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TIME, GENDER AND PERFORMANCE IN ONLINE BIOLOGY ASSESSMENT

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Abstract. *The study highlights the influence of exam duration and gender on student performance in the "Bios" National Competition, held online by the Biology Department on the Moodle platform of the West University of Timișoara. The research was quantitative and used a quasi-experimental intergroup design, comparing two time conditions—30 minutes (2024 edition) and 20 minutes (2025 edition)—on a sample of N = 103 high school students. Performance was measured by the final score obtained on a standardized biology test, consisting of 30 multiple-choice items. Statistical analyses (independent t-test and Pearson correlation) were applied separately for two thematic sections: Plant and Animal Biology (grades IX–X) and Anatomy and Physiology, Genetics, and Human Ecology (grades XI–XII). The results showed that, for the IX–X grade section, reducing the duration from 30 to 20 minutes did not produce significant differences in average scores, while for the XI-XII grade section, the group with reduced time performed significantly better. Correlations between gender and performance were insignificant. The study contributes to understanding how test duration influences results in a competitive context. The conclusions can support the optimization of digital exam duration without compromising the fairness and validity of the assessment process.*

Keywords: *Online assessment; Exam duration; Student performance; Biology competition; Gender differences*

INTRODUCTION

Understanding how the duration of an exam influences student performance is a central theme in the field of educational psychology and applied educational sciences. Assessing academic performance, especially in a digital context, involves a number of cognitive, affective, and situational factors that can alter measurement results. Recent studies have shown that the time allocated, the level of time pressure, test anxiety, and students' individual characteristics are in a complex relationship, mediating the efficiency and validity of the assessment process (JENSEN ET AL., 2013; MARCUS ET AL., 2025).

Educational assessment is based on solid psychometric principles designed to ensure the reliability and validity of results, regardless of the administration environment (ANBAR, 1991; NATIONAL RESEARCH COUNCIL, 1996). In the era of accelerated digitization, these principles are applied and adapted to the online context, where consistency and correct interpretation of scores must be maintained, despite the additional variables imposed by technology. Online assessment involves the use of computer networks for the systematic collection of learning information in order to identify progress (HEIL & IFENTHALER, 2023).

The distinction between "online assessment" and "digital assessment" is conceptual. Online assessment always involves connectivity. Digital assessment may also include offline tools. In practice, however, the two overlap to a large extent, with most digital assessments being conducted online (PORTOLESE ET AL., 2016). Comparative research has shown that these modern forms of assessment

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offer advantages in terms of accessibility and flexibility. However, they can raise issues related to fairness, control of the environment, and the level of stress experienced by participants (CAMPION ET AL., 2025).

The duration of the exam is a determining factor of performance, directly influencing cognitive processing and attention management. Time pressure affects access to information in semantic memory and item-solving strategy (COLLINS & QUILLIAN, 1972; ANDERSON, 1976). Jensen et al. (2013) showed that longer exams can favor performance on similar items, and that additional time does not guarantee an overall improvement in results. Other research (MARCUS ET AL., 2025; TARCHINSKI ET AL., 2022) argues that extending the duration of an exam does not significantly reduce anxiety or eliminate disparities between groups. Thus, it appears that the relationship between time and performance is nonlinear and context-dependent.

Test anxiety and time management skills are key factors in how students respond to time constraints. Britton and Tesser (1991) showed that effective time management correlates positively with academic success and performance on standardized tests. In the digital environment, these skills are even more important, as the lack of direct interaction with the evaluator and the pressure of autonomy can amplify situational stress.

Individual characteristics play an essential role in determining performance in the online environment. Studies by Wojciechowski and Bierlein Palmer (2005) highlight that factors such as learning style, motivation, and level of autonomy can predict success in digital environments. Aragon et al. (2002) emphasized that learning styles influence information processing and performance in online contexts. Ifenthaler and Schweinbenz (2016) demonstrated that perceptions of the usefulness and ease of use of technology influence the intention to adopt it. These findings are supported by the technology acceptance model proposed by Venkatesh and Davis (2000), according to which attitudes toward digital tools condition performance and engagement.

Overall, the literature reveals a complex interdependence between assessment design, test duration, time pressure, anxiety, learning styles, and students' personal characteristics. Understanding these mechanisms is essential for optimizing online assessments, ensuring a balance between measurement accuracy and participant well-being.

This study aims to compare the performance of high school students based on the time allocated to complete a standardized biology test, in the context of a national online competition.

MATERIALS AND METHODS

Research design and variables introduced

This research is quantitative in nature, with a quasi-experimental intergroup design and a cross-sectional approach. The independent variable (IV) is the time allocated for completing the test, operationalized on two experimental values: 20 minutes (2025 edition) and 30 minutes (2024 edition). The dependent variable (DV) is student performance, expressed by the final grade obtained on the biology test. A participant variable (predictor) was also included—the gender of the participants, coded dichotomously (1 = male, 2 = female), used to analyze possible correlations with performance. The following elements were kept constant as control variables: the fixed number of items (30), the subject (biology), the type of assessment (online school competition), the standardized structure of the test, and the test administration platform.

Participants

The target population consists of high school students participating in online biology competitions. The demographic data available included the participants' level of education (grades IX–X / XI–XII) and gender. The students' identities were completely anonymized, ensuring data

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confidentiality and compliance with ethical principles of educational research. The available sample included 103 participants who obtained valid scores in one of the two sections of the test, corresponding to grades IX–X and XI–XII. The participants come from two consecutive editions of the National "Bios" Competition (2024 and 2025). Of these, 36 students took the test in Section 1 – Plant and Animal Biology (grades IX–X), and 67 students took the test in Section 2 – Anatomy and Physiology, Genetics, and Human Ecology (grades XI–XII). Participants were divided into two groups, according to the time conditions set by the organizers:

- Group 1 – 2024 edition: 30 minutes allocated to complete the test
- Group 2 – 2025 edition: 20 minutes allocated

Data collection instruments

The main assessment tool was the standardized biology test used in the National ,,Bios" Competition. It contained 30 multiple-choice items, each with a single correct answer. Student performance was measured by the final score, calculated as the sum of the points obtained for the correct answers. Each item contributed 0.33 points to the total score, resulting in a maximum score of 10.

Research procedure

The data was collected from the digital archives of the two editions of the competition. The collection was carried out entirely online, immediately after the completion of each testing session. Subsequently, the results were anonymized, centralized, and organized for statistical analysis.

Data analysis

Statistical analysis was performed using specialized data processing software (SPSS), ensuring methodological rigor and accuracy of interpretations. Descriptive statistics (means, standard deviations, minimum and maximum values) were performed for each time group and section, providing a complete picture of student performance. The following methods were applied to test the hypotheses:

- Independent t-test, to compare the means between time conditions (20 vs. 30 minutes)
- Pearson correlation, to assess the relationship between gender and performance, calculated separately for each section

The significance level adopted was $p < 0.05$, considered standard for interpreting statistical results.

RESULTS AND DISCUSSIONS

Presentation of descriptive data

The descriptive analysis aimed to provide an overview of the performance of students participating in the national biology competition ,,Bios", held in 2024 and 2025. A total of 103 students participated in the competition, divided into two sections: Plant and Animal Biology (Grades IX–X) and Anatomy and Physiology, Genetics, and Human Ecology (Grades XI–XII). The aggregate results indicate an overall average score of 7.10 points (SD = 1.60) for the Plant and Animal Biology section and an overall average of 5.49 points (SD = 1.73) for the Anatomy and Physiology section. The descriptive analysis also reveals a moderate dispersion of scores, suggesting a balanced distribution of performance among students. In general, scores range between 0.67 and 9.67 points, demonstrating a wide range of results and a level of educational heterogeneity specific to voluntary national competitions.

Hypothesis 1: The impact of exam duration on average performance

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To examine the effect of time allocation on student performance, the average scores between the 30-minute (2024 edition) and 20-minute (2025 edition) groups were compared separately for each section.

Plant and Animal Biology Section (IX–X). In the 30-minute group (N = 7), scores ranged from 5.00 to 9.67, with an average of 7.00 points. In the 20-minute group (N = 29), scores ranged from 2.67 to 9.67, with an average of 7.12 points. The application of the independent t-test showed that the difference between the two averages is not statistically significant (p = 0.853669). This result indicates that, for this section, reducing the exam duration from 30 to 20 minutes did not significantly influence the overall performance of the students.

Anatomy and Physiology, Genetics, and Human Ecology Section (XI–XII). In the 30-minute group (N = 29), scores ranged from 0.67 to 9.67, with a mean of 4.92 points. For the 20-minute group (N = 38), scores ranged from 2.67 to 9.33, with a mean of 5.92 points. The independent t-test indicated a statistically significant difference between the two groups (p = 0.017011636), suggesting that students who took the test in a shorter time (20 minutes) achieved higher results. This result, although counterintuitive at first glance, may suggest that a stricter time constraint favored the adoption of a more effective response strategy and greater concentration, reducing hesitation or over-analysis that can occur under extended time conditions.

Table 1.

Descriptive statistics and comparisons of mean scores (independent t-test)

Contest Section	Year (Time Allocated)	N	Average	Standard Deviation (SD)	Minimum Score	Maximum Score	P-value	Conclusion Significance
Competition Section Plant and Animal Biology (IX-X)	2024 (30 min)	7	7	1.4796	5	9.67	0.853669	Insignificant
	2025 (20 min)	29	7.12	1.6555	2.67	9.67		
Anatomy and physiology, genetics, and human ecology (XI-XII)	2024 (30 min)	29	4.92	1.6943	0.67	9.67	0.01701163	Significant
	2025 (20 min)	38	5.92	1.6528	2.67	9.33		

Hypothesis 2: The impact of exam duration on score variability

To assess whether the time allocated influences performance consistency, the standard deviation values for each group were analyzed. In the Plant and Animal Biology section, the standard deviation was 1.48 for the 30-minute group and 1.66 for the 20-minute group, with minor differences. In the Anatomy and Physiology section, the SD values were 1.69 (30 minutes) and 1.65 (20 minutes), indicating an almost identical dispersion between groups. These results show that the variability of scores does not differ significantly depending on the duration of the exam, suggesting a stable distribution of performance in both time conditions. From an educational perspective, this is positive because it indicates that shortening the duration of the test does not affect the fairness of the assessment process.

Hypothesis 3: Correlation between participants' gender and performance

Pearson correlation analyses were used to explore the relationship between gender and competition performance. For Section IX–X, 2024 edition, a significant negative correlation was observed ($r = -0.773$, $p = 0.021$). Male students had higher scores compared to female students. For Section XI–XII, 2024 edition, the correlation was positive but insignificant ($r = 0.081$, $p = 0.339$), and

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for the 2025 edition, both sections showed negative but statistically insignificant correlations (r between −0.107 and −0.122). The overall analysis, combining data from the two editions, showed that there is no significant linear relationship between gender and performance in either section (r = −0.219, p = 0.100 for IX–X; r = −0.031, p = 0.403 for XI–XII). These results suggest that gender is not a relevant predictor of performance in the context of online biology assessments. The differences observed can be attributed to contextual variations (motivation, prior preparation, self-confidence) rather than gender itself.

Table 2

Correlation between participants' gender and competition performance (Pearson correlation)

Contest Section	Year / Time Group	Pearson Correlation Coefficient (r)	P-value	Conclusion Significance
Plant and Animal Biology (IX-X)	2024 (30 min)	-0.773	0.021	Significant
Anatomy and physiology, genetics, and human ecology (XI-XII)	2024 (30 min)	0.081	0.339	Insignificant
Plant and Animal Biology (IX-X)	2025 (20 min)	-0.107	0.291	Insignificant
Anatomy and physiology, genetics, and human ecology (XI-XII)	2025 (20 min)	-0.112	0.223	Insignificant
Plant and Animal Biology (IX-X)	Global (2024 & 2025)	-0.219	0.100	Insignificant
Anatomy and physiology, genetics, and human ecology (XI-XII)	Global (2024 & 2025)	-0.031	0.403	Insignificant

Hypothesis 4: Frequency distribution of scores

The analysis of score distribution provides additional insight into overall performance and sample homogeneity. For the Plant and Animal Biology Section (IX–X), most grades were concentrated in the range of 6–9 points, indicating an approximately normal, Gaussian distribution. This distribution is characteristic of populations that are homogeneous in terms of their level of preparation, where extreme results (very low or very high) are rare. For the Anatomy and Physiology section (XI–XII), the highest frequencies were recorded in the 4–7point range, with a slight asymmetry towards lower scores. However, the overall shape is close to a normal Gaussian distribution, suggesting a natural distribution of performance: most students achieve average results, and extreme cases are rarer. Such a distribution is common and considered typical in educational assessments. In both cases, the distribution shape can be considered compatible with a normal distribution of performance, which confirms the validity of the tests used and indicates the absence of external factors that may have distorted the results.

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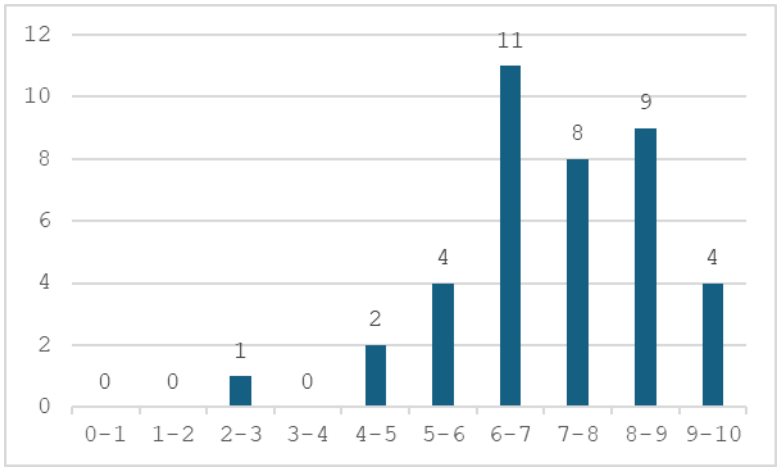

Figure 1 - Distribution of Overall Grades for Plant and Animal Biology (Grades IX-X)

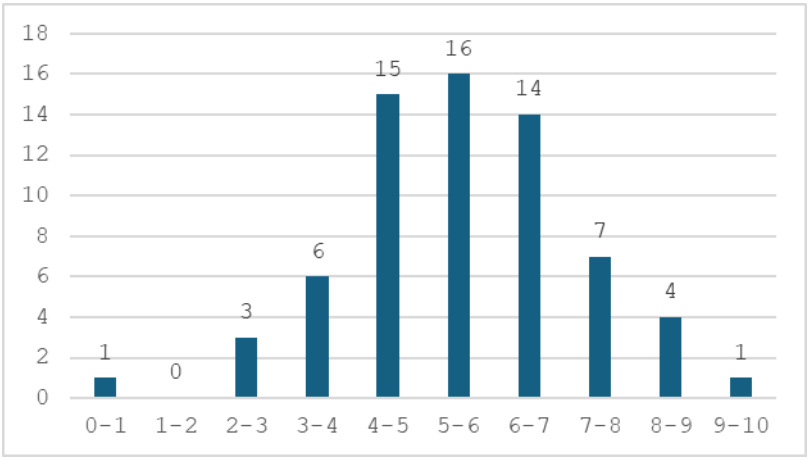

Figure 2 - Distribution of Overall Grades for the Anatomy and Physiology, Genetics, and Human Ecology Section (Grades XI-XII)

CONCLUSIONS

The study investigated the influence of exam duration, score variability, and gender on the performance of students participating in the online biology competition "Bios."

The results showed that, for the Plant and Animal Biology Section, reducing the time from 30 to 20 minutes did not significantly affect average performance, indicating that the initial time was sufficient. In contrast, for the Anatomy and Physiology, Genetics, and Human Ecology Section, performance was significantly higher under time constraints, suggesting a possible optimization of cognitive efficiency under time pressure. Gender did not significantly influence performance, with only one isolated correlation recorded in the 2024 edition for Section IX-X.

These findings have important theoretical and practical implications: the relationship between time and performance is not linear, and a shorter test duration may, under certain conditions, stimulate

concentration and performance. From an applied perspective, the results can guide the optimization of online exam duration and support efforts to maintain fairness in educational assessments.

Although the research has limitations specific to its design, it opens up promising directions for future studies to explore in more detail the interaction between time, stress, and performance in the context of digital assessments in STEM subjects.

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