend to create detailed guidelines with best practices. Furthermore, we seek to gather helpful advice on the creative process behind our set of story-driven questions to support the creation of new quiz content.

We have already received positive feedback from other lecturers who expressed interest in reusing the `QUEST` template, question structures, or a set of questions suitable for their own lectures. All `QUEST` resources, including templates, questions, and further information, are openly shared in a repository[2].

> Finally, the `correct answer` for our example question is `B`.
> The catchphrase "Up, up, and away" is the only one that is not changed by lemmatization. Were you able to save the earth?

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[2] https://github.com/UKPLab/QUEST

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