02/7671_the_nea_smr_dashboard_-_second_edition.pdf (date accessed: 20.01.2025).

16. Kisen L., Otero L., Multi-criteria decision model for selection of nuclear power plant type // Progress in Nuclear Energy, Vol. 159, 2023. – URL: https://doi.org/10.1016/j.pnucene.2023.104647 (date accessed: 12.11.2024).

17. Udaykumar S., Archana U., Saurabh N., A Review of Mathematical Multi-criteria Decision Model with a Case Study // International Conference on Efficacy of Software Tolls for mathematical Modeling, 2021. ISSN 2348 –1269. – URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3751947 (date accessed: 10.01.2025).

18. Koltun O., Malykha G., Pavlov A., Using Multi-criteria Analysis to Select an Energy Source // E3S Web Conferences 164, 13001, 2020. – URL: https://doi.org/10.1051/e3sconf/202016413001 (date accessed: 6.01.2025).

19. IAEA, Evaluation of the Status of National Nuclear Infrastructure Development // Nuclear Energy Series No. NG-T-3.2 (Rev. 2), 2022. ISBN: 978-92-0-121422-5. – URL: https://www-pub.iaea.org/MTCD/Publications/PDF/PUB2001_web.pdf (date accessed: 1.02.2025).

20. Rusatom Service, Nuclear Infrastructure and Sustainable Development // Rosatom – 2019. – URL:https://www.rosatom.ru/upload/iblock/Nuclear %20Infrastructure %20and %20SDG_Rus.pdf (date accessed: 15.07.2023).

Fahmy Abdalla (Egypt)

National Research Tomsk Polytechnic University, Tomsk

Scientific supervisor: Inga V. Slesarenko, PhD in Pedagogy

**EXAM ANXIETY ACROSS ASSESSMENT FORMATS:
A GAUSSIAN ANALYSIS**

Introduction

Anxiety is a multifaceted emotional response that encompasses feelings of apprehension, worry, and tension usually triggered by either anticipated or ongoing stressors. This normal human experience can escalate into disorders when it interferes significantly with daily functioning and quality of life. Among various forms of anxiety, examination anxiety, specifically, has emerged as a significant concern in educational settings, affecting university students across different academic levels. This specialized form of anxiety, characterized by intense nervousness before, during, and after exam periods, can adversely impact students' performance and overall mental

_____

health. Understanding the nature of anxiety, particularly in relation to university exams, is crucial for developing effective coping strategies to mitigate its effects [1].

Exam anxiety is particularly prevalent during the approach of exam dates, often intensifying as the actual test time approaches. A student's awareness of an upcoming exam can initiate a cascade of anxious thoughts and physical responses, impacting their ability to study effectively or perform during the actual exam. The relationship between time and anxiety can be significant; as the exam draws nearer, stress levels often spike [2].

Exam-related anxiety (ERA) refers to the experience of excessive worry, fear, or physiological discomfort before, during, or after an exam [3]. Research shows that ERA is common, with approximately 20 %- 30 % of students experiencing performance-impairing high levels of anxiety [4]. These intense emotions can undermine students' test results, lead to avoidance behavior, and negatively affect long-term learning outcomes [5].

Different types of assessments which are split into two main groups written tests, and oral presentations. Such as report writing, multiple-choice formats, and mixed-format exams demand distinct approaches, creating varied stress trigger. For example, spoken exams often evoke high anxiety due to public-speaking fears and real-time evaluation, while multiple-choice exams are typically associated with lower anxiety as they are more objective and structured [6].

The goal of this study is to investigate how university exam anxiety is perceived by university international and home students and what recommendations can be given to overcome this factor.

For this goal the survey has been designed by the author of this study. The survey was offered to TPU bachelor degree students majoring in Condensed Matter Physics, specialization 03.03.02 Physics; master degree students majoring in Condensed Matter Physics, specialization 03.04.02 Physics; TPU first year bachelor degree students specializing in 54.03.01 Design; 13.03.02 Electric power engineering; and five-year specialist training 14.05.02 Atomic stations: design, service and engineering.

Methodology

The research encompassed the following research methods: literature review; survey of university students. Gaussian analysis, commonly referred to as the normal distribution for analyzing patterns in exam-related anxiety (further in the text, ERA) across different assessment formats. Anxiety levels, when measured across a large sample, often follow a natural clustering pattern around a central value, with most students experiencing moderate anxiety and fewer experiencing either extremely low or high anxiety. Gaussian analysis enables us to calculate the mean (average anxiety level) and standard deviation (spread of anxiety levels) for each type of exam, offering insights into how students' anxiety is distributed. By plotting the anxiety scores

_____

for each format on a Gaussian curve, we can visually and statistically compare how different exams influence students' stress levels.

Factors Influencing ERA Levels

ERA was analyzed in relation to three key variables:

Length of study experience at university: Early-stage students (1st – 2nd year) may exhibit higher anxiety due to unfamiliarity with academic expectations.

Degree of exam format novelty: Anxiety levels were hypothesized to correlate with students' exposure to unfamiliar assessment types (e.g., spoken exams vs. traditional written exams).

Personal predispositions: General anxiety levels and individual responses to stress (e.g., time pressure, public speaking) were accounted for, as these traits skew the distribution's mean and standard deviation.

The 5-point Likert scale assessed anxiety across five exam types: written, spoken, report-writing, multiple-choice, and mixed-format exams [11].

The study focused on the 1st and 2nd year university students, home country question was implemented to identify students with prior academic experience in non-Russian academic systems, which may influence degree of familiarity with diverse exam formats. All participants of the survey had prior experience of studying in Russian university academic settings, ensuring a controlled cultural context for exam format familiarity.

The Gaussian framework was critical for interpreting how the above variables influenced anxiety distributions. For instance, students with limited exposure to spoken exams (a novel format in Russian settings) exhibited higher standard deviations, reflecting wider variability in anxiety scores. Conversely, mixed-format exams, being more familiar, clustered closer to the mean, aligning with the expected bell-curve symmetry.

Results

The study evaluated university students' anxiety levels associated with different exam formats, including spoken exams, as seen in fig. 1. Written exams, making reports as part of exams, mixed format exams, and multiple-choice questions (MCQs).

The data reveal that spoken exams elicited the highest anxiety levels, with a mean score of 3.43 (SD = 1.15), suggesting that the direct interpersonal and performance aspects of oral examinations are particularly stressful [7]. Written exams, with a mean of 2.88 (SD = 0.99), and making reports as part of exams, at a mean of 3.41 (SD = 1.175), demonstrated moderately high anxiety levels, reflecting concerns over the structured, evaluative nature of these assessments [8]. The mixed format exams, which combined elements of both written and oral evaluation, showed a slightly lower mean anxiety level of 3.35 (SD = 0.996), perhaps indicating that the variation in exam style might distribute the anxiety load among different skills [9]. MCQs recorded the lowest anxiety levels, with a mean score of 2.588 (SD = 1.175), likely due to

_____

the objective nature of this assessment format that minimizes the subjective pressure inherent in other exam types [10].

Table 1

Gaussian distribution parameters

Type of Assessment	Mean	Standard deviation
Spoken exams	3.43	1.15
Written exams	2.88	0.992
Making report as a part of exams	3.41	1.175
Mixed format	3.35	0.996
MCQ	2.588	1.175

Conclusions

This study underscores the significant impact of university exam formats on students' anxiety levels, revealing that spoken exams and report-based assessments generate the highest stress, while multiple-choice questions (MCQs) are associated with the lowest anxiety. The Gaussian analysis highlights variability in anxiety distribution, influenced by factors such as exam novelty, academic experience, and individual predispositions. To address these findings, future research should prioritize expanding the demographic scope of anxiety studies to include diverse cultural and institutional contexts, ensuring results are generalizable beyond Russian universities. Longitudinal studies tracking anxiety trajectories over academic years could further clarify how familiarity with exam formats mitigates stress, while investigations into targeted interventions such as mindfulness training or peer mentoring could validate their efficacy in reducing exam-related anxiety.

Recommendations

For students, adopting proactive coping strategies is critical. Structured study plans and mock exams can alleviate uncertainty, particularly for high-anxiety formats like oral exams. Mindfulness practices, including exercises and time management techniques are essential for managing physiological and emotional stress. Peer support networks should be encouraged to normalize anxiety and foster collaborative learning environments. Universities, in turn, must diversify assessment methods by integrating mixed-format exams, which balance objective and subjective evaluation and reduce anxiety clustering. Preparatory workshops for novel formats, such as spoken exams, can ease student adaptation, while mental health resources such as counseling services and anxiety management modules should be embedded into curricula to ensure accessibility.

References

1. Chakraborty A. Exploring the root causes of examination anxiety: effective solutions and recommendations // International Journal of Science and Research (IJSR). – 2023. – Vol. 12, no. 2. – P. 1096–1102.

2. Kaushal V., Tewari S. A study on anxiety among school students during exams // International Journal of Indian Psychology. – 2021. – Vol. 9, no. 1.

3. Howard E.L. (red.) A review of the literature concerning anxiety for educational assessments. – 2020.

4. Shimave S., Cerkez Y., Baysen E. An Empirical Study on the Relationship between Causes of Teacher Examination Anxiety and Dimensions of Coping with Pre-Exam Anxiety: A Structural Equation Modelling Approach // Psychologica Belgica. – 2020. – Vol. 60, no. 1. – P. 255–269.

5. Lee R., Thompson S. Exam Anxiety: A Review Including Assessment Alternatives to Summative Exams // Teaching So. – 2024. – Vol. 18, no. 1. – P. 21–28.

6. Chakraborty A. Exploring the root causes of examination anxiety: effective solutions and recommendations // International Journal of Science and Research (IJSR). – 2023. – Vol. 12, no. 2. – P. 1096–1102.

7. Buchwald P., Schwarzer C. The exam-specific Strategic Approach to Coping Scale and interpersonal resources // Anxiety, Stress & Coping. – 2003. – Vol. 16, no. 3. – P. 281–291.

8. Videnovic M. Oral vs. written exams: What are we assessing in Mathematics? // 1ST international Conference on Higher Education Advances (HEAD'15). – Valencia : Editorial Universitat Politècnica de València, 2017. – P. 10–17.

9. Garg N., Lee E. Mixed-format exams in higher education: Assessment of internal consistency reliability // 1ST international Conference on Higher Education Advances (HEAD'15). – Valencia : Editorial Universitat Politècnica de València, 2015. – P. 10–17.

10. Wang W., Drasgow F., Liu L. Classification accuracy of mixed format tests: A bi-factor item response theory approach // Frontiers in Psychology. – 2016. – Vol. 7. – P. 270.

11. Sullivan G.M., Artino A.R. Analyzing and interpreting data from Likert-type scales // Journal of Graduate Medical Education. – 2013. – Vol. 5, no. 4. – P. 541–542. – DOI: 10.4300/JGME-5-4-18.