BRAIN. Broad Research in Artificial Intelligence and Neuroscience
e-ISSN: 2067-3957 | p-ISSN: 2068-0473
Covered in: Web of Science (ESCI); EBSCO; JERIH PLUS (hkdir.no); IndexCopernicus; Google Scholar; SHERPA/RoMEO; ArticleReach Direct; WorldCat; CrossRef; Peeref; Bridge of Knowledge (mostwiedzy.pl); abcdindex.com; Editage; Ingenta Connect Publication; OALib; scite.ai; Scholar9; Scientific and Technical Information Portal; FID Move; ADVANCED SCIENCES INDEX (European Science Evaluation Center, neredataltics.org); ivySCI; exaly.com; Journal Selector Tool (letpub.com); Citefactor.org; fatcat!; ZDB catalogue; Catalogue SUDOC (abes.fr); OpenAlex; Wikidata; The ISSN Portal; Socolar; KVK-Volltitel (kit.edu)
2025, Volume 16, Special Issue 1 (April 2025), pages: 193-208.
Special Issue 1: *Neuroscience, Artificial Intelligence, and Innovation in Education*
Submitted: January 17th, 2025 | *Accepted for publication:* March 18th, 2025

From Digital Literacy to Cognitive Gains: The Role of E-Administration Platform eAsistent

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Abstract: *This study explores the impact of the e-administration platform eAsistent on digital literacy and cognitive gains in 150 high school teachers at school center Šolski center Novo mesto, Slovenia. Results indicate that engagement with eAsistent enhances digital literacy by improving users' ability to navigate digital tools efficiently, strengthens digital inclusion by fostering confidence in digital environments, and contributes to problem-solving and adaptability in digital tasks. Principal Component Analysis (PCA) revealed that intuitive platform design significantly contributes to cognitive engagement, with distinct user profiles emerging based on digital competence. Findings suggest that the platform eAsistent can serve as cognitive tool fostering efficiency and problem-solving skill in education settings. However, the study's cross-sectional design limits the ability to draw definitive causal conclusions, highlighting the need for further research to assess long-term cognitive impacts.*

Keywords: *e-administration platform eAsistent; digital literacy; cognitive gains; high school teachers.*

How to cite: Mihelač, L. & Klarić, B. (2025). From digital literacy to cognitive gains: The role of e-administration platform eAsistent. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, *16*(Sup1), 193-208. https://doi.org/10.70594/brain/16.S1/16

1. Introduction

In the early 1990s, e-administration platforms (e-government online platforms) were introduced to offer "one-stop" portals for accessing diverse government services online. Since the initial successful implementations of e-government, exemplified by Singapore's eCitizen in 1999 (Ke & Wei, 2004), several countries have established their analogous systems. The primary objective of these platforms was to enhance the efficiency of public administration by minimising the time and resources required for administrative processes, improving accessibility, ensuring transparency in governmental operations to mitigate corruption, and providing convenience through online access to services without the necessity of visiting government offices (United Nations, 2008).

Digital platforms have been shown to enhance digital literacy and competence by offering access to diverse technology tools and information. They provide individuals with opportunities to interact with digital content, foster the development of essential digital skills, and facilitate adaptation to a changing digital landscape. Digital platforms facilitate a comprehensive grasp of technology and its applications, irrespective of their usage in education, professional development, e-administration, or communication (Brazinskas, Pipiriene, & Khayrzoda, 2021).

Research findings by Tomaszewicz (2015), Chohan & Hu (2022), and Falco & Kleinhans (2018) indicate that these platforms influence users' digital literacy, as users must browse web portals, complete digital forms, and obtain information, thereby fostering fundamental digital abilities. They also show that regular use of such platforms and support offered within these platforms, such as online communication, use of tutorials, help by support centers, etc., increase users' digital literacy as well.

One of the key effects of digital platforms is their ability to promote self-directed learning. By accessing simple (or more complicated) and diverse functionalities, either for work or for learning and/or for collaboration, individuals can acquire new skills and expand their knowledge at their own pace. This flexibility allows users to stay abreast of technological advances that improve their ability to effectively navigate digital environments (Huu, 2023).

Digital platforms help us understand complex problems and how to solve them, as they offer numerous and flexible digital tools and systems. Indirectly, they influence users' greater self-confidence in using technology for personal, educational, and professional needs. Ahmed et al. (2019), Hansen et al. (2014), and Meissner et al. (2018) highlight the positive impact of digital platforms, such as social networks, in facilitating complex problems. The results show that these platforms serve as open communication spaces that promote equal access to information and facilitate the free exchange of knowledge for integration, collaborative problem-solving, and the swift dissemination of solutions.

The success of general e-administration platforms has indirectly led to the development of similar systems in various industries, including education. The benefits observed in government service platforms—such as increased efficiency, greater accessibility, and improved transparency—highlight the advantages of integrating e-government concepts into educational institutions. Implementing e-administration platforms in these institutions has automated many administrative tasks, including data management, attendance tracking, assessments, and communication with stakeholders like parents and students. Additionally, it has enhanced transparency regarding student progress (German & Ikediugwu, 2021).

The introduction of e-administration platforms in education has not only brought about significant changes in educational management but also transformed the role of teachers. Educators are now expected to engage on multiple levels, become familiar with the technology behind these platforms, and utilise various features in their work. Recent research shows that e-administration platforms in the education sector have a similar impact on educators' digital literacy and skills as those in other industries. Regular interaction with these platforms improves teachers' proficiency with e-administrative tools and enhances their overall digital competence, ultimately boosting their confidence in using digital technology (Nguyen & Habók, 2024; Refik, Ragmi, & Kujtim, 2023).

While research suggests that frequent engagement with e-administration platforms enhances digital literacy, the effect of these platforms on users' *cognitive capacities* remains ambiguous. Research conducted by Firth et al. (2019) examined the impact of Internet usage on attentional memory and social cognition, indicating potential alterations in brain function. Findings imply that involvement with e-administration platforms might improve cognitive abilities as well. Considering increasing dependence on digital platforms in education settings, it is crucial to investigate possible impact on cognitive abilities, such as problem-solving, memory, multitasking, information processing, and cognitive flexibility.

This study aims to examine the relationship between digital literacy and cognitive gains[1] in high school teachers by utilising the e-administration platform eAsistent, used in the school centre Šolski centre Novo mesto, Slovenia. The structure of this paper is as follows: Section 2 provides a review of the relevant literature. Section 3 introduces the e-administration platform eAsistent. Section 4 describes the data, followed by Section 5, which presents the results, and Section 6, which discusses the results. In Section 7, proposals are presented to enhance the AI capabilities of eAsistent. Finally, Section 8 concludes the study and outlines directions for future research.

2. Literature Review

Information literacy and digital literacy are frequently misinterpreted. Although they are fundamentally alike, they also display significant distinctions. Information literacy emerged before the digital age and focuses on the ability to recognise the need for information, locate it, evaluate its credibility, and use it ethically and responsibly. Traditionally, this encompassed utilising tangible materials such as books, encyclopedias, and archives. These skills are essential nowadays, particularly in fields such as academia, law, and history, where critical assessment and accountable communication are crucial (Čuljak, 2023; Isbell & Hammond, 1993).

Digital literacy extends the principles of information literacy, adapting to the problems and opportunities posed by digital technologies and the Internet. It emphasises the identification, organisation, and integration of digital information with resources such as web search platforms, digital media, and software applications. Digital literacy prioritises competencies in cooperation, multimedia content creation, and effective navigation of the extensive digital environment (Becker, 2018; Osterman, 2012).

Digital literacy also integrates broader socio-political considerations. It includes comprehending the impact of advertising, media ownership, and socioeconomic variables on the accessibility and consumption of information. In contrast to conventional information literacy, digital literacy prioritises active participation in online platforms to promote democratic engagement and critical analysis in the digital era (Čuljak, 2023; Polizzi, 2020). Furthermore, digital literacy includes technical skills that traditional information literacy does not address. These encompass competencies in the use of networked devices, the supervision of online identities, and the secure interaction within digital contexts. Critical digital literacy extends to assessing the credibility of online material and comprehending the ethical ramifications of digital activities, including data privacy and intellectual property (Eshet, 2004; Polizzi, 2020).

Both forms of literacy are necessary in the 21st century. Information literacy establishes the foundation for comprehending and interacting with information comprehensively, whereas digital literacy embodies the swiftly changing demands of a technology-oriented society. They enable individuals to proficiently acquire, analyse, and utilise information in various formats for personal, social, and professional objectives (Leu et al., 2007).

As technology advances, digital literacy now encompasses multimedia communication, online collaboration, and continuous learning. However, its foundation in information literacy

[1] Cognitive gains refer to improvements in mental process such as memory, attention, problem-solving, decision-making, and cognitive flexibility. These gains can result from learning, practice, or exposure to new cognitive anmchallenges, such as using digital tools, engaging in a digital/educational learning environment and so on.

ensures that these two forms of literacy mutually reinforce one another. Together, they provide a comprehensive framework for navigating the complexities of today's information landscape (Durak, 2019; Vuorikari, Kluzer, & Punie, 2022).

Over the past 20 years, the rise of social networks, cellphones, and interactive digital platforms has transformed the concept of digital literacy. Beyond just technical skills and information literacy, it has become essential to also consider ethics and safety. This includes understanding online risks, protecting personal data, and respecting copyright. Digital literacy is now a crucial skill for education, employment, and everyday life. In many sectors, being digitally literate is not just beneficial; it is often a requirement for employment (EU, 2024). Employers value candidates who can utilise technology to enhance processes, analyse data, and develop innovative solutions. Moreover, digital literacy significantly contributes to increased productivity and efficiency, as individuals who are skilled in using digital tools can complete tasks more rapidly and effectively (Gadde & Kalli, 2020).

Digital literacy is crucial to foster collaboration and communication in a digital workplace. Effective communication and collaboration through digital platforms are necessary as remote work becomes more common. Generally, digital literacy is a fundamental skill that enables individuals to thrive in the contemporary workforce and contribute to the organisational development in a world that is becoming increasingly digital (Gadde & Kalli, 2020).

Several studies demonstrate that digital literacy and the use of digital tools can improve cognitive functioning, which can lead to demonstrable cognitive advantages in a number of different areas. The study conducted by Camacho and Torous (2023) shows that training in digital literacy can enhance functional digital skills in those who are suffering from severe mental illness, hence indicating the possibility of cognitive advantages. The study by Clemente-Suárez et al. (2024) indicates that digital gadgets have the potential to either foster cognitive development or exacerbate developmental challenges, depending on the environment, content, and duration of use. In addition, digital technology has the potential to offer “abundant opportunities” for the development of toddlers aged 0 to 3 years, hence aiding the acquisition of language and other skills through sensory exploration that encompasses touch, vision, hearing, and movement (Flewitt et al., 2024).

According to research, executive functions, such as problem-solving, critical thinking, and decision-making, can be enhanced by digital literacy. This involves the filtering of a vast quantity of information, the assessment of credibility, and the making of quick judgments in order to engage with digital environments and analytical and evaluative abilities. Individuals with superior executive functions are more inclined to employ technology than their counterparts with inferior performance, which implies a correlation between enhanced executive functioning and digital engagement (Bali et al., 2024).

The study conducted by Shanmugasundaram and Tamilarasu (2023), which examines the positive and negative effects of digital technologies on critical cognitive functions such as attention, memory, decision-making, and critical thinking, indicates that the use of digital tools can influence these areas. Digital devices can facilitate development using educational activities (e.g., educational games) that encourage critical thinking and problem-solving. These games frequently necessitate that users adhere to intricate instructions, make strategic decisions, and solve puzzles, which can improve their flexibility and executive function (Clemente-Suárez et al., 2024).

Research about the influence of digital literacy on working memory and attention control shows mixed results. While some digital activities, such as playing action video games, are associated with enhancements in selective attention and cognitive flexibility, other studies show that multitasking on various digital platforms can cause a rise in cognitive load, which potentially harms working memory and attention control. Ballesteros et al. (2017) discovered that training with video games for older adults might improve certain cognitive aspects that decrease with age, providing a hopeful method of training. On the other hand, research by Hasan (2024) shows that digital multitasking can increase cognitive load since the brain must shift attention between tasks, which results in an overload of working memory and reduces overall efficiency in cognition.

Engagement in digital activities holds the capability to enhance processing speed and flexibility, which significantly aids in boosting cognitive functions (Bonnechère et al., 2021). Training the brain utilising cognitive apps has the potential to improve the function of cognition and speed of processing for individuals who are 50 years old or more. Furthermore, older people who have been trained on tablet computers show notable improvements in processing speed and episodic memory when compared with those trained through control groups (Chan et al., 2016). According to Pappalettera et al. (2024), a strong understanding of digital technology not only enhances processing speeds but also promotes adaptability, which in turn supports lifelong learning and the development of cognitive skills.

3. E-Administration Platform eAsistent

The introduction of e-administrative platforms in education has greatly changed the way educational management operates. These platforms offer efficient solutions for processing student data, tracking attendance and performance, and enhancing communication among teachers, parents, and students. As society and various sectors continue to undergo digital transformation, schools worldwide are increasingly choosing to adopt these platforms to improve educational quality and operational efficiency.

An examination of the functionalities offered by various e-administration platforms (such as SIMS, PowerSchool, Edves, ENT, Schulportal Hessen, Wilma, etc.) reveals that they generally provide similar solutions, including:

(i) Digital administration (management and oversight of educational documentation).
(ii) Assessing student performance.
(iii) Engaging with school stakeholders (digital communication; certain platforms also provide mobile applications).
(iv) Documenting student attendance and conduct.

Although these platforms serve similar functions, they are customised to align with local educational policies and take into account the diverse curricula and administrative practices of individual countries. This customisation provides greater flexibility in supporting the learning process and the overall school system (Cobo & Rivas, 2023). Additionally, these platforms comply with regulatory requirements, including the GDPR in Europe (European Commission, 2025; Independent Schools' Bursars Association [ISBA], 2025), which establishes strict guidelines for protecting the personal data of students and employees.

The e-administration platform eAsistent has similar capabilities to those of platforms used in other countries, particularly resembling Germany's e-administrative platform Schulportal Hessen and France's ENT. The continuous enhancement of platforms, the introduction of new features, and their extensive applicability within the country align with the policy aimed at advancing digital literacy and skills, consistent with the European digital transformation strategy (Vlada Republike Slovenije, 2025).

eAsistent is an e-administration platform utilised by 516 schools and 246 kindergartens. Current data indicates a utilisation rate of 58.85% for kindergartens and 81.13% for primary and secondary schools in the Republic of Slovenia (eAsistent, 2025). Data indicates that the platform encompasses three-quarters of the Slovenian school system. The developer of this platform, eŠola d.o.o. (eSchool), commenced its development over 13 years ago to streamline daily educational tasks, enhance communication between schools and parents, minimise administrative burdens, and facilitate effective management of the learning process.

The school center Šolski center Novo mesto undertook a trial utilisation of the eAsistent platform in the 2011/12 academic year, initially within selected departments, and then implemented it comprehensively across all organisational units and departments in the 2012/13 academic year. Throughout the trial year, they facilitated training sessions for teachers and professionals regarding

the capabilities of this platform. The majority promptly embraced the improvements, with pushback emerging primarily among older, less digitally proficient educators. Over 13 years of use, eAsistent demonstrates that teachers have effectively incorporated it into their regular workflows. It has become an essential instrument for both classroom instruction and the organisation of extracurricular activities.

4. Data

For the empirical research, 150 high school teachers employed at the school center Šolski center Novo mesto, Slovenia, participated between October 24 and November 8, 2024, in an anonymous survey created as an online Google form. The survey included 44 different questions covering the following areas:

(i) General information about the participants.
(ii) Participants' work habits in the eAsistant platform (use of devices, problems at work, etc.).
(iii) Participants' experience in using eAsistant.
(iv) Participants' knowledge about the protection of personal data in eAsistant.
(v) Participants' information and communication skills.
(vi) Impact of the e-administration platform eAsistant on participants' digital literacy and cognitive gains.

Table 1 illustrates the age distribution of the participants. Out of 150 participants, 94 were female, constituting 62.67%, and 56 male, comprising 37.33%. The survey included teachers with varying years of work experience. The duration of employment or the tenure of the participants in the field of education is presented in Table 2, and the educational qualifications of the participants are presented in Table 3.

Table 1. Age distribution of the participants.

Age	21 - 30	31 - 40	41 - 50	51 - 60	60+
f	15	39	54	33	9
f %	10.00	26.00	36.00	22.00	6.00

Table 2. Participants' work experience (in years).

Work experience	< 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 40
f	28	26	12	15	24	28	11	6
f %	18.67	17.33	8.00	10.00	16.00	18.67	7.33	4.00

Table 3. Participants' educational obtained level.

Educational level	High school graduate	Highly professional qualification	Higher education	Bachelor's degree	Master's degree	Doctorate
f	9	17	23	75	23	3
f %	6.00	11.33	15.33	50.00	15.33	2.00

5. Results

5.1. Relationship Between Educational Level and Duration of Engagement in eAsistent Activities

A Chi-square test of independence was conducted to examine the relationship between educational level and duration of engagement in eAsistent activities. The results were statistically significant $\chi 2$ (25, N = 150) = 74.54, $p < .001$. Participants with higher education (e.g., bachelor's, master's, and doctorate degrees) are engaged in e-activities for a shorter duration on average than those with lower educational attainment (e.g., higher education or less). Participants possessing a university and master's degree have a broader distribution of e-activities throughout various time intervals; nevertheless, for those holding a doctorate, the duration allocated to e-activities diminishes substantially.

5.2. Digital Inclusivity

The Pearson correlation was employed to assess the relationship between the variable "use of time" (the extent of eAsistent utilisation in everyday tasks) and the composite variable "Digital inclusion," which integrates eleven variables about the participant's digital engagement:

- the participant's basic understanding and ability to use digital tools in their work,
- the participant's ability to use digital tools in collaborative activities with other participants in the digital environment,
- the participant's experience of difficulties in utilising new technology or digital tools,
- the participant's ability to solve problems that he may encounter in his own/collaborative work in the digital environment,
- the participant's willingness to permanently educate himself and update his knowledge and skills in the field of digital technologies,
- the participant's self-assessment of proficiency in using advanced functionalities of digital tools (e.g., spreadsheet formulae, video editing, programming),
- the participant's self-assessment of improved information and communication skills,
- the participant's belief that by working in the eAsistent environment, he has acquired new digital skills that help him in his own/collaborative work in a digital environment,
- the participant's belief that he understands the eAsistent platform and does not have any problems understanding this digital environment in his own/collaborative work,
- the participant's consistent enhancement of digital knowledge and skills (e.g., online courses, examining professional papers),
- the participant's belief that he knows how personal data is used/protected in the digital environment.

The results have shown a statistically significant negative correlation, $r(148) = -0.178$, $p = 0.029$, suggesting that higher digital inclusion is associated with reduced time spent on digital tasks (see Figure 1). The 95% confidence interval for the correlation coefficient ranged from -0.329 to -0.018, which supports the presence of a genuine relationship between the two variables. Although the correlation is weak, it is still statistically significant, indicating potential behavioural patterns in which greater digital inclusion—often associated with improved digital literacy and effective technology use—may reduce excessive digital activity or promote a more balanced approach to technology use.

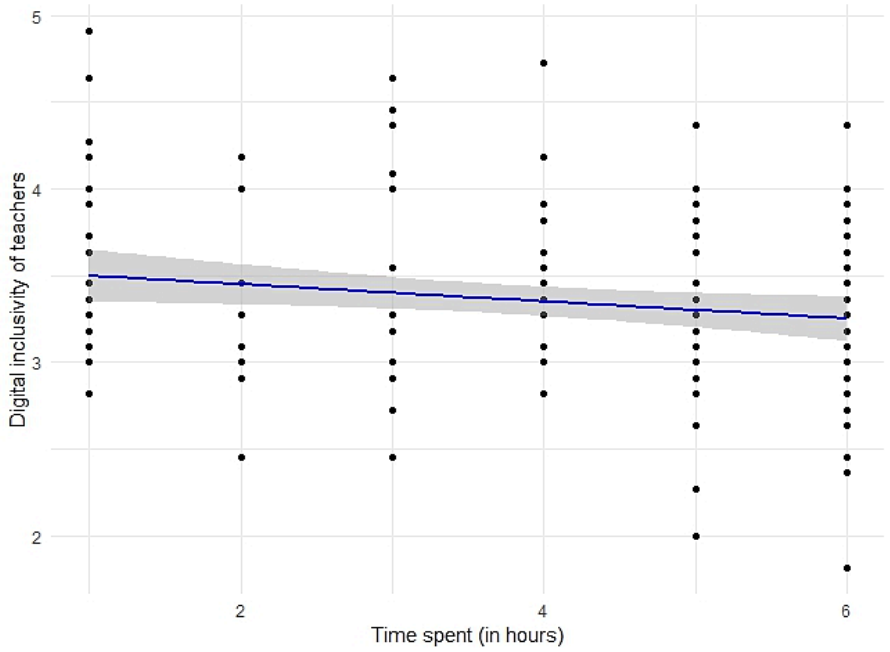

Figure 1. Relationship between the usage frequency of eAsistent and digital inclusion.

The results show possible patterns of behaviour in which greater digital inclusion (which usually means access to knowledge and vision of digital tools or the ability to effectively use digital technology in one's own/collaborative work) can reduce the need for excessive digital activity or lead to a more balanced way of using digital technology.

5.3. Digital Literacy

The impact of the eAsistant platform on participants' digital literacy was evaluated by multiple linear regression analysis. A composite dependent variable for digital literacy was established, incorporating multiple facets of digital competence (using the same first six variables as used in the composite variable Digital inclusion when testing Digital inclusivity) and an additional six variables, covering awareness of data protection and cybersecurity.

The analysis utilised a model incorporating several independent variables, including time allocated on the eAsistent platform (segmented into various categories), educational level obtained, the eAsistent "user interface index," and the age of teachers. The eAsistent user interface index was used to evaluate the usability and accessibility of the eAsistent platform's interface. It quantifies how intuitive, user-friendly, and efficient the platform is for users. The findings demonstrated the subsequent outcomes:

- The eAsistent user interface index has a statistically significant correlation with digital literacy ($p < 0.001$), indicating that a more intuitive and accessible eAsistent user interface enhances participants' digital competences.
- The duration of engagement with the eAsistent platform did not exhibit statistically significant effects on digital literacy levels. Nevertheless, specific categories, such as extended usage, demonstrated a trend of negative connection.
- None of the educational level groups achieved statistical significance, indicating that formal education does not significantly influence the development of digital abilities in the context of eAsistent usage.
- The age of participants does not have a statistically significant impact on digital literacy levels, suggesting that digital literacy is not inherently tied to age demographics but is instead associated with the particular utilisation of digital tools.

The model explained 16.86% of the variance in the data ($R^2 = 0.169$), with an adjusted R^2 of 0.075, indicating moderate explanatory power. The overall significance of the model was confirmed by a *p*-value of 0.038.

5.4. Digital Literacy and Cognitive Gains in Participants Using eAsistent

A Principal Component Analysis (PCA) was performed to investigate if and how the e-administration platform eAsistent impacts cognitive gains in digital contexts, utilising six standardised indicators of digital competence: digital advancement, digital understanding, digital education, problem-solving within the platform environment, eAsistent user interface index, and new skills acquisition. These variables were chosen as indicators of cognitive improvements linked to digital tool utilisation, demonstrating participants' capacity to comprehend, adjust to, and resolve issues in digital contexts.

The PCA revealed that the first principal component (PC1) explained 70.33% of the variance, while the second principal component (PC2) accounted for an additional 12.42%, bringing the cumulative explained variance to 82.75%. The third and fourth components contributed 6.88% and 5.00%, respectively, resulting in a cumulative variance of 94.63% across four dimensions (Table 4).

Table 4. Explained variance and principal components.

Component	Eigenvalue	Variance (%)	Cumulative Variance (%)
PC1	4.220	70.33	70.33
PC2	0.745	12.42	82.75
PC3	0.413	6.88	89.63
PC4	0.300	5.00	94.63
PC5	0.168	2.80	97.43
PC6	0.154	2.57	100.00

The highest contributions of variables on PC1 were made by eAsistent user interface index (0.893), new skills acquisition (0.849), problem-solving (0.828), and digital understanding (0.826), indicating that a digital interface that is more user-friendly and intuitive can help to improve cognitive engagement, problem-solving, and skill acquisition.

The second component was most significantly influenced by digital advancement (0.484) and digital understanding (0.474), suggesting that digital literacy enhancement and comprehension skills are essential for deeper cognitive development in digital learning contexts. Meanwhile, the third component, PC3, was significantly impacted by new skills acquisition (-0.488), indicating that the acquisition of new digital skills may entail a different cognitive processing pathway compared to fundamental digital understanding and problem-solving (Table 5).

Table 5. Variable contributions to principal components.

Variable	PC1	PC2	PC3
user interface index	**0.893**	-0.239	-0.172
new skills acquisition	**0.849**	-0.025	**-0.488**
problem-solving	**0.828**	-0.317	0.303
digital understanding	**0.826**	**0.474**	0.097
digital advancement	0.820	**0.484**	0.120
digital education	0.814	-0.358	0.171

Using k-means clustering analysis, a further examination was performed to examine individual differences in cognitive gains. Using the within-cluster sum of squares (WSS) method, the optimal number of clusters was determined to be three. Figure 2 shows clusters and reveals distinct cognitive profiles among participants:

- Cluster 1 (grey cluster): high digital problem-solving skills, strong interface adaptability, and rapid acquisition of new digital skills.
- Cluster 2 (yellow cluster): moderate digital understanding, lower adaptability to new interfaces and skills.
- Cluster 3 (blue cluster): limited digital engagement with cognitive development hindered by difficulties in navigating digital environments.

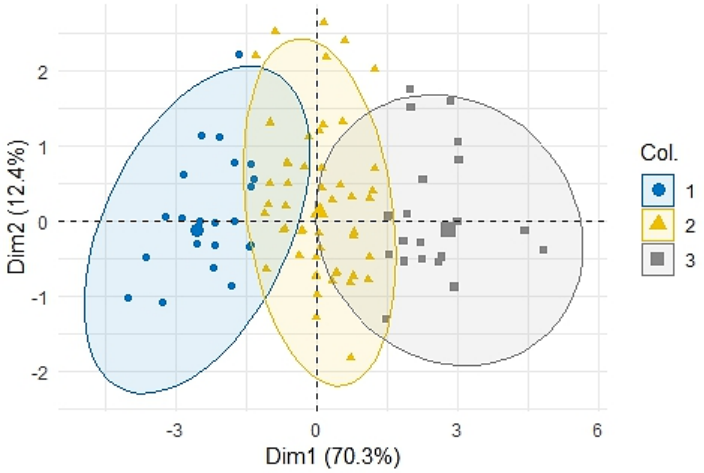

Figure 2. Clusters and cognitive profiles of participants.

6. Discussion

This study examined how using the e-administration platform eAsistent affects participants' cognitive abilities, including problem-solving comprehension and adaptability to digital environments, in addition to digital literacy. The results show that regular engagement with the eAsistent platform can improve both digital skills and cognitive adaptability, along with problem-solving capabilities. These results align with previous research suggesting that digital platforms serve as cognitive tools, facilitating users' ability to navigate complex digital environments and apply critical thinking skills (Mayer, 2020).

One of the key findings of this study relates to digital inclusivity. The results showed a statistically significant negative correlation (r = -0.178, p = 0.029) between digital inclusion and time spent on digital tasks, suggesting that users with greater digital skills tend to spend less time performing digital activities in an eAsistent environment. This aligns with similar research indicating that digital literacy helps users to complete digital tasks more efficiently and effectively, reducing the cognitive effort required for routine digital interactions (Winne & Hadwin, 1998). Instead of struggling with basic functionalities, digitally skilled users can direct more cognitive resources to higher-order thinking tasks, such as evaluating information, problem-solving, and collaboration.

The multiple linear regression analysis revealed that the eAsistent user interface index was a significant predictor of digital literacy ($p < 0.001$), highlighting the role of intuitive and accessible digital environments in promoting digital competence. These findings are consistent with previous studies, emphasising that well-designed digital tools reduce cognitive load and facilitate skill acquisition (Sweller, 2011). Notably, formal education level and age did exhibit statistically significant effects on digital literacy, underscoring the assumption that digital competence is influenced more by practical interaction with digital tools rather than traditional education or age-related variables.

Additionally, Principal Component Analysis (PCA) was implemented in this study to investigate the cognitive advantages that are linked to digital engagement. The PCA results indicate that the first principal component, Dim1, accounted for 70.3% of variance, indicating that the most significant cognitive improvements were closely associated with fundamental digital competencies such as digital problem-solving, information processing, and adaptive reasoning. The second

component, Dim2, which accounts for 12.4% of the variance, is likely to represent more complex cognitive benefits, such as metacognitive awareness and flexibility in digital environments. The findings indicate that cognitive benefits from digital tool utilisation vary among participants and are influenced by a combination of digital literacy, problem-solving skills, and user interface engagement. Furthermore, the clustering results reveal that participants have diverse patterns of digital skills acquisition, potentially influenced by prior cognitive abilities, exposure to digital technologies, and adaptive learning strategies. These findings are consistent with research that emphasises the role of digital tools in promoting cognitive adaptability and executive function (Robledo-Castro, Castillo-Ossa, & Corchado, 2022).

The cluster analysis also illustrated that participants can be classified based on their cognitive enhancements. A high level of engagement in interactive learning components and problem-solving tasks is demonstrated by the cluster that showcases the most significant cognitive improvements. These results are in agreement with comparable research (Gee, 2013; Kuhn, 2009) that suggests that cognitive flexibility and higher-order thinking abilities are improved by active digital engagement in the digital environment. The moderate-gain cohort demonstrated a more profound level of problem-solving abilities. Conversely, the lowest-gain cluster may suggest that participants who engaged passively or had limited prior digital experience may have a more challenging time effectively developing cognitive strategies.

Cognitive load and engagement theories may partially account for the disparities. Participants who were actively involved with the platform eAsistent were more likely to have experienced optimal levels of cognitive challenge, which enables deep long-term learning and profound processing (Sweller, 2011). In contrast, participants who demonstrate minimal engagement may not have met the necessary threshold for significant cognitive adaptation. In line with previous research (Jonassen, 2011; Mayer, 2020), it has been demonstrated that digital learning environments are most effective when they encourage active participation and problem-solving.

7. Expanding eAsistent AI Capabilities

The analysis of eAsistent shows that artificial intelligence (AI) has been implemented to some degree. At present, the platform employs artificial intelligence-driven analytics in order to simplify administrative procedures, such as monitoring students' performance, tracking attendance, and assigning grades. eAsistent provides teachers with insights into the amount of student involvement by automating the process of data gathering and visualisation. This offers teachers the ability to make decisions more quickly and effectively, which in turn enables them to improve student learning. As several administrative tasks in eAsistent are driven by AI, it suggests that the cognitive overload that teachers experience is reduced, which enables them to concentrate on higher-order thinking tasks such as designing lessons and pedagogical innovation.

Furthermore, the platform has recommendation systems that are driven by artificial intelligence. These systems assist teachers in the context of the organisation of lessons, the enhancement of their workflow, and the reduction of administrative responsibilities. By increasing educators' digital adaptability, analytical reasoning, and decision-making efficiency, these existing features in eAsistent indicate how artificial intelligence is already contributing to cognitive advancements: (i) teachers are more motivated to develop thinking strategies for classroom management, and (ii) creativity in lesson preparation is stimulated by reducing the frequency of repeated tasks.

Nevertheless, eAsistent could be expanded to incorporate supplementary AI-powered functions in order to improve the teachers' cognitive benefits. The integration of AI to assist in *lesson planning* is one potential improvement. Artificial intelligence has the potential to suggest a wide variety of teaching methods, provide suitable resources, and create optimised lessons by assessing trends in student performance, curricular requirements, and previous lesson plans. This AI-driven solution could also provide real-time suggestions for personalised teaching, allowing teachers to better adjust lessons to particular student needs.

Based on the findings of this study, revealing three distinct groups of teachers with different levels of engagement with AI-driven functionalities, personalised AI-powered training modules could identify individual teachers' strengths and shortcomings in digital literacy, classroom management, and pedagogy. AI could suggest focused professional development courses, interactive simulations, or peer collaboration opportunities to ensure ongoing skill development and adaptability to changing educational technology. These training programs run by AI might also include adaptive learning methods. This would let teachers learn at their own pace while getting personalised feedback on how they are improving their skills.

To provide real-time help for educators, chatbots and virtual assistants powered by artificial intelligence could be developed in eAsistent to answer questions concerning educational policies, grading systems, and best practices. By lowering the amount of daily work that teachers have to do and freeing up time for them to engage in more meaningful educational activities, these tools could help teachers manage communication with parents, streamline scheduling, and provide automatic feedback on assignments as well.

Enhanced decision-making by teachers could potentially be achieved through the use of predictive analytics. Artificial intelligence could help teachers in identifying students who require additional assistance before a decrease in academic performance and learning by analysing patterns of their performance and behaviours. Consequently, this would enable a more proactive teaching approach, optimising learning outcomes and refining cognitive strategies for intervention and resource allocation. From the viewpoint of the institution Šolski center Novo mesto, predictive analytics could be beneficial to school leaders/administrators in order to improve the overall efficiency of teaching by optimising the distribution of tasks among teachers and in identifying areas where additional training of teachers could be beneficial. Last but not least, by using predictive analytics, collaborative teaching could be facilitated, which could bring together teachers who use similar teaching methods or have experience with the same subject, letting them share information and make unified lesson plans.

8. Conclusions and Future Work

The findings from this study highlight the dual impact that digital platforms have, showing that structured engagement with e-administration platforms like eAsistent can promote both digital literacy and cognitive development. While digital literacy is usually linked to technical proficiency and information processing, results suggest that regular interactions with digital environments also enhance broader cognitive skills such as problem-solving, executive function, and adaptability.

The PCA analysis shows that cognitive gains are not the same among participants. The first principal component (PC1) explained 70.3% of variance and correlated strongly with important cognitive dimensions like problem-solving, digital understanding, and acquisition of new skills. Additionally, cluster analysis identified three distinct cognitive profiles, showing that while some users displayed strong adaptability to digital environments and problem-solving abilities, others have difficulties in navigating those environments effectively. This variation highlights the critical role of interventions for digital literacy in bridging the gaps in cognitive skills among various user groups.

The findings of the study have major implications in both theory and practice. From a theoretical perspective, the results support models of cognitive load theory (Sweller, 2011) and self-regulated learning (Winne & Hadwin, 1998), which indicates that meaningful engagement with digital platforms promotes cognitive efficiency and strategic learning behaviours. Practically speaking, the findings highlight the necessity for well-designed digital tools that exceed simple administrative tasks to actively improve users' cognitive skills. Educational institutions, along with policymakers, should be considering incorporating components of cognitive training into digital literacy programs, so users not only develops technical proficiency but also enhance their problem-solving and adaptive learning abilities.

Even with these encouraging results, there are multiple limitations of this study that need to be addressed in future research. Firstly, the cross-sectional design limits the ability to evaluate

causal relations between engagement on digital platforms and cognitive improvements. Longitudinal studies that track cognitive advances over time would give deeper insights into if the observed benefits are maintained with ongoing digital engagement or if they decrease after users become accustomed to the platform.

Secondly, while the study highlights gains in cognitive abilities, it does not directly examine the neural mechanisms that underlie these improvements. Future research using neuroimaging techniques (e.g., fMRI, EEG) could provide valuable insight into how engagement with digital environments influences plasticity of brain working memory and function on a neurological level. Such studies help to clarify if certain digital tasks activate different cognitive networks.

Another important area for future exploration is the role of user experience and interface design in cognitive gains. Our findings indicate that the eAsistent user interface index was significantly correlated with digital literacy ($p < 0.001$), suggesting that more intuitive and accessible digital environments facilitate cognitive learning. Future studies could investigate how different user interface designs influence cognitive outcomes, potentially leading to evidence-based recommendations for developing more effective digital platforms.

Moreover, future research could examine demographic factors that influence cognitive gains. The obtained results suggest that age and formal education do not significantly impact digital literacy development, indicating that cognitive benefits may be more closely tied to user engagement and digital exposure rather than traditional educational background or age. Further studies could explore if these findings hold across different age groups and professional backgrounds, which include populations such as older adults, individuals with cognitive impairments and employees in non-educational sectors.

In addition, future work could explore customised digital literacy interventions to address the specific needs of low-gain users that are identified in our cluster analysis. Designing adaptive learning modules tailored to individuals who struggle with digital engagement could help to reduce cognitive disparities and promote greater inclusivity in the digital learning environments/e-administration environments.

Lastly, the implications of policy ought to be taken into account. If an e-administration platform, such as eAsistent, has shown to improve cognitive function, then it could be integrated into lifelong learning programs and the training of the workforce. Institutions and governments should think about developing curricula of digital literacy that include components for building cognitive skills, which ensure that digital proficiency will contribute to broader cognitive and problem-solving abilities in both educational and professional environments as well.

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