ANALYSIS OF QUIZZES FOR THE PRINCE2 METHODOLOGY IN RELATION TO THE ASSESSMENT OF STUDENT KNOWLEDGE AND THE AUTOMATED GRADING OF THE PROJECT MANAGEMENT COURSE

Natália Gonosová

Abstract:

This study examines the use of quizzes as a tool for assessing students' knowledge in a university course on project management focused on the PRINCE2 methodology. The study is based on a selected set of 80 multiple-choice questions, from which three tests of 20 questions each were selected and compiled; these were semi-automatically implemented in Microsoft Excel and subsequently in Google Forms to support scalable delivery, automatic grading, and structured data collection. Using descriptive statistics and item-level error analysis, the results compare performance on midterm exams and during the final exam period. The findings show a significant improvement from an average success rate of 68.72% on midterm exams to 92.89% during the exam period, suggesting that more intensive preparation is associated with better results, although claims about relationships remain weaker due to the still low granularity of the questions. At the item level, several questions showed consistently low success rates (approximately 45–64%), particularly regarding PRINCE2 management and decision-making responsibility, suggesting systematic conceptual difficulties. Automated analysis (Excel/Google Forms) provides a framework for rapid feedback to students and practical diagnostics for instructors, thereby supporting targeted improvements in teaching and assignment design.

Keywords:

PRINCE2, project management education, knowledge assessment, quiz analysis, automated grading, Microsoft Excel, Google Forms.

Introduction

Education in project management today lies between two dominant approaches—traditional (process-based) methodologies and agile frameworks. In the academic environment, there is a growing need not only to provide students with theoretical knowledge, but also to objectively and effectively assess their understanding of key concepts. One methodology that offers a clear structure of roles, decision points, and management processes is PRINCE2 [1], [2]. Its process-oriented nature, emphasis on responsibilities, and control mechanisms create a solid foundation for the systematic development of students' project thinking.

From a didactic perspective, PRINCE2 primarily supports students' ability to understand the logic of project management: who makes decisions, when decisions are made, and what information is required to make them. This type of "structured" understanding is important not only for mastering terminology, but also for navigating organizational roles and correctly interpreting project situations. On the other hand, agile frameworks such as Scrum promote flexibility, teamwork, and adaptability to change, but often do not provide such an explicit and formally defined management structure.

From the perspective of knowledge assessment, PRINCE2 therefore offers an advantage—its concepts are more clearly mappable to test items and allow for more precise diagnosis of areas where students struggle.

The core of the work lies in identifying questions that most reliably distinguish different levels of student understanding, as well as in detecting problematic topics (e.g., roles, processes, and decision-making responsibilities) that require targeted instructional improvement. The contribution of this paper is the integration of a didactic perspective with analytical processing of test results, enabling the creation of a repeatable and objective assessment mechanism that provides immediate feedback for both students and instructors.

The paper addresses the following research questions:

1. **RQ1:** What is the overall success rate of students in PRINCE2 tests during the semester and during the examination period, and what are the differences between them?
2. **RQ2:** Which questions (or PRINCE2 topic areas) achieve the lowest success rates and repeatedly appear as problematic?
3. **RQ3:** How does student performance change between semester and examination testing for questions of varying difficulty (easy/medium/hard)?
4. **RQ4:** To what extent can automated processing of results (e.g., in Excel or Google Forms) be used for fast and consistent test evaluation and reporting for instructors?
5. **RQ5:** What recommendations for improving teaching and test design emerge from the analysis (e.g., the need for visualizations, examples, or explanations of incorrect answers)?

At the beginning of the question-development process, we formulated two hypotheses that we wanted to test:

H1: Students' average scores on PRINCE2 tests during the exam period are higher than their average scores during the semester.
H2: The improvement in scores between the semester and the exam period is more pronounced in questions grouped by topic area.

1 Methodology

1.1 Test Design

The testing process was designed with the aim of comprehensively assessing the level of students' knowledge while also creating conditions for its detailed analysis. Emphasis was placed not only on the efficient implementation of testing, but also on obtaining accurate and informative results that enable objective evaluation and the identification of problematic areas within the subject matter.

In the initial phase, a database of 80 test questions was created, covering the full scope of the curriculum and various levels of difficulty. After revision, 60 questions were selected for testing, while 20 were excluded due to their overly theoretical nature. From the selected questions, three separate tests were subsequently constructed, each consisting of 20 questions.

The questions were designed as multiple-choice items with four possible answers (A, B, C, D), with only one correct answer in each case. This approach ensured unambiguous evaluation, eliminated subjectivity, and enabled straightforward automated processing of results.

During the development of the questions, particular emphasis was placed on clarity of formulation and relevance of content. The questions were based on validated study materials and covered key thematic areas of the course. At the same time, an appropriate level of difficulty was

considered, with a combination of easier and more challenging questions allowing for better differentiation among students and providing a realistic picture of their level of knowledge.

1.2 Implementation of Tests

After designing the test questions, the next phase was their practical implementation, which was carried out in two steps – first in the Microsoft Excel environment and subsequently on the online platform Google Forms [4]. This two-step approach made it possible to effectively combine the advantages of local data processing with the capabilities of online testing and response collection.

In the first phase, the tests were implemented in Microsoft Excel, which served as the main tool for design, functionality verification, and ongoing evaluation of the tests (Fig.1). Each test was created as a separate file, and its structure consisted of multiple worksheets. The main worksheet was used for entering students' answers.

PRINCE2 Foundation – Interactive Test (a–d)

Instructions: In the columns, select one answer from the drop-down list. The correctness is evaluated automatically. Results can be found in the 'Overview' sheet.

#	Question	a)	b)	c)	d)	Your Answer	Correctness
6	Which of the following is NOT one of the 7 PRINCE2 processes?	a) Directing a Project	b) Closing a Project	c) Planning a Project	d) Controlling a Stage	a	Incorrect
7	Who is responsible for approving the Business Case?	a) Project Manager	b) Project Board (Project Board)	c) Team Manager	d) Project Sponsor	b	Correct
8	Which document defines requirements for the quality of a specific product?	a) Product Description	b) Quality Register	c) Risk Register	d) Issue Register	a	Correct
9	What is the PRINCE2 principle that deals with learning from previous projects?	a) Managing by Stages	b) Learning from Experience	c) Focus on Products	d) Managing by Exception	c	Incorrect
10	Which process closes a project in PRINCE2?	a) Starting up a Project	b) Initiating a Project	c) Managing a Stage Boundary	d) Directing a Project	a	Correct
11	Which document identifies and records risks?	a) Issue Register	b) Risk Register	c) Quality Register	d) Product Description	b	Correct
12	Who is responsible in PRINCE2 for delivering work packages?	a) Project Manager	b) Team Manager	c) Project Management Team	d) Project Sponsor	b	Correct
13	What is the purpose of a PRINCE2 Theme?	a) Managing Stakeholders	b) Configuration	c) Organization	d) Communication	c	Correct
14	Which process ensures that the project is successfully concluded?	a) Closing a Project	b) Directing a Project	c) Managing Product Delivery	d) Initiating a Project	a	Correct
15	Which document records issue resolution during a project?	a) Risk Register	b) Issue Register	c) Quality Register	d) Business Case	b	Correct
16	Which PRINCE2 principle is about tailoring the method to the project context?	a) Managing by Stages	b) Tailoring to the Project Environment	c) Focus on Products	d) Managing by Exception	c	Incorrect
17	What is the main output of the Initiating a Project process?	a) Project Brief	b) Project Initiation Document (PID)	c) Business Case	d) Product Description	b	Correct
18	Who is responsible for managing (controlling) a stage?	a) Project Manager	b) Project Management Team	c) Team Manager	d) Project Sponsor	a	Correct
19	Which plan typically includes the delivery of work packages to a team level?	a) Stage Plan	b) Team Plan	c) Project Plan	d) Exception Plan	a	Incorrect
20	Which process performs end of stage control as part of the stage?	a) Controlling a Stage	b) Managing Product Delivery	c) Directing a Project	d) Closing a Project	a	Correct

Fig.1. Test sheet (a test worksheet for answering PRINCE2 questions with automatic correctness evaluation).

An integral part of the implementation in Excel was the automatic evaluation of answers, which was carried out using logical functions, primarily the IF function. These functions compared the answers entered by students with the correct answers stored in the system. This evaluation method ensured speed, accuracy, and objectivity without the need for manual intervention.

After verifying the functionality of the tests in the Microsoft Excel environment, the tests were transferred to the Google Forms platform (Fig.2), which enabled easier distribution among students and more efficient data collection. The tests were made available via a link, increasing their accessibility.

From the original three tests, six variants were created, each containing a different combination of questions from the database. These variants were used during different testing sessions, contributing to the systematic organization of testing and an even distribution of difficulty.

The Google Forms platform also provided tools for automated evaluation, particularly the ability to define correct answers and set a random order of questions. The system then automatically evaluates responses and assigns points, eliminating the need for manual grading, reducing the risk of errors, and increasing the overall efficiency of the process (Fig.3), (Fig.4).

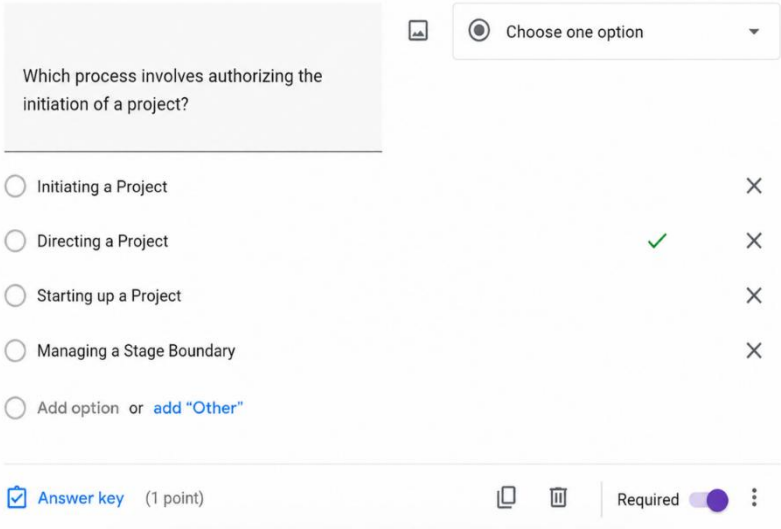

Fig.2. Google Forms – Project management quiz (creating a question in Google Forms).

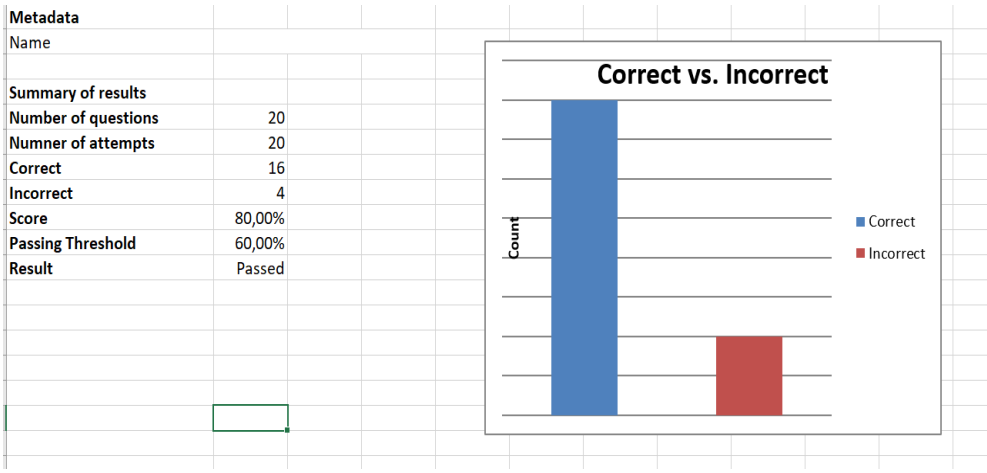

Fig.3. Test Results Summary and Performance Chart
(summary of test results with score and correct vs. incorrect comparison).

Another significant advantage was the possibility of immediate feedback for students. After submitting the test, students were able to instantly view their results. Google Forms also ensured centralized data collection, with all responses automatically stored in a structured spreadsheet. This spreadsheet contained information about individual students' answers, their final scores, and the time of test submission. The data could subsequently be exported to the Microsoft Excel environment, where it was further processed and analyzed.

Časová pečiatka	Výsledok	Piezvisko	Ktorá téma PRINCE2 zabezpečuje, že projekt	Kto je zodpovedný za Business Case a je jedi v	Ktorý proces udeľuje povol
10.12.2025 15:24:12	4 / 10	-	Business Case	Project Manager	Directing a Project
10.12.2025 15:25:00	10 / 10	-	Business Case	Executive	Directing a Project
10.12.2025 15:31:13	10 / 10	-	Business Case	Executive	Directing a Project
17.12.2025 11:26:14	7 / 10	-	Pokrok	Executive	Starting up a Project
17.12.2025 11:26:17	6 / 10	-	Organizácia	Senior User	Initiating a Project
10.1.2026 10:50:52	8 / 10	-	Business Case	Executive	Initiating a Project
10.1.2026 10:57:53	7 / 10	-	Business Case	Project Manager	Starting up a Project
14.1.2026 10:55:00	10 / 10	-	Business Case	Executive	Directing a Project
17.1.2026 10:46:08	10 / 10	-	Business Case	Executive	Directing a Project
17.1.2026 11:17:54	10 / 10	-	Business Case	Executive	Directing a Project

Fig.4. Viewing quiz responses in Google Forms
(Google Forms quiz responses with scores and answers:
Timestamp, Result, Name (empty), Which topic, Responsible, Supervisor)

2 Analysis

After the completion of testing, the collected data were processed in the Microsoft Excel environment, which served as the main tool for their analysis and interpretation. This phase represented a key step of the entire process, as it enabled the evaluation of student performance, assessment of test quality, and identification of problematic areas of the subject matter.

In the first step, the data were collected, organized, and prepared for further processing. Subsequently, basic statistical indicators were calculated to provide an overview of the testing process. These indicators mainly included the number of correct and incorrect answers, the total number of participating students, and the average success rate of the test.

In addition to the overall success rate, special attention was paid to the analysis of individual questions, which made it possible to identify both easier questions and those with a higher level of difficulty. Based on the achieved success rate, the questions were subsequently divided into three categories – easy, medium, and difficult. This classification was based on predefined success rate intervals, which allowed for the systematic assignment of each question to the appropriate category.

For each test, charts were created showing the number of correct answers (Fig.5), (Fig.6), which made it possible to quickly identify differences in student performance and also highlighted questions that were either easier or more difficult.

The analysis also included a comparison of results between testing conducted during the semester and the examination period, which made it possible to track the development of students' knowledge and assess the effectiveness of teaching. Data processing was carried out systematically in the Microsoft Excel environment as an analytical pipeline, which included steps from data import and cleaning, through the calculation of statistical indicators, to visualization and interpretation of results. The advantage of this approach lies in its systematic nature and repeatability, as the same procedure can be applied to future testing, thereby reducing the risk of errors and increasing the reliability of the results.

No.	Question	Correct answer	Correct	Incorrect	Number of students	Success rate	Question difficulty
1	What is the main output of the project start-up phase (Initiating a Project)?	Authorization from Directing a Project	5	6	11	45.45%	Difficult
2	Which process authorizes the initiation of a project?	Directing a Project	10	6	16	62.50%	Difficult
3	Which role ensures that the project delivers the required outputs and outcomes?	Senior User	7	4	11	63.64%	Difficult
4	Which of the following is NOT one of the six quality management objectives in PRINCE2?	Resource capacities	11	5	16	68.75%	Difficult
5	Who is responsible for continuously ensuring and improving the quality of the supplied products?	Senior Supplier	5	2	7	71.43%	Difficult
6	Who is responsible for managing (controlling) a stage?	Project Manager	8	2	10	80.00%	Medium
7	Who is responsible in the Business Case at a single point of accountability for the project?	Executive	13	3	16	81.25%	Medium
8	When is the Lessons Report created?	At the end of the project	9	2	11	81.82%	Medium
9	Which process produces the Project Brief?	Starting up a Project	6	1	7	85.71%	Medium
10	Which document specifies the quality details of the product within the quality tolerances?	Product Description	6	1	7	85.71%	Medium

Fig.5. Quiz results analysis (overview table showing quiz statistics, correct answers, success rates, and question difficulty).

Fig.6. Question error rate chart (bar chart displaying the number of incorrect answers for individual quiz questions).

3 Results

3.1 Results During the Semester

During the semester, three continuous tests were conducted with the aim of monitoring students' level of knowledge and identifying possible gaps in their understanding of the subject matter. The achieved success rates of the individual tests were 70.17%, 69.83%, and 66.17%, with an average success rate of 68.72%. This result provides an overall picture of students' knowledge during the teaching period and serves as a basis for comparison with the results from the examination period (Fig.7).

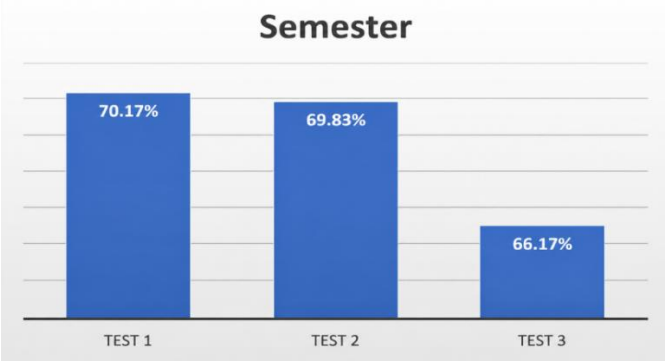

Fig.7. Semester test results (bar chart comparing success rates across three semester tests).

From a developmental perspective, a relatively stable level of success can be observed, with a slightly decreasing trend. This decline may be related to the increasing difficulty of the subject matter and the accumulation of knowledge, which place higher demands on the ability to connect and apply concepts. The results of continuous testing serve an important diagnostic function, as they allow for the identification of weaker areas and provide feedback for adjusting the teaching process.

3.2 Results During the Examination Period

During the examination period, six tests were conducted to assess students' level of knowledge after completing the course and preparing for the exam. The achieved success rates of the individual tests were 96%, 85%, 86.36%, 97.14%, 98.57%, and 94.29%. The average success rate reached 92.89%, which represents a significant improvement compared to continuous testing.

Most of the tests showed very high success rates, with several exceeding 95%, indicating a strong understanding of the subject matter. However, slight differences were observed between individual tests. The lowest success rate was recorded in the second test (85%), likely due to higher difficulty or the presence of more challenging questions. In contrast, the highest success rate was achieved in the fifth test (98.57%), indicating excellent mastery of the given topic. Overall, the results during the examination period do not show a significant upward or downward trend, but rather slight fluctuations around a high level of success.

3.3 Comparison of Results

Based on the processed data, a comparison was made between the results achieved during the semester (Fig.8) and those from the examination period. The average success rate during the semester was 68.72%, while during the examination period it reached 92.89%, representing an increase

of more than 24 percentage points (Fig.9). This difference indicates a significant improvement in students' level of knowledge.

The results indicate a significant shift in performance between continuous testing and final assessment. While continuous tests provide an overview of the current level of knowledge and help identify weaker areas, the results from the examination period reflect a more comprehensive understanding of the subject matter after revision and consolidation.

The improvement can be explained mainly by more intensive student preparation and the cumulative effect of learning, as students have more time during the examination period to systematize their knowledge. Continuous testing also serves a formative function – it provides feedback and guides students in their preparation for the exam.

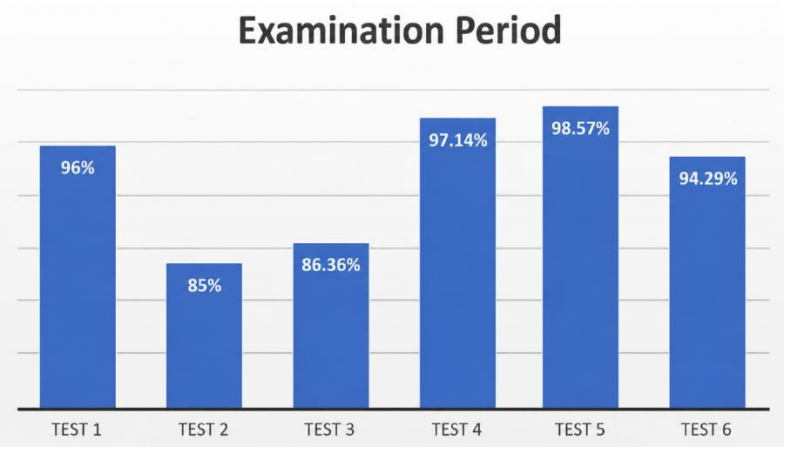

Fig.8. Examination period test results
(bar chart showing success rates across six tests during the examination period).

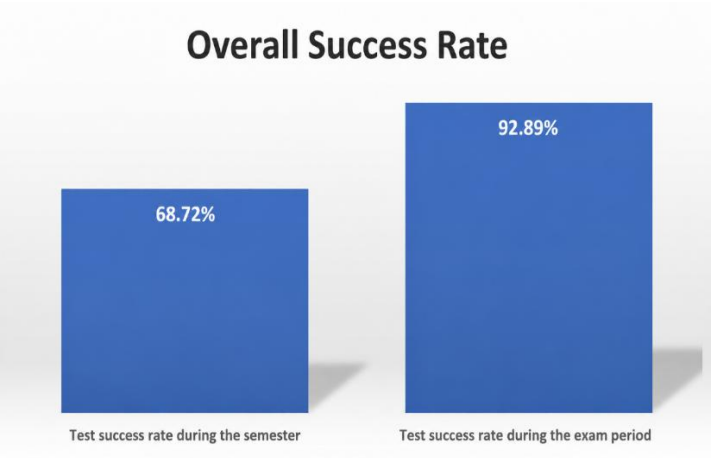

Fig.9. Overall success rate comparison
(Bar chart comparing test success rates during the semester and examination period.)

3.4 Hypothesis Testing H1

Hypothesis H1 assumes that student performance during the examination period is higher than during the semester. Its objective was to verify whether there is an improvement in knowledge as a result of more intensive preparation and revision of the subject matter.

The average success rate during the semester was 68.72%, while during the examination period it reached 92.89%, representing an increase of more than 24 percentage points (Fig.9). This difference indicates a significant improvement in student performance.

The improvement can be explained mainly by more intensive preparation, systematic revision of the subject matter, and greater time available for studying. An important role is also played by the experience gained during the semester, as continuous testing helps students identify weaker areas and better prepare for the final assessment.

Based on these findings, it can be concluded that hypothesis H1 was confirmed, as students achieved significantly higher success rates during the examination period.

3.5 Hypothesis Testing H2

To verify hypothesis H2, which assumes a more significant improvement in performance on difficult questions during the examination period, a detailed analysis at the level of individual questions is required. This primarily involves comparing their success rates during the semester and the examination period within individual difficulty categories.

Such an analysis requires the creation of a per-question success matrix, which would contain data on student performance for each question in both periods. Based on this, it would be possible to accurately assess changes, especially for difficult questions.

However, based on the available aggregated data, it is not possible to conclusively confirm or reject hypothesis H2. The results suggest that some questions remain problematic even during the examination period.

From a methodological perspective, this analysis can be automated in the Microsoft Excel environment, for example using VBA [3], which enables efficient data processing and more accurate comparison of results.

3.6 Discussion

The significant increase in student success rates during the examination period can be explained by a combination of several factors. A key role is played mainly by higher motivation and more intensive preparation, which includes systematic revision and reinforcement of knowledge. An important factor is also the formative nature of continuous testing during the semester, which provides feedback, helps identify weaker areas, and develops students' test-taking skills. The combination of these factors leads to a gradual improvement in performance, which becomes especially evident during examinations.

An important contribution of this work is also the use of automation in data processing through Microsoft Excel and VBA. This approach enables repeatable and consistent processing of results, minimizes the risk of errors, and significantly increases the efficiency of the analytical process. The automated procedure includes data import and cleaning, calculation of statistical indicators, analysis of question success rates, and creation of graphical outputs, allowing the rapid generation of clear and structured reports.

Another important aspect of the teaching process was the connection of theory with practice through semester projects implemented in the Microsoft Project environment. Students worked on projects from technical fields, where they applied principles of planning, resource management, and scheduling. In this context, traditional methodologies such as PRINCE2 proved to provide an appropriate management structure, while agile approaches were less applicable in their pure form.

3.7 Problematic Questions and Suggestions for Improvement

Based on the analysis of test results, problematic questions with the lowest success rates were identified. These were mainly questions 1 to 3, whose success rates ranged approximately from 45% to 64% (Fig.10). These questions were also classified as difficult, confirming their higher level of complexity for students.

Number	Question	Correct Answer	Correct	Incorrect	Number of Students	Success Rate	Difficulty Level
1	What is the first step in initiating a project (Initiating a Project)?	Authorization from the Directing a Project	5	6	11	45.45%	Difficult
2	Which process is responsible for initiating a project?	Directing a Project	10	6	16	62.50%	Difficult
3	Who is responsible for delivering operational outputs and benefits of the project?	Senior User	7	4	11	63.64%	Difficult
4	Which of the following is NOT one of the seven performance targets in PRINCE2?	Resource capacity	11	5	16	68.75%	Difficult
5	Who is responsible for the continuous supply of products and ensuring their quality?	Senior Supplier	5	2	7	71.43%	Difficult

Fig.10. Analysis of difficult quiz questions (table showing the least successful quiz questions, including correct answers, success rates, and difficulty levels).

The content of these questions focused mainly on the Directing a Project process, the Senior User role, and the fundamental principles of project roles within the PRINCE2 methodology. The lower success rate indicates insufficient understanding of these areas, suggesting that the problem is not random but systematic.

The main cause lies primarily in the theoretical nature of the questions, which requires precise knowledge of terminology and the ability to correctly interpret individual concepts in context. Students particularly struggled with understanding the strategic role of the Directing a Project process and with correctly distinguishing project roles, especially the Senior User role, which they often confused with other project roles.

To improve teaching effectiveness, it is recommended to use visual aids such as process diagrams and organizational charts, which help students better understand the relationships between the individual elements of the methodology. Equally important is connecting theory with practical examples and model situations that allow better application of knowledge.

At the same time, greater attention should be devoted to explaining incorrect answers and including more practice tasks focused on the identified problematic areas. These measures can contribute to deeper understanding and improved student performance.

3.8 Limitations and Constraints

When interpreting the obtained results, it is necessary to consider several limitations that may have affected the accuracy and completeness of the analysis.

One of the main limitations is the unavailability of detailed data at the level of individual questions for both observed periods. To accurately verify hypothesis H2, it would be necessary to work with a per-question success matrix that would allow comparison of student performance on

each question during both the semester and the examination period. Due to the absence of such data, the interpretation of the results can only be considered partial.

Another factor that may have influenced the results is the different composition of students across individual testing periods. Different groups of students may have varying levels of knowledge, motivation, or experience, which may be reflected in the overall success rate.

The results may also have been affected by differences in the difficulty of individual test variants. Although creating multiple test variants helps reduce the possibility of cheating, it may also lead to slight differences in difficulty that can influence the achieved results.

Based on these limitations, the results should be interpreted with a certain degree of caution. Nevertheless, the obtained data provide a relevant insight into the level of student knowledge and make it possible to identify the main trends and problematic areas.

Conclusion

In this paper, we analyzed the PRINCE2 test questions used in a project management course with the aim of:

(i) comparing students' performance on formative assessments during the semester with their performance on assessments administered during the exam period,
(ii) identify tasks with consistently low success rates, and
(iii) evaluate the benefits of automated data collection, scoring, and reporting of results.

The findings revealed a significant difference between these two periods: the average success rate was 68.72% during the semester and 92.89% during the exam period, representing an increase of more than 24 percentage points. This empirical pattern is consistent with the interpretation that formative assessment can serve as a formal function and, when combined with more intensive preparation during the exam period, is associated with higher success rates; however, given the study design and data availability, causal explanations should be approached with caution.

Some questions were identified as consistently problematic, exhibiting the lowest success rates in relation to certain PRINCE2 processes and principles. From a pedagogical perspective, these results highlight the need to strengthen instruction in the identified areas and revise the wording of items to promote a logical understanding of managerial responsibilities and process interconnections, rather than primarily testing memorization of terminology. Regarding data processing, automated grading in Excel/Google Forms increased the repeatability and consistency of scoring and enabled the rapid generation of analytical outputs and timely feedback for students.

The interpretation of results is limited by differences in the difficulty of individual test variants. Therefore, a priority for further development is to implement systematic item-level data collection throughout the semester, define metrics (including linking items to subject areas and difficulty levels), and standardize the creation of test variants in terms of both content and difficulty. In conclusion, it can be stated that the combination of structured PRINCE2 concepts with regular assessment and automated processing provides a functional framework for a more objective evaluation of knowledge and for the continuous improvement of teaching quality in the Project Management course.

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Author

Natália Gonosová
Faculty of Informatics
Pan-European University in Bratislava, Slovakia
xgonosova@paneurouni.com

Natália Gonosová is a student of Applied Informatics at the Faculty of Informatics, Pan-European University in Bratislava, Slovakia. My academic interests include project management methodologies, especially PRINCE2, and their practical application in process management and optimization.