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Communication Aspect of National Testing Digitalization: Investigating Key Stakeholders' Satisfaction

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Abstract:

Research Question: The paper deals with the analysis of the elements of the communication system in the process of digitalization of the national testing process in the Republic of Serbia. **Motivation:** National testing represents an important segment of education in most countries. Considering that it involves a large number of stakeholders and activities, innovations based on the implementation of new technologies are complex and require significant efforts and resources for their implementation. The digitalization of national testing in Serbia, in addition to the development of software and organizational solutions, is accompanied by the development and implementation of a communication system aimed at facilitating the acceptance of innovations by all participants. This paper addresses the analysis of the efficiency of the elements of the communication system and satisfaction of stakeholders with them, at the final exam at the end of primary education in the Republic of Serbia. **Idea:** The paper aims to describe a successful communication system implemented to support the process of national testing digitalization. Effective communication is essential due to the large number of participants involved in the process and should ensure national testing effectiveness and transparency. **Data:** For the analysis of the satisfaction of two stakeholder groups with the highest interest and influence in the process of conducting the final exam, data obtained from surveys conducted in 2021, 2022, and 2023 were used. Each year, the questionnaire was completed by over 900 primary school principals and over 8,000 parents of final-grade pupils. **Tools:** In the research, a questionnaire specifically designed for two stakeholder groups - primary school principals and parents of final-grade pupils was used. Statistical analysis was performed using SPSS software. Descriptive statistics and correlation analysis were employed. **Findings:** The research has found that high satisfaction among key stakeholders (primary school principals and parents) is achieved through a carefully designed and implemented communication system, which includes an internet portal, written and video instructions, as well as direct support from trained and expert individuals. The communication system element that has the greatest impact on principals' satisfaction is the administrative portal, while for parents, it comprises all instructions prepared for carrying out activities. **Contribution:** This paper expands on existing research related to the digitalization of national testing and highlights the key elements of the communication system to enhance participant satisfaction in the process.

Keywords: Digital transformation, Education, National testing, Communication System

JEL classification: M14, M30, H75, I20

1. Introduction

Digital transformation has become a trend in education due to its potential to revolutionize educational processes and improve educational outcomes (Moldagali et al., 2022; UNESCO, 2020; Koszalka & Ntloedibe-Kuswani, 2010).

It refers to the integration of digital technologies and tools into various aspects of teaching, learning, and administrative processes within educational institutions (Pellegrino & Hilton, 2012; Means et al., 2009). In the digital transformation of education, special importance is given to the digitalization of national testing, which involves various innovations and improvements. There are different aspects of applying modern technologies

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in the digitalization of national testing, including computer-based testing, digital question banks, data analysis, online test preparation, computerized scoring and others (Saheb & Tben, 2024; Christina & Hanna, 2019). All of them bring improvements in the efficiency, reliability, and transparency of the entire process (Wyatt-Smith et al., 2021). Additionally, they enable data management enhancements and provide valuable insights into pupils' outcomes and performance (Ronn, 2023; Oncul, 2021).

One of the challenges in the digitalization of national testing, in addition to the development of software and organizational solutions, relates to the communication aspect, considering the large number of participants and institutions involved in this process (Gunnulfson & Roe, 2018). Communication plays a pivotal role in the whole process, influencing its effectiveness and transparency. Digitalization fundamentally transforms communication processes, introducing novel conditions for the exchange, interaction, and dissemination of information (Kupchuk & Miasoid, 2021; Bobokulov, 2022). The communication system requires employing modern information formats and strategies to involve end-users, thereby initiating a series of changes in attitudes and communication practices with stakeholders (Moisescu & Titu, 2021). Effective communication ensures that the process of national testing is clearly defined and understood by all involved stakeholders, including state institutions, educators, test administrators, and participants together with their parents (Pellegrino & Quellmalz, 2010). In addition, clear and transparent communication fosters trust and confidence among stakeholders, encouraging their active engagement and cooperation (Lane & Stone, 2006). Since the communication aspect of national testing is insufficiently explored in the literature, especially in the domestic context, this paper describes the communication system tailored to the final exam at the end of primary education in the Republic of Serbia.

The Final exam has been mandatory in Serbia since 2012/13. Generally, the final exam plays a crucial role in achieving the goals of education, namely, to improve the quality of primary education and develop equal opportunities for all pupils in the national system (Jerrim, 2021; Teodorovic et al., 2020; Sahlberg, 2012). In Serbia, it consists of tests in the native language, mathematics, and one of five elective subjects (geography, biology, history, physics, or chemistry). Until 2019, the administration of the final exam took place without significant digitalization. From the school year 2019/20, the focus has shifted to the digitalization of parts of the process, particularly answers reviewing, to achieve higher objectivity and transparency. This approach resulted in innovations and improvements in all phases preceding and after the test review. In addition to developing software solutions for the final exam digitalization, it was necessary to devise appropriate organizational solutions and a communication system with many stakeholder groups. This paper aims to describe a case of successful development and implementation of the communication system (in the following text CS) within the national testing digitalization process. This success story can serve as an example of good practice for other countries where national testing is in the process of digitalization.

The principal approach employed in this paper is a case study, focusing on examining the distinctive attributes of a particular case, event, or situation. While it is recognized that utilizing a single case study offers insights into only one instance and its context (Woodside, 2010), the chosen case serves as a representative model from which valuable insights and principles can be extrapolated and applied in all countries where national testing is traditionally conducted using paper forms, including printing and manual test review. Within this case study, data for analyzing the satisfaction of key stakeholders (primary school principals and parents/guardians of pupils) were obtained from surveys conducted in 2021, 2022, and 2023. The survey was conducted through questionnaires, with over 900 school principals and over 8.000 parents/guardians (hereinafter: parents). Statistical analysis was conducted on the collected data, including descriptive statistics and correlation analysis.

The paper is structured as follows: the next section presents a process of the digitalization of national testing in Serbia, describing the basics of the developed software and organizational solution, outlining the participants in the process, identifying key stakeholders, and describing the CS established with them. In the third section, the satisfaction research of key stakeholders is described, followed by the presentation of results and discussion. The final chapter presents concluding considerations and directions for further development and improvement of the CS.

2. Digitalization of National Testing in the Republic of Serbia: Final Exam at the End of Primary School

In the Republic of Serbia, the digitalization of the final exam was based on the development and implementation of several software solutions, which, among others, enable the transformation and review of tests/tasks in the digital form. Digital task review involves an automatic review of close-ended tasks by the

software, while all open-ended tasks, after transformation into digital form, are reviewed by two independent reviewers. The fact that tasks are transformed into digital form and anonymized, so reviewers do not know which pupil's task they are reviewing, along with the requirement that both reviewers must score the task with the same number of points, significantly improved the objectivity of the entire national testing process. Before digitalization, test task review was conducted at schools, where it was not possible to achieve even an approximate level of objectivity in evaluation. Objectivity in reviewing is one of the most important outcomes of the digitalization process (Wyatt-Smith et al., 2021).

In addition to reviewing tasks in digital form, the digitalization of national testing in Serbia involved the development and implementation of software for activities preceding review: test generation software, test packing plan creation software, test packing software, and task scanning software (converting tasks from paper to electronic form). All developed software solutions are integrated because changes in one subsystem affect all previous and subsequent phases of the process.

2.1 Stakeholder mapping

In addition to the development and alignment of the mentioned software, a particular challenge in implementing the final exam arises from the large number of institutions and participants involved in the national testing process. To ensure that the interests, needs, and concerns of all relevant parties are effectively addressed throughout the testing process, a stakeholder management approach was applied. The first step involved identifying all individuals, groups, and organizations with an interest in or impacted by the testing initiative (Bryson, 2004). In addition to 65,000 pupils taking the final grade (Ministry of Education, 2023) and approximately 130,000 of their parents, who are not only end-users but also active participants in the realization of activities, many institutions are responsible for various aspects of this process. Key institutions are depicted in Figure 1.

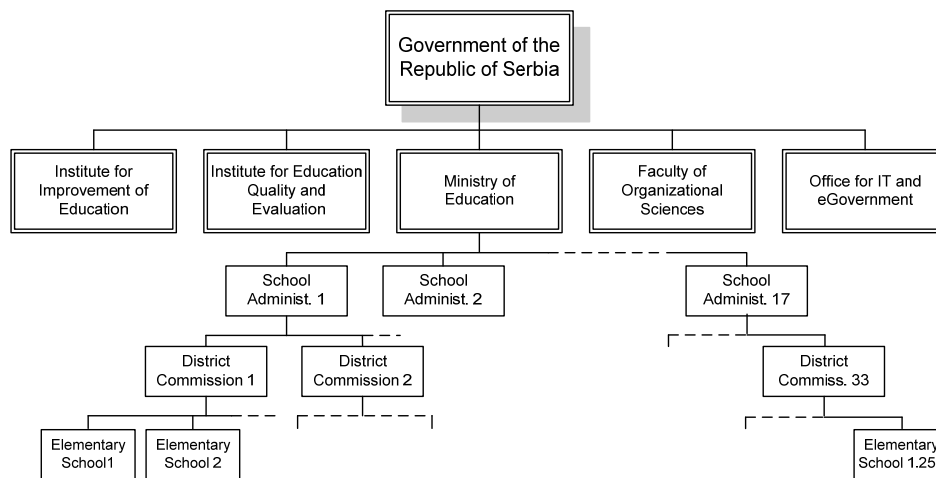


Figure 1: Organizational chart of participants in the national testing process

The main institution at the top of the hierarchy for this and similar state projects is the Government of the Republic of Serbia, which has both a strategic and supervisory role. Most activities are carried out by the Ministry of Education, which oversees around 1,250 primary and 500 secondary schools across 17 school administrations and 35 district commissions organized by regions in Serbia. School administrations and district commissions have the role of coordinating and monitoring the activities of the primary and secondary schools for which they are responsible (Ministry of Education, 2023).

The majority of individuals involved in the implementation activities of the final exam are employed in primary and secondary schools. In addition to their regular activities, teachers in schools also have various roles defined by the organization of the final exam. Each year, the approximate number of different roles and their responsibilities during the realization of the final exam and enrollment of pupils in secondary schools are (Institute for Education Quality and Evaluation, 2022):

- Around 1,250 principals of primary schools - responsible for all activities taking place in the schools, from pupil records, their registration for the final exam, assigning various roles to their employees (class teacher, duty teacher, examiner, or supervisor), creating a plan for the realization of the final

exam on-site (determining rooms, seating arrangements, security conditions, etc.), collecting tests at checkpoints, collecting tests after the final exam, submitting reports after the final exam, returning tests to scanning centers, etc.

- About 500 principals of secondary schools - responsible for all activities related to the registration and implementation of entrance exams for specialized schools and enrollment of pupils in secondary schools.
- Around 3,500 class teachers - responsible for providing timely and accurate information to pupils and their parents about the realization of the final exam, conducting trial final exams, verifying pupil data, registering for the final exam, submitting wish lists for enrollment in secondary schools, etc.
- Around 13,500 duty teachers - responsible for activities carried out in the examination halls on the days of the final exam.
- About 12,000 examiners - responsible for reviewing tasks in digital form through one of the software solutions - the review application. Access to the application is only granted to authorized users with the right to access specific groups of tasks (depending on the subject and language in which the tasks are composed).
- About 2,250 supervisors - responsible for monitoring all activities at the location on the days of the final exam, from checking the protective bags in which the tasks arrive at the location to monitoring the procedures of each participant in the process (pupils, duty teachers, principals, etc.)

To establish a communication system, a special group of 34 IT coordinators was introduced to provide support to school principals in carrying out all activities. Due to the varying competencies of principals regarding the use of different software, this group of IT specialists proved to be of great importance in situations where principals could not resolve the problems they encountered. IT coordinators also serve as a direct channel of communication between school principals and other participants in the process.

School administrations represent permanent organizational units responsible for monitoring the execution of all activities and compliance with all laws, rules, and procedures in schools, including those related to the realization of the final exam. They represent the formal line of authority between the Ministry and school principals, but also an important channel of communication and control to ensure that all activities are completed on time and by procedures.

The Office for Information Technology and Electronic Administration of the Government of the Republic of Serbia is responsible for providing information support and infrastructure in all phases of the realization of the final exam and enrollment of pupils in secondary schools. Similar offices exist in most developed countries.

The Institute for Education Quality and Evaluation is the institution responsible for preparing tests. The final exam includes tests in seven subjects (native language, mathematics, and five elective subjects, from which pupils choose one) in nine languages (Serbian and eight languages of national minorities). The quality of tasks and tests has a significant impact on the quality of the entire process of implementing the final exam. Moreover, considering that the questions in the majority of the 63 tests are shuffled, verifying the correctness of the tests becomes even more complex. At the end of the test preparation process, each test is assigned unique graphical and alphabetical elements (QR codes and Correlation key) to ensure the uniqueness of each of the 185,000 tests.

The Institute for Improvement of Education is responsible for the formal implementation of the competency check for participants in the process who are located in primary and secondary schools. On a specially designed platform, employees in all roles must take a test on knowledge of rules and procedures they have previously familiarized themselves with.

The Faculty of Organizational Sciences, University of Belgrade, was engaged in the development and implementation of a comprehensive software and organizational solution for the final exam. The software solution includes the following web and desktop applications:

- Public portal "My High School" - a web portal intended for pupils in the final year of primary school and their parents. Its primary function is to provide information and perform activities related to taking the final exam from home.
- Administrative portal "My High School" - a web portal for administrative support intended for principals and other school employees involved in the realization of the final exam and pupil enrollment in high school. Its primary function is to input and update all necessary data for the realization of the final exam and pupil enrollment in high school.

- Test generation software.
- Test packing plan creation software.
- Test packing software.
- Scanning software.
- Task review software.

In addition to software development, within the organizational solution developed at the Faculty of Organizational Sciences, special attention was paid to the development and implementation of a communication system - establishing a system for informing, monitoring, communicating, and coordinating the activities of participants in all phases of the final exam realization and pupil enrollment in secondary school. For these tasks, the following CS elements were established: administrative and public portals, instructions for conducting the final exam (written and video instructions), and a trained group of IT coordinators, while existing schools were turned into communication hubs within the CS. For the implementation of the software and organizational solution, as well as establishing the CS, it was necessary to train many users and participants in the process. The interconnectedness of all activities and the large number of participants required a special approach to each stakeholder group, the creation of numerous instructions, and the organization of many practical training sessions, which were the responsibility of the Faculty of Organizational Sciences.

The complexity of the implementation process of such a project is underscored by a large number of institutions and participants. The number of participants in the process of implementing national testing by categories is shown in the following figure.



Figure 2: Number of participants by categories

2.2 Communication system and key stakeholders

To identify stakeholders with the greatest influence and, simultaneously, the highest interest in the outcomes achieved through the realization of the final exam, the Mendelow matrix of interest groups (1991) was used. All depicted stakeholders are mapped out on the grid to classify them by both their influence and interest and the size of the circles is determined based on the number of members of a specific stakeholder group.

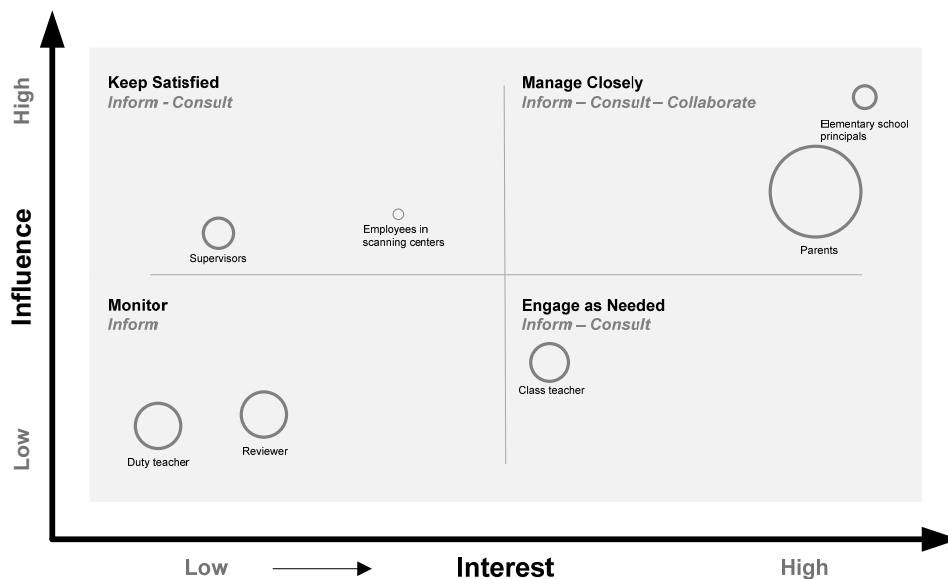


Figure 3: Matrix of Stakeholder Interest Groups (Mendelow, 1991)

According to the matrix, the two groups with the highest interest and influence in the process of realization of the final exam and enrolling pupils in secondary schools are the principals of primary schools and the parents of pupils taking the final exam. These two stakeholder groups were also recognized in the project implementation as groups requiring a special communication plan, which involved several key activities.

School principals are directly responsible for all employees in the schools, among whom individuals are recruited for the roles mentioned above: class teachers, duty teachers, examiners, and supervisors, totaling around 30,000.

The CS was established with the principals, which involved direct communication between members of the school administrations and IT coordinators. These actors were in direct and immediate contact with school principals, conveying all important information and providing all necessary support. Additionally, for more efficient communication with principals, as well as for data input, monitoring, and verification, an administrative portal "My High School" was developed with several key functionalities:

- Information and communication - principals receive notifications about upcoming activities and prepare written and video instructions via the portal.
- Data entry, modification, and review - the portal allows the input and updating of all necessary information about the school, classes, pupils, and employees involved in the realization of the final exam, as well as reviewing this data at any time.
- Activity realization - various activities such as pupil registration for the final exam, defining locations for the final exam, submitting reports on attendance and realization of the final exam, and others can be performed through the portal.

Many primary schools, and hence principals, as well as the complexity of the processes and activities principals must undertake, require the organization of a daily support system. For this purpose, the team as mentioned above of 34 IT coordinators was formed at the level of the Republic of Serbia, tasked with providing technical and informational support to principals at all times. The coordinators rely on the functionality of the administrative portal, which enables them to monitor all activities carried out by the principals of the assigned primary schools.

A significant number of instructions and video tutorials have been prepared for principals to support them in their activities. Together with the IT coordinators, the goal of these instructions is to ensure that all activities are carried out as planned and within the specified deadlines. Feedback from principals is obtained indirectly, through IT coordinators, and occasionally directly. Although indirect, this communication channel has proven to be an efficient way to make changes and improvements in the system, as suggestions and requests are quickly processed and delivered to the right address.

The other significant stakeholder group consists of the parents of pupils taking the final exam and enrolling in high school. To inform parents, the public portal "My High School" has been created. Through this portal, parents can check all data about their children at any time (school performance, results of entrance exams for specialized schools, results of the final exam, enrollment results), and they can also perform various activities without visiting the school. Additionally, they can register their child for the final exam and choose the subject for the third test, register for entrance exams for specialized schools, lodge complaints about the results of entrance and final exams, submit their wish list for enrollment in high school, and finally complete the enrollment according to the final ranking.

An important part of the CS with parents are the instructions explaining parents' obligations and procedures for carrying out activities. During the preparation of instructions, emphasis was placed on the timeliness, accuracy, and completeness of information. The portal includes a calendar of activities in a special section, serving as a reminder to parents of activities that must be completed at specific times.

Another communication channel with parents is through primary schools, specifically through class teachers. Class teachers also provide all necessary information to pupils and parents and direct them to the public portal and the useful information available on it. Service support for obtaining feedback from parents has not been provided. Currently, information from parents is only obtained indirectly, through class teachers and schools.

3. The Satisfaction Survey of Key Stakeholders

To measure stakeholder satisfaction with the entire organization of the final exam and communication throughout the process, a satisfaction survey of all stakeholder groups was conducted consecutively for three years - from 2021 to 2023. Each year, the survey was conducted immediately after the completion of the final exam. Below are the results of the stakeholder survey, identifying the two most important groups through mapping: primary school principals and parents of final-grade pupils.

A separate questionnaire was created for each stakeholder group, containing questions specific to the activities and experiences of that particular group. The SERVQUAL model was used as the basis for forming the questionnaire, which involves assessing customers' perceptions of service quality against their expectations across dimensions (Zeithaml et al., 1990). For the research, the impact of CS elements on overall satisfaction was evaluated for principals: administrative portal (ease of use and design), instructions and video tutorials, and support (from IT coordinators and school administrations), and for parents: public portal (ease of use and design), instructions, and support (from schools and class teachers). Also, overall satisfaction with implementing software and organizational solutions during national testing was examined. A scale of 0 to 10 was used for the evaluation of all the components and stakeholders' satisfaction.

The research with primary school principals was conducted consecutively in 2021, 2022, and 2023. The invitation to complete the questionnaire was sent to principals via email from the Ministry of Education and relevant school authorities. The response rate was high all three years, exceeding 88% in the first year. The satisfaction survey of final-grade pupils' parents was conducted in 2022 and 2023. The questionnaire was sent to parents through the public portal, and the questionnaire link was only available to authorized portal users, which means that only parents of final-grade pupils were able to complete the questionnaire. Out of 65,000 parents, approximately 12% completed the questionnaire in the first year and 14% in the second year.

3.1 Research results and discussion

Table 1 displays the mean values and standard deviations of school principals' satisfaction with elements of the CS. All measured indicators have an average value higher than 8.5, indicating extremely high user satisfaction. The lowest satisfaction value throughout the entire measurement period pertains to the administrative portal. Analysis of the standard deviation reveals greater inconsistency among respondents regarding this element of the CS. This can be explained by the multitude of functionalities the portal offers, which may have created resistance among principals in terms of adopting new technologies (Alanoglu et al., 2022; Howard & Mozejko, 2015). Slightly lower satisfaction with the portal can also be interpreted in terms of varying levels of principals' IT literacy, which affects their satisfaction with utilizing its functionalities (Chen, 2015).

Table 1: Satisfaction of primary school principals with CS elements

	2021		2022		2023	
Number of participants	1,107		895		935	
	Mean	SD	Mean	SD	Mean	SD
Administrative portal	8.69	1.55	8.72	1.64	8.69	1.54
Instructions	9.06	1.30	9.25	1.29	9.23	1.17
Support	9.47	1.04	9.62	0.98	9.62	0.89

Analyzing the satisfaction of school principals with instructions and video tutorials, a significant increase in mean values and a decrease in standard deviation can be observed over the years of measurement. To implement national testing, over 20 instructions were created, ranging from those explaining procedures to technical instructions elucidating the functionalities of the administrative portal. Over time, these instructions were improved based on feedback provided through the CS.

The highest ratings and the greatest consensus regarding satisfaction with the elements of the CS were observed for the support provided by IT coordinators. Through these coordinators, principals received not only technical assistance but also help with all procedural matters. The second line of support consisted of school administrators responsible for primary schools. Ongoing support from IT coordinators and relevant school administrations contributed to principals being able to complete all activities by procedures and within the specified deadlines.

To identify and assess the strength of the relationship between established elements of the CS and the overall satisfaction of school principals, a correlational analysis was conducted (Table 2). Statistically significant linear relationships were found between all elements of the CS and the overall satisfaction of school principals. All identified relationships are positive and of strong intensity. Contrary to the determined ranking of satisfaction levels with individual elements of the CS, where the highest average rating was for the Instructions element and the lowest for the Administrative portal, the correlational analysis indicates that throughout all years of observation, the strongest linear relationship was found precisely between the Administrative portal element ($r_{21}=0.637$, Sig.<0.01, $r_{22}=0.630$, Sig.<0.01, $r_{23}=0.628$, Sig.<0.01), followed by Instructions ($r_{21}=0.618$, Sig.<0.01, $r_{22}=0.667$, Sig.<0.01, $r_{23}=0.588$, Sig.<0.01), and finally Support ($r_{21}=0.571$, Sig.<0.01, $r_{22}=0.573$, Sig.<0.01, $r_{23}=0.503$, Sig.<0.01). This means that the overall satisfaction of school principals largely depends on the functionality of the administrative portal, while to a lesser but still significant extent, on instructions and support. If we were to influence an increase in the level of overall satisfaction, this could primarily be achieved through interventions in the first CS element. For each identified linear relationship, coefficients of determination are also shown in Table 2, indicating the degree to which the variability of the related variables is explained.

Table 2: Correlation matrix of CS elements and overall satisfaction of school principals

Stakeholder: School Principals		The Communication System								
		Administrative portal			Instructions			Support		
		2021	2022	2023	2021	2022	2023	2021	2022	2023
Overall Satisfaction	Coef.	0.637	0.630	0.628	0.618	0.667	0.588	0.571	0.573	0.503
	R	0.406	0.397	0.395	0.381	0.445	0.346	0.325	0.329	0.253
	N	1091	880	924	1091	880	924	1091	880	924
	T stat.	27.303	24.020	24.513	25.907	26.545	22.100	22.924	20.739	17.687
	DF:	1089	878	922	1089	878	922	1089	878	922
	Sig.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

It can be assumed that the lowest satisfaction rating was assigned to the administrative portal due to its complexity, i.e., the large number of functionalities it offers. Although the portal facilitates many activities related to data management and reporting, it also represents a technically demanding tool for school principals. Nevertheless, any improvements in the functionalities, design, and user-friendliness of the portal significantly contribute to increasing the overall satisfaction of principals with the organization of national

testing. In the case of the other two CS elements, there is less room for further improvements that would lead to an increase in this satisfaction because they are almost fully developed.

Table 3 displays the results obtained from the questionnaire for parents of pupils who took the final exam. Considering the large sample of respondents, all evaluated elements have values higher than 8.5, indicating high satisfaction of parents with the implemented CS. Similar to school principals, the element with which parents are most satisfied is the support provided by the primary school and class teachers. Second in satisfaction ranking is the quality of the public portal (its design and user-friendliness), while instructions are slightly lower rated compared to the other two elements of the CS.

Table 3: Parents' satisfaction with elements of CS

	2021	2022		2023	
Number of respondents	N/A	7.931		9.137	
		Mean	SD	Mean	SD
Public portal	N/A	9.02	1.53	8.84	1.60
Instructions	N/A	8.98	1.57	8.76	1.72
Support	N/A	9.34	1.54	8.90	1.95

Correlational analysis of the elements of the CS and overall satisfaction was also conducted for the other relevant stakeholder - parents of pupils. Similar to school principals, statistically significant linear relationships were found between all elements of the CS and overall satisfaction in this case as well. The identified relationships are also positive and of moderate to strong intensity.

The correlational analysis revealed that throughout all years of observation, the strongest linear relationship was found between the Instructions ($r_{22}=0.611$, Sig.<0.01, $r_{23}=0.653$, Sig.<0.01), followed by Support ($r_{22}=0.534$, Sig.<0.01, $r_{23}=0.547$, Sig.<0.01), and finally the Public portal ($r_{22}=0.487$, Sig.<0.01, $r_{23}=0.566$, Sig.<0.01). Therefore, the satisfaction of parents largely depends on Instructions, while to a lesser but still significant extent, on support and the Public portal. Increasing the level of overall satisfaction can primarily be achieved through interventions in the instructions provided to parents.

Table 4: Correlation matrix of CS elements and overall satisfaction of parents

Stakeholder: Parents		The Communication System					
		Public portal		Instructions		Support	
		2022	2023	2022	2023	2022	2023
Overall Satisfaction	Coef.	0.487	0.566	0.611	0.653	0.534	0.547
	R	0.237	0.320	0.374	0.426	0.285	0.299
	N	7844	9016	7844	9016	7844	9016
	T stat.	49.415	65.109	68.402	81.792	55.894	61.990
	DF:	7842	9014	7842	9014	7842	9014
	Sig.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Similar to school principals, the correlational analysis examining the relationship between the CS elements and parent satisfaction indicates that the least evaluated element (Instructions) has the greatest impact on improving overall parent satisfaction with the organization of national testing. The Public portal, designed for parents, was significantly easier to use with fewer functionalities. Additionally, there is less room for improvement in this CS element compared to the case with school principals. This CS element does not have the strongest correlation with overall satisfaction with the organization of national testing among all observed elements. It can be concluded that by improving instructions, the highest increase in overall parent satisfaction with the organization of national testing can be achieved.

All described communication activities, particularly feedback mechanisms facilitate ongoing dialogue and collaboration for the continuous improvement of national testing practices, as has already been proven by previous research (De Nobile & Bilgin, 2022; Shepard, 2000). By soliciting input from various stakeholders, emerging challenges can be addressed and areas for improvements can be defined.

Conclusion

Digital transformation in education represents a trend aimed at improving practices and outcomes (Moldagali et al., 2022). A particular segment in this field is the digitalization of national testing, which enhances the process, increases objectivity, reduces errors, and enables more efficient data management and insights into candidates' performance and results (Hatfield & Solost, 2024; Saheb & Tben, 2024).

This paper presents a case study of digitalization in the process of national testing at the end of primary education in the Republic of Serbia, involving a large number of stakeholders, with over 70,000 participants. The software and organizational solutions in the digitalization of the final exam process are presented, with a special focus on the established communication system and its elements - administrative/public portal, instructions, and support.

The case study presents a communication system with two groups of stakeholders that have the greatest impact on the success of the process and are simultaneously most interested in the achieved results - primary school principals and parents of pupils. The communication system with these two groups included the development of two specialized internet portals serving as communication channels, as well as applications for data entry, modification, control, monitoring, reporting, and performing all activities in the process. Secondly, the communication system involved the creation of over twenty instructions and video tutorials for a better understanding of all activities. Thirdly, direct communication and support were established for participants through employees tasked with providing support in carrying out activities (IT coordinators, school administrations, and school staff). A satisfaction survey was conducted among the mentioned stakeholders regarding the established elements of the communication system and their connection to overall satisfaction with the organization of national testing. By analyzing the organization and the established communication system, guidelines for further system development can be identified. Although the satisfaction with the quality of services of both key stakeholder groups is high, further improvements in the communication system can be suggested. The analysis of the elements of the communication system and the overall satisfaction of these two stakeholder groups suggests that the greatest improvements can be achieved through interventions on the administrative portal in the case of school principals, while in the case of parents, the focus should primarily be on the instructions tailored for them. In the case of school principals, improvements could involve greater integration of the administrative portal with other software used in schools (such as eGradebook, Unified Educational Information System), as well as the addition of new functionalities to the portal (reporting, result analysis, etc.). For parents, better support is proposed through the creation of a larger number of video tutorials and instructions for all activities related to taking the final exam and enrolling in secondary schools (exam registration, exam preparation, obtaining medical certificates, submitting the wish list for enrollment, enrollment process, viewing results, etc.).

The potential application of the proposed solutions is manifold in all countries organizing national testing, at the end of both primary and secondary school, as well as in tests conducted during the school year at the national level. Further research should focus on improvements to the communication system in terms of activities and channels used to strengthen the trust of all stakeholders involved in the national testing process and ensure their active engagement and cooperation.

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