E-LEARNING AS A FACTOR IN STIMULATING GIFTED STUDENTS TO ACHIEVE ACADEMIC SUCCESS

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Abstract: *The aim of the study is to examine how gifted students are stimulated to use e-learning for academic achievement. The main questions to which an answer is sought in this context are: What types of activities do gifted students use in e-learning? How do students evaluate the adequacy of ICT resources for their academic achievements so far? What are the relationships between the use of ICT for learning and the personality traits, self-esteem, and motivational strategies of gifted people? The theoretical context consists of concepts of self-regulation, new concepts of intelligence - self-management of intellectual processes - Sternberg, emancipatory didactics. The research has used the method of systematic, non-experimental observation, and as instruments, a battery of questionnaires: (PSIKT) Protocol on students' self-perception about the importance and use of ICT and e-learning to stimulate students towards academic achievements—made for this research; Questionnaire of Motivation for Learning (LLOS-IEA), SMS-Scale of Motivational Strategies, Inventory of Competencies for Memory and Reasoning (MARCI-Stankov & Crawford), and Personality Traits (BFIIV). Metric characteristics of the instruments: Krombach's α for parts of the battery ranges from 0.62 to 0.83. It was used as a*

convenience sample, consisting of 687 students from the universities of Belgrade, Novi Sad and Niš (within this number, 127 are academically gifted, with an average grade above 9.00). Basic findings: When compared to other students, academically gifted students focus more on expanding their knowledge based on their interests, research work, and interactive self-evaluation tests in e-learning. Using ICT for learning and academic success is closely related to students' personal characteristics (personality traits, self-confidence, motivation). Gifted students have stronger self-confidence, motivation, and personality traits than other students.

Keywords: *academically gifted students; e-learning; confidence; motivation; personality traits.*

1. Introduction

Modern approaches to motivating students to achieve academic success aim to find more effective ways to motivate them and direct them towards self-regulated learning. Research findings indicate that success in studies largely depends on competencies for self-learning, i.e., self-regulation. Within this, significant attention has been devoted to research findings (Susilawati & Supriyatno, 2020) that indicate the ways in which ICT (information and communication technology) can be used for the purpose of encouraging motivation. Thus, the findings conclude that knowledge acquired with the help of online platforms is essentially an update or change resulting from processes of solving problems encountered by an individual or a group of students, contributed to higher motivation, independence, and the acquisition of more information (Indariani & Sulivoro, 2018).

The basic concept and classification of e-learning refer to the educational context supported by information and communication technologies (ICT) (Ristić, 2009). In addition to the previous definition, the ASTD (American Society for Trainers and Development) understands e-learning as educational content or learning activities in which learning takes place with the help of electronic technology (Ristić, 2009). This understanding implies numerous learning strategies and technologies that support learning with the help of media-based educational Internet programs (DVD, CD-ROM), educational work using program content downloaded from the Internet, video conferencing systems, and distance learning with the help of the Internet. One way to define this term is that e-learning represents a new approach to learning that is independent of time and space, and is also defined by the teacher's new

role, which implies new teaching methods, new tools, and new approaches to learning. The latter is considered the most important criterion for defining e-learning, and it refers to new communication strategies between teachers and students (Ristić, 2009).

Taylor (in Ristić, 2009) distinguishes telecommunications models of e-learning based on their technologies of delivery:

- multimedia model (press, audio tapes, video tapes, computer-based training, interactive video);
- telecommunications model (audio teleconferencing, video conferencing, audio graphic communication, broadcasting TV/radio, and audio teleconferencing);
- flexible learning model (interactive multimedia and web-oriented learning or online learning);
- Intelligent flexible learning model (intelligent tutoring systems, interactive multimedia)

According to a review of Taylor's classification, the differences between models by which multimedia has been classified are essentially designated already in their names, referring to the combination of several media at the same time and the possibility of interaction among students themselves and with the teacher; interactive. The shortcoming of this model is that individuals and institutions are not sufficiently equipped with the necessary technical means for making the model functional (incompatibility, etc.). Video conferences are considered the most popular form of telecommunication. With regard to the topic of this paper, the following characteristics of the flexible learning model are important: interactivity, non-linearity, and collaboration. This model is appropriate for education because it promotes learning autonomy as a principle and mode of learning that allows teachers to tailor students' guidance to their specific needs and personalise it through mentoring work. This is an indispensable learning and teaching style for gifted students, with exceptional motivational power for self-regulation and self-direction towards high academic achievements (Siegle, 2003, 2005; Alibabi; Ziegler, 2021). The following guidelines are stated as essential prerequisites for effective e-learning when working with the gifted:

- Clear strategic determination of the educational institution for the introduction of ICT in the educational process of the gifted;
- Supporting the gifted in e-learning;
- Having appropriate e-learning standards (in addition to knowing how to mentor gifted students, mentors and other teachers should know how to use ICT tools in order to make e-learning decisions). In addition, it

> is also necessary to have trained teaching staff and provide equipment and infrastructure adequate for the stimulating function of ICT in teaching activities that should motivate students towards academic achievement.

For the title of this paper, it is important to note that the above-mentioned online applications are in use in everyday life, which facilitated the technical part of their use for students' learning and teachers' cooperation with them. Communication takes place with the aid of an internet service, which has several functions contained in WhatsApp and other applications (image gallery, inserting contacts, camera for taking images, sending voice messages, coordinate maps, etc.), so that online media enables easier communication and more effective learning (Susilawati & Supriyatno, 2020). The advantages of this application are in the fact that it can be used to motivate students to expand their knowledge. One of the models is discussion groups where students can share opinions and information online through this virtual space, which, according to research findings (Susilawati & Supriyatno, 2020), combined with classroom learning, provides opportunities to reduce the gap between learning and work. This is justified by the finding that online collaborative learning, suitable for learning in tertiary institutions, is also effective for learning in larger groups characterized by differences among students and can be adapted to all levels of learning and many institutions, including universities (Susilawati & Supriyatno, 2020). In their research, Susilawati and Supriyatno (2020) found that online learning as a learning tool is suitable for acquiring knowledge in the sense of collaborative and cooperative learning in the form of a discussion forum. They also find that the contents of mobile tools are accepted for student learning as they enable ad hoc communication and informal interaction between students and teachers. Based on their findings, the same authors conclude that combined learning integrated with WhatsApp Messenger has several advantages, such as the quick exchange and transfer of information and knowledge and the ease of creating discussion forums. Thus, social media have already become a useful and accepted means of learning, which enables excellent and easy cooperation both between students themselves and with the teacher.

Susilawati and Supriyatno (2020) found that combined learning with WhatsApp helped students learn more. However, they also say that other models should be looked into in a more critical and thorough way. These models would provide a wider range of possibilities for choosing among online media for learning that would be more adapted to the learning context,

learning needs and abilities, or differences in student learning and teaching. The authors also point out the necessity of providing several models, because there is no single method that could be used in all conditions, while online content enables adaptation to the students' experiences for successful collaboration. So that combined learning is considered a revolution in the field of education, which was included in the educational process as a result of circumstances during the pandemic; in the same way, it showed the advantages it presents for stimulating students towards reaching academic achievements. However, research findings (Susilawati & Supriyatno, 2020) have already led to the conclusion that, if the online approach could be called a teaching method, using only online methods for a combined approach to learning and teaching through the Internet is not enough, because it is mainly characterized by contents in a single teaching medium, in this case the Internet, and the application of e-learning must still be used with a face-to-face approach, and by combining them, the advantages of both can be used. Numerous authors (Amri, 2014) emphasize that Internet-based social media enable students to share different types of content in accordance with their accompanying functions. This makes them popular tools for learning and collaborating with the group in the exchange of information, as they make learning related to various topics through discussing questions asked by the teacher interesting. As a result, digital generations of students perceive popular technology as providing affordable access to tools for online learning that can be less of a burden and more of a game. The motivational value of this is inestimable; we just need to develop teaching approaches that, by combining these approaches, would stimulate autonomous approaches to learning and discussing questions for which they found answers, etc. Digital technology thus provides opportunities to make learning more active, use teaching methods in which information can be obtained individually, reach information individually, find various learning contents that can be easily accessed at a time that suits the students, and take responsibility for their own advance towards academic achievements by learning either individually or in a group (Stone & Logan, 2018). This is particularly suitable for students who do not like lectures, as well as for gifted students who are looking for broader knowledge than the program provides, relating concepts from different scientific fields, etc.

Research (Stone & Logan, 2018) shows that e-learning lets students be more involved in their own learning because it focuses on personalization, which includes the ability to adapt to the student's skill level and the accumulation of knowledge resources as mutual support (Pratama & Iusro, 2016). Adaptive

attitudes will also give students room and flexibility when it comes to organizing, which will help them learn better (Pratama & Iusro, 2016).

In addition to the above, previous studies on e-learning have been characterized by discussions on learning models based on three perspectives. The first perspective is provided by studies that examine the issue of online learning as a new system of learning media that promotes learning efficiency. The second is focused on the direction of the online learning media, which could create conditions for satisfying the student's needs (Amri, 2014). The third emphasizes the importance of adequate selection of contents for online learning, i.e., it includes the selection of components that help improve learning (Boiinbode et al., 2017), which is directed towards issues of designing online content. This is an increasingly interesting issue, induced by the level of need to use the Internet, which encourages the development of learning materials that are developed based on the subject (Amal, 2019). These studies have come to the conclusion that there are currently four basic elements that must not be neglected in designing online learning: (a) learning structure, (b) presentation content, (c) collaboration and interaction, and (d) timely feedback.

The research findings also conclude that online learning implies meeting the requirements for material availability or easy access.A study conducted by Amri (2014) shows that in online learning, students tend to access course materials in the form of lecture slides, video lectures, shared assignments, and forum messages. Students with different goals, motivations, and preferences have different behaviors when accessing these materials. This difference in behavior can then affect their academic achievement. From this research, it follows that students view teaching materials related to their classroom lectures (lecture slides and video lectures) longer and more often than other learning materials. It has also been concluded that, in spite of the time spent viewing online learning materials, most of them do not use analytical tools, thereby reducing the effects of e-learning. For the gifted, it was found that their interests are broader and that they use materials from the Internet to expand their knowledge because their interest in certain issues is not covered in the mandatory program, etc. (Stojanović, et al., 2021)

According to the title of this paper, there are significant research findings (Susilawati & Supriyatno, 2020; Iustina et al., 2020) that indicate the ways in which technology can encourage learning motivation. Projects based on teacher-student interaction as well as those that support interaction in groups that allow the sense of competence to be recignized as a first step towards motivation and enable to cope with difficulties in independent learning,

efficient time management, orientation towards approaches to tasks, meta-cognitive skills, and perseverance towards the goal have shown good effects for this purpose (Sitar-Taut, 2021; Pelikan et al., 2021). Based on an experimental design with a specific group (test-retest), Susilawati & Supriyatno (2020) found that combining learning with the use of WhatsApp contributes to increasing motivation to learn. With the help of this platform, learning unfolds optimally, as students and teachers can communicate and share PowerPoint files, Microsoft Word files, JPG files, voice notes, videos, and links to learning resources. The experiences of this study suggest that learning activities and the learning media should be adapted to the context of the learning environment and that avoiding to impose certain activities and methods is a wise step in presenting learning experiences to students because, as previously mentioned, there is no unified method, not only for all students but also for all content. In accordance with this, Prajana (2017) suggests that the way in which ICT is used as a learning medium was able to create effective learning because it provided students with better and faster learning opportunities by loading the teaching material, showed tasks in discussion between students, and enabled organizing consultations with teachers beyond formal teaching classes. His experience with the WhatsApp application is that it is convenient because it runs on mobile devices, uses web-based social networks, and integrates with various applications used to communicate with other users, starting from education, business, entertainment, etc.

The above findings speak in favor of the efficacy of e-learning for stimulating students towards academic efficiency, but for the topic of this paper, they are just an introduction, because in addition to the previous questions, there are also significant issues related to the design of hypermedia from the aspect of types of activities that enable students to find adequate sources for academic achievements, such as the relationship between the use of ICT and personality traits, self-confidence, motivational strategies, etc. Significant in this sense are the findings of Wells & McCrory (2011). In their study, they considered theoretical and design issues related to the use of learning environments, specifically the use of hypermedia to promote recalling, synthesis, integration, and storing of information, i.e., some types of academic efficacy. It is an experimental draught with two different hypermedia systems for complex historical content. The authors concluded that the findings of their study are consistent with previous studies, which suggest that, in spite of the compelling promises of hypermedia, there are limited evidences of differential cognitive impacts based on differential design (Dillon & Jobst, 2005). It is important to note that the findings from this study suggest that linear, indexed, and/or

immersion-based designs can improve remembering the facts. Thus, they conclude that there are no structural differences in hypermedia that follow a more minimal design, which analyzes the discrete points of information instead of presenting highly interconnected information that helps learning, which otherwise allows the use of hypermedia as a system of non-sequential or non-linear text that enables readers to freely explore and relate information in ways that make sense to them (Nelson, 1965). Based on the above, it can be concluded that hypermedia, composed of multiple related texts and other forms of media (image, video, and sound), does not guarantee that the process of searching for discrete resources will force individuals to mentally construct coherent understandings of the ways resources are interrelated and that this process later facilitates certain types of learning. Also significant are the findings (Dillon & Jobst, 2005), which indicate that non-linear web presentations (i.e., those that allow viewing in multiple orders) can lead to reduced free memory and learning of factual information compared to traditional linear print-like web design. Their findings suggest, however, that a non-linear design may facilitate learning about the interrelationships of the information presented. It is also important to mention the findings of the same authors, which they reached through experimental research on a sample of students who manipulate the site design and motivation designed to test these different learning effects and examine the potential influence of two mediating variables: selective scanning and elaboration (see more in: Gojkov, Rajić, et. al. 2021; Gojkov Rajić and Prtljaga, 2916 a, b; Stojanović, et. al. 2021). Also significant is the finding of other research (Stojanović, et al., 2021), which suggests that the linear site design encourages the learning of facts while the non-linear design increases the density of the knowledge structure. However, the effects of elaboration and selective scanning are mixed. Thus, based on the previous finding, we could accept the opinion of Foltz and Landauer (1998) that systems should first be empirically tested to determine whether they are useful and usable. Accordingly, if the features of more complex systems are not more usable than those of simpler, linear systems, then findings that linear systems facilitate learning may ultimately mean that we need better designs for complex systems. The same authors (Foltza and Landauer, 1998) suggest that alternative conclusions about research findings should also be analyzed and considered. They believe that it is necessary to see to what extent the design adequately reflects the CFT theory. To what extent were the chosen principles of CFT—context-dependence and interrelationship—adequately manifested in the system? They believe that there is a possibility that, perhaps, the use of other principles or several principles would yield different results.

Also significant is their reflection on the possibility that there were systematic differences in interest and/or motivation among the participants that were not taken into account and that the differences influenced the findings rather than the conditions. The conclusion is that this study may suggest that hypermedia learning is more elusive than some studies have shown.

Based on the above, we should take into account the conclusions of several research studies that point to future trends and refer to the impression that adapting to individual differences in general and learning styles in particular, is gaining ground in current educational hypermedia research. Findings also show that most existing systems treat learning styles separately from other characteristics in the student profile (knowledge, interests, goals), which is a flaw. Therefore, it is necessary to integrate all the mentioned and other characteristics into a more comprehensive and representative student profile. In such an integrative context, implicit modeling methods should be combined with explicit methods, for a more precise diagnosis. The authors consider the possibility of educating students and teachers to properly understand and address learning styles an even more useful approach. Thus, to familiarize both students and teachers with the essence and ways of mastering meta-cognition and awareness of learning style, so that they understand their strengths and weaknesses in the learning process and persist in self-regulating learning. The most significant conclusion of these findings is the need for these systems (LSAES) to go beyond their current research status and be used in practice, gaining popularity similar to that of self-regulated learning systems. Based on the above, it could be concluded that the mentioned e-learning systems should be brought closer to each other, because in that case they would be tested in practice, verified, and their effects manifested.

Further confirmation of the above context and the need to bring the system closer to student learning can be found in the research of Popescu (2009). In diagnosing the style of the educational hypermedia learning system, she started from the position that personalizing the learning experience for each student is an important goal for educational systems, and the accurate modeling of learning based on the individual student is the first step towards achieving this goal. This author views modeling from the perspective of learning styles, which she believes is an important factor in the effectiveness of the learning process. In a critical meta-analysis, she provides an overview of existing modeling methods, highlighting the specifics and limitations of current learning style-based adaptive educational systems (LSAES). The author sees controversy in the multitude of learning style models, as a result

of partial overlap in the use of a complex of characteristics, each of which has its own importance and influence, and advocates their unification (the so-called "unified learning style model"). The controversy was not overcome by the introduction of implicit modeling methods based on the analysis of student behavior patterns. The approach has been experimentally validated, and good accuracy rates have been reported. The author concludes that the modelling components could be expanded to account for perturbations in adaptation attempts and improved with pattern threshold weights.

The following findings from an earlier study conducted by the co-author of this study (Stojanovi et al., 2021) are relevant to this research:

- The learning motivation of gifted students was manifested under the influence of internal factors, but also of factors present in the students' social and natural environments. Thus, in addition to internal factors that are under the students' control, factors that depend on the teacher, as well as contextual factors, are also important.
- During the learning process, each student develops a specific motivational structure, which consists of learning behaviors (certain activities, persistence, achievement of learning goals, quality of learning) on the one hand and their own motivational beliefs and strategies on the other (Wigfield & Eccles, 2000). A well-structured hypermedia learning system, i.e., well-designed ICT learning and teaching content, can be a significant aid in all of this (Stojanović, et al., 2021).

As it can be seen from the previous short sketches of theoretical and design issues surrounding the use of hypermedia for learning, there is still plenty of room for further research into ways to make these more effective in the field of encouraging self-regulated learning in students. One problem is that it is hard to organise the modelling parts in a way that makes it possible to customise the learning experience. This is still an open methodological question that has real-world effects. Researchers continue their search for a complex of characteristics whose unification would bring them as close as possible to individual needs in the use of hypermedia for encouraging self-regulated learning and, above all, learning motivation. This was the impetus for the research, the findings of which are presented in this paper from the perspective of students. In other words, it provides an overview of the intersecting external and internal factors of e-learning and seeks to move closer to the holistic approach of adapting e-learning to individual needs, particularly for the gifted, who show higher motivation and stronger self-regulation in the research findings. In addition, e-learning heads towards

adapting educational hypermedia, which also means higher personalization in terms of stimulating the gifted to use hypermedia for their own self-development.

The study's goal was to determine how much gifted students are encouraged to use e-learning to help them do better in school. This was done so that the researchers could then look at the ways in which didactic approaches and motivational tools help internal learning factors. Formulated in this way, it addresses the following questions:

- To what extent do gifted students use ICT for independent learning? What types of activities are represented in e-learning: expanding knowledge-broader interests, increasing understanding after lectures; creating exercises or presentations based on the assignment of the professor/assistant; research work – creating papers for scientific meetings; preparation of seminar papers; (expressed by % or ranking, interactive tests with automatic evaluation) and to what extent and in what way do teachers stimulate students to use ICT?
- How do students decide if ICT sources are good enough and if they add to what they've already learned, and where do they focus on e-learning (general education, vocational, vocationally applied, and foreign languages)?
- What is the relationship between the use of ICT for learning and students' personality traits, self-confidence, motivational strategies, memory, and memorization competences? How important is the use of ICT for academic success in relation to internal factors?
- How many technical opportunities and ICT do students have, and how well do they know how to use them?

The basic idea is that e-learning is a *big part of what motivates gifted students to do well in school, which also means that it starts the process of self-regulated learning.* Therefore, the general hypothesis is that ICT, as a modern tool for e-learning, is more important than other sources of knowledge that are used to stimulate students for academic achievement.

General hypothesis: The academically gifted use ICT more than others for academic achievements.

Working hypotheses:

Hypothesis 1 – ICT, as a modern tool for e-learning, is more important than other sources of knowledge used to stimulate students´ academic achievements.

Hypothesis 2 – In e-learning, the academically gifted pay more attention to broadening their knowledge than other students.

Hypothesis 3 – Academically gifted students are more focused on e-learning general education subjects and foreign language, while others are more focused on vocational and vocational-application subjects?

Hypothesis 4 – Professors stimulate students to use ICT.

Hypothesis 5 – Academically gifted students evaluate ICT resources as high-quality resources for e-learning due to the following factors:

- the program infrastructure and technical support provide an efficient, high-quality, interesting, interactive learning experience and knowledge evaluation.
- enables high success criteria, the acquisition of a large fund of information on various contents, learning activity at the appropriate level and pace,
- allows for stimulating independent reading and exposure to the most diverse areas of knowledge (arts, occupations, professions); promotes experience in creative thinking and creative problem solving with multiple solutions;
- allows for experiences in logical thinking, logical reasoning, and problem solving with a single correct solution;
- stimulates imagination and special abilities;
- encourages motivation as well as insight and understanding of one's own abilities, interests, and needs
- enable the development of independence, skills of orientation, and consistency in learning;
- enables the setting of high goals and aspirations, experience in intellectual, artistic, and emotional contacts with other students;
- stimulates the need for independence in learning (independent work and research).

Hypothesis 6 – Technical capabilities of ICT are available to students, and they have access to the Internet and IT competencies.

Hypothesis 7: The use of ICT for learning is linked to students' personal characteristics (personality traits, memory and reasoning abilities, motivation).
Hypothesis 8 – Academically gifted students have stronger self-confidence, motivation, and personality traits important for academic achievement than other students.

Predictor variables:
- having adequate technology for e-learning,
- level of competence in using hypermedia content,
- personality traits, motivational strategies, self-confidence, memory, and reasoning competencies,
- forms and methods of stimulating students towards academic achievements through e-learning

Criterion variables:
- academic success,
- assessment of the quality of online tools for achievement,
- types of competences as effects of stimulating e-learning,
- students' own ideas about how important ICT and e-learning are and how they can be used to improve academic performance

2. Method

Sample

In total, there were 204 participants in the sample. Out of those, 101 participants provided information about gender, and there were 76 (75.2%) female participants. In total, 91 participants provided valid information about their grade point average during college, and there were 71 (78%) academically gifted students, i.e., students with a GPA of 8.00 or higher. College year was treated as an ordinal variable with 7 levels, and the distributions of levels were: 32 1st year students, 62 2nd year students, 20 3rd year students, 28 4th year students, 41 1st year master students, 14 2nd year master students, and 4 PhD students.

Instruments

Big five inventory (*Goldberg's Big Five Personality Traits from the International Personality Item Pool; Goldberg, 2001).* A short version, 20 five-point Likert type item questionnaire intended to assess the big five personality traits i.e., Extraversion, Emotional stability, Intellect, Agreeableness and Conscientiousness, each through 4 items. The reliability of

the scales, measured by Cronbach alpha, was: Extraversion $\alpha = 0.72$; Emotional Stability $\alpha = 0.70$; Intellect $\alpha = 0.63$; Agreeableness $\alpha = 0.68$; Conscientiousness $\alpha = 0.77$.

The Memory and Reasoning Competency Inventory (MARCI; Stankov & Crawford, 1997) consists of 16 items that are graded on a six-point Likert scale. The instrument includes two subscales designed to assess memory and reasoning abilities. Cronbach's alpha for memory competences was $\alpha = 0.92$ and for reasoning competences was $\alpha = 0.88$ indicating excellent reliability of the scales.

The Motivation Strategies Scale consists of 21 items measured on a five-point Likert scale. Exploratory factor analysis was performed to explore the latent space of the variable, and two subscales were extracted: an organization and perseverance scale and a strategy directed at lowering or creating negative expectations. Cronbach alpha organization and perseverance was $\alpha = 0.92$ and for negative expectations was $\alpha = 0.82$ indicating good to excellent reliability of the scales.

3. Results

Hypothesis 1: ICT, as a modern tool for e-learning, is more important than other sources of knowledge used to stimulate students for academic achievements in order to test the hypothesis. "ICT, as a modern tool for e-learning, is more important than other sources of knowledge used to stimulate students for academic achievements." descriptive statistics for six items are presented, as well as correlations with GPA and current year in college. GPA was significantly positively correlated with lectures as a stimulus for learning, indicating that those with higher GPAs find lectures somewhat more stimulating for learning. The strength of this correlation was weak in intensity. College year was positively correlated with learning from supplementary literature and negatively correlated with learning from lecture notes, indicating that older students learn more from supplementary literature while younger students learn more from lecture notes. The intensity of these correlations was moderate. Answer distributions for these items are presented on Figures 1–6.

Table 1. *Descriptive statistics for items regarding the usage and stimulation of ICT and other learning methods*

	Item	Min	Max	Mean	SD	Correlation with GPA	Correlation with year
How educationally stimulating you are	ICTs	1	5	3.77	1.17	0.19	0.06
	lectures	1	5	3.98	1.08	0.21*	0.02
How much time do you spend learning with the help of	Electronic content	0	100	32.21	21.57	0.07	0.14
	Textbooks	0	100	37.46	23.80	-0.01	-0.04
	Supplementary literature	0	100	15.35	16.11	0.19	0.22**
	Lecture notes	0	100	27.40	21.96	-0.15	-0.19**

Note. Correlations presented for GPA with two "How educationally stimulating you are …" items are Spearman's rank correlations, while with "How much time do you spend learning with the help of…" items are Pearson's correlations. Correlations for college year are Spearman's rank correlations; * - $p < 0.05$; ** - $p < 0.01$.

Hypothesis 1: The academically gifted use ICT more than others for academic achievements.

To test this hypothesis, a t-test was used to look for differences between academically gifted and other students for the item *How much time do you spend learning with the help of...* A Mann-Whitney U test was used to explore differences using the item "*How stimulating for learning are...* Results of t-tests are presented in Table 2. There was a statistically significant difference on one item, lecture notes, with other students having higher scores, indicating that they use lecture notes to learn more than academically gifted students. Results of Mann-Whitney U tests are presented in Table 3. There were significant differences for lectures, with academically gifted students having a higher mean rank score, indicating that they find lectures more stimulating than other students.

Table 2. *Differences between academically gifted and other students for time spent using different learning tools/methods*

	Item	Mean – others	Mean - AG	t	df	p
How much time do you spend learning with the help ...	Electronic content	30.83	31.76	-0.17	85	0.865
	Textbooks	33.82	31.72	0.34	84	0.731
	Supplementary literature	15.29	15.86	-0.14	82	0.889
	Lecture notes	41.38	28.32	2.14	84	0.035

Table 3. *Differences between academically gifted and other students for how stimulating different learning methods are*

	Item	Mean rank – others	Mean rank – AG	U	Z	p
How stimulating for learning for you are	**ICTs**	**36.42**	**47.93**	**502**	**-1.78**	**0.074**
	lectures	**32.82**	**48.31**	**433.5**	**-2.46**	**0.014**

Hypothesis 2. In e-learning, the academically gifted, compared to other students, pay more attention to broadening their knowledge.

In order to test the hypothesis that "*In e-learning, the academically gifted, compared to other students, pay more attention to broadening their knowledge,"* Mann-Whitney U test was used to explore differences between academically gifted students and other students. Results are presented in Table 4. There were statistically significant differences on all 4 items, with academically gifted students having higher scores on all items, indicating that they use electronic learning more than other students for all listed topics.

Table 4. *Differences between academically gifted and other students in how much attention they pay to broadening their knowledge*

	Item	Mean rank – others	Mean rank – AG	U	Z	p
I use electronic learning for	**Expanding knowledge according to personal interests**	**34.54**	**48.64**	**480.5**	**-2.27**	**0.023**
	Completing my understanding after the lecture	**35.88**	**48.25**	**507.5**	**1.97**	**0.049**
	For research work/writing papers for magazines or scientific meetings	**33.78**	**49.44**	**465.5**	**-2.50**	**0.012**
	For interactive tests with automatic evaluation / knowledge check	**33.10**	**49.63**	**452**	**-2.55**	**0.011**

Hypothesis 3. Academically gifted students are more focused on e-learning general education subjects and foreign languages, and others are more focused on vocational and vocational-application subjects.

In order to test the hypothesis, "*Academically gifted students are more focused on e-learning general education subjects and foreign languages, and others are more focused on vocational and vocational-application subjects?*" Mann-Whitney U test was used to explore differences between academically gifted students and other students. Results are presented in Table 5. Statistically significant differences were present only for one item, vocational-applied subjects, with academically gifted students having higher scores compared to other students.

Table 5. *Differences in how academically gifted students and other students use e-learning*

Item		Mean rank – others	Mean rank – AG	U	Z	p
E-learning is aimed at	**General education subjects**	**37.05**	**48.52**	**531**	**-1.78**	**0.075**
	Foreign languages	**47.88**	**45.47**	**672.5**	**-0.37**	**0.710**
	Vocational subjects	**43.93**	**45.95**	**668.6**	**-0.33**	**0.742**
	Vocational-applied subjects (application of knowledge, exercises, etc.)	**33.85**	**48.83**	**467**	**-2.36**	**0.018**

Hypothesis 4: Teachers stimulate students to use ICT.

In order to test the hypothesis "*Teachers stimulate students to use ICT through seminar papers, making exercises-presentations according to the task of the teacher, research papers for scientific conferences and journals, using tests with automatic evaluation, and referring to supplementary literature*," descriptive statistics for five items are presented, as well as correlations with GPA and current year in college. GPA was significantly positively correlated with professor stimulation of ICT for seminar papers, references to additional literature, and preparation of exercises and presentations, indicating that students with higher GPAs on average perceive that professors stimulate the usage of ICT for these topics more than students with lower GPAs. The college year was positively correlated with references to additional literature, preparation of exercises and presentations, and research papers for scientific conferences and journals, indicating that older students assess professors' stimulation for ICT usage higher for these topics, compared to students in lower years. Answer distributions for these items are presented on Figures 7–11.

Table 6. *Descriptive statistics for items regarding teacher's stimulation to use ICT*

	Item	Min	Max	Mean	SD	Correlation with GPA	Correlation with year
The teacher stimulates me to use ICT through:	**seminar papers**	**1**	**5**	**3.93**	**1.30**	**0.29****	**0.14**
	references to additional literature	**1**	**5**	**3.87**	**1.21**	**0.25***	**0.20****
	preparation of exercises - presentations	**1**	**5**	**4.18**	**1.16**	**0.23***	**0.17***
	research papers for scientific conferences and journals	**1**	**5**	**3.42**	**1.30**	**0.20**	**0.29****
	using tests for automatic evaluation / self-evaluation	**1**	**5**	**3.16**	**1.31**	**0.19**	**0.11**

Note. All presented correlations are Spearman's rank correlations; * - $p < 0.05$; ** - $p < 0.01$.

Hypothesis 5. *Academically gifted students evaluate ICT resources as high quality for e-learning because of the following factors*

To test the hypothesis that "*academically gifted students evaluate ICT resources as high quality for e-learning due to the following factors*:." Mann-Whitney U test was used to explore differences between academically gifted students and other students. Results are presented in Table 7. There were statistically significant differences on five items, namely: "*Program infrastructure and technical support provides an efficient, high-quality, interesting, interactive experience of learning and evaluating knowledge*," "*enables high success criteria, the acquisition of a large fund of information*

on various contents, learning activity at an appropriate level and pace," "*enables stimulation of independent reading*", " *enables experiences in creative thinking and creative problem solving with multiple solutions*", and "*enables the development of independence, direction skills and consistency in learning".* Academically gifted students scored higher on all of these items, indicating that they value ICT for e-learning as more stimulating in these areas than other students.

Table 7. *Differences between academically gifted and other students for how much they value ICT for e-learning as a motivator*

	Item	Mean rank – others	Mean rank – AG	U	Z	p
In terms of quality, ICT for e-learning is valuable and stimulating because:	**program infrastructure and technical support provide an efficient, high-quality, interesting, and interactive experience of learning and evaluating knowledge**	**34.60**	**48.61**	**482.0**	**-2.21**	0.027
	enables high success criteria, the acquisition of a large fund of information on various contents, and learning activity at an appropriate level and at an appropriate pace	**33.18**	**49.61**	**453.5**	**-2.59**	0.010
	Enables the stimulation of independent reading,	**34.10**	**48.76**	**472.0**	**-2.34**	0.019

	enables openness towards the most diverse areas of knowledge, arts, occupations, and professions.	**37.68**	**48.35**	**543.5**	**-1.72**	0.085
	experiences in creative thinking and problem solving with multiple solutions are made possible.	**34.65**	**49.20**	**483.0**	**-2.28**	0.022
	allow for experiences in logical thinking, logical reasoning, and problem solving with a single correct solution.	**40.20**	**47.63**	**594.0**	**-1.16**	0.246
	stimulates imagination and special abilities	**40.68**	**47.50**	**603.5**	**-1.08**	0.282
	stimulates motivation and insight into and understanding of one's abilities, interests, and needs	**37.05**	**48.52**	**531.0**	**-1.82**	0.069
	allows for the development of independence, leadership, and learning consistency	**32.98**	**49.67**	**449.5**	**-2.63**	0.009
	enables the setting of high goals and aspirations	**36.60**	**48.65**	**522.0**	**-1.89**	0.059
	enables experience in intellectual, artistic, and	**42.87**	**46.20**	**624.5**	**-0.51**	0.607

	emotional contacts with other students					
	stimulates the need for independence in learning (independent work and research)	**38.74**	**47.31**	**546.0**	**-1.35**	0.177

Hypotheses 6. The technical capabilities of ICT are available to students, and they have access to the Internet and IT competences.

In order to test the hypotheses "*Technical possibilities of ICT are available to students. Students have a computer of appropriate performance*" and" Students *have access to the Internet and IT competences. Students are good at using ICT."* descriptive statistics for 2 items are presented, as well as correlations with GPA and current year in college. The means of both items were high indicating that students evaluate their competencies and technical equipment as adequate. The item "*Specifications of the computer I own are adequate for my e-learning needs*" was positively correlated with GPA. Answer distributions for these items are presented on Figures 12 and 13.

Table 8. *Descriptive statistics for items regarding technical capabilities and access to ICT*

Item	Min	Max	Mean	SD	Correlation with GPA	Correlation with year
The specifications of the computer I own are adequate for my e-learning needs.	**1**	**5**	**4.10**	**1.16**	**0.26***	**0.02**
My IT competences for using the Internet for e-learning are adequate.	**1**	**5**	**4.04**	**1.05**	**0.17**	**-0.00**

Hypothesis 7. The use of ICT for learning is linked to students' personal characteristics (personality traits, memory and reasoning abilities, motivation).

Descriptive statistics for personality traits, memory and reasoning competencies, and motivation scales are presented in Table 9. All research variables had values of skewness and kurtosis in the suggested range of ±2 (George & Mallery, 2010) indicating that there were no significant deviations from univariate normal distributions.

Table 9. *Descriptive statistics for personality traits, memory and reasoning competencies, and motivation scales*

Variable	Min	Max	Mean	SD	Sk	Ku
Extraversion	**1.00**	**5.00**	**2.83**	**0.94**	**0.09**	**-0.43**
Emotional stability	**1.00**	**5.00**	**2.95**	**0.91**	**0.16**	**-0.40**
Intellect	**1.75**	**5.00**	**3.73**	**0.82**	**-0.12**	**-0.89**
Agreeableness	**1.00**	**5.00**	**3.84**	**0.79**	**-0.75**	**0.77**
Conscientiousness	**1.00**	**5.00**	**3.91**	**0.94**	**-0.98**	**0.56**
Memory competencies	**1.00**	**6.00**	**4.02**	**1.12**	**-0.50**	**0.07**
Reasoning competencies	**1.13**	**6.00**	**4.21**	**0.95**	**-0.50**	**0.35**
Motivation strategy – organization and perseverance	**1.36**	**5.00**	**4.02**	**0.79**	**-1.25**	**1.35**
Motivation strategy – negative expectations	**1.00**	**5.00**	**2.72**	**1.20**	**0.28**	**-0.98**

Note. Sk – skewness; Ku – kurtosis.

The correlations between items about using ICT for learning and traits are presented in Table 10. Using ICT for expanding knowledge according to personal interests was positively correlated with Intellect, Agreeableness, memory and reasoning competencies and organization and perseverance motivation strategies. Using ICT to complete and comprehend the lecture was positively related to agreeableness, conscientiousness, reasoning abilities, organization, and perseverance motivation strategy. Using ICT for research work was positively correlated only with organization and perseverance motivation strategy, while using ICT for interactive tests was positively correlated with Agreeableness, Conscientiousness, memory competencies and

organization and perseverance motivation strategy. All the significant correlations were weak to moderate in intensity.

Table 10. *Spearman's rank correlations between items about using ICT for learning and personality traits, memory and reasoning competencies, and motivation scales*

	I use electronic learning for			
Variable	**Expanding knowledge according to personal interests**	**Completing understanding after the lecture**	**For research work/writing papers for magazines or scientific meetings**	**For interactive tests with automatic evaluation / knowledge check**
Extraversion	**0.06**	**0.02**	**-0.01**	**0.07**
Emotional stability	**0.06**	**0.00**	**-0.09**	**0.00**
Intellect	**0.22****	**0.06**	**0.04**	**-0.12**
Agreeableness	**0.17***	**0.21****	**0.13**	**0.22****
Conscientiousness	**0.11**	**0.22****	**0.13**	**0.27****
Memory competencies	**0.18****	**0.10**	**0.08**	**0.17***
Reasoning competencies	**0.34****	**0.18****	**0.12**	**0.06**
Motivation strategy – organization and perseverance	**0.30****	**0.35****	**0.24****	**0.26****
Motivation strategy – negative expectations	**-0.12**	**-0.01**	**-0.04**	**0.12**

Note. All presented correlations are Spearman's rank correlations; * - $p < 0.05$; ** - $p < 0.01$.

Hypothesis 8. Academically gifted students have stronger self-confidence, motivation, and personality traits important for academic achievement than other students.

In order to test the hypothesis that "*Academically gifted students have stronger self-confidence, motivation, and personality traits important for academic achievement than other students*" binary logistic regression was conducted. A binary variable indicating whether a student is academically gifted or not was a criterion in the model, while there were nine predictors in total: five personality traits, two memory and reasoning competences, and two motivational strategies. Results indicate that the tested model is not statistically significant ($\chi^2(9) = 10.38$, $p = 0.321$). Even though the model was not significant, the contribution of predictors is presented (for descriptive purposes) in Table 11. The only predictor that reached significance was the negative expectations motivation strategy, indicating that this strategy is less often used by academically gifted students compared to other students.

Table 11. *Contribution of predictors in binary logistic regression model*

	Wald	df	p	Exp (B)
Extraversion	**0.52**	**1**	**0.471**	**0.78**
Emotional stability	**0.84**	**1**	**0.358**	**0.71**
Intellect	**0.59**	**1**	**0.444**	**0.75**
Agreeableness	**0.65**	**1**	**0.421**	**1.39**
Conscientiousness	**0.86**	**1**	**0.355**	**1.41**
Memory competencies	**0.00**	**1**	**0.960**	**0.97**
Reasoning competencies	**0.53**	**1**	**0.466**	**1.55**
Motivation strategy – organization and perseverance	**0.10**	**1**	**0.755**	**0.88**
Motivation strategy – negative expectations	**4.10**	**1**	**0.043**	**0.55**

4. 4. Interpretation of findings

From the perspective of the basic question of this study, which refers to the extent to which e-learning is used to stimulate gifted students for academic achievements and thus speaks about the use of the potential of e-learning for self-regulated learning, the above findings are not in line neither with the general hypothesis nor with hypothesis 1, which assumed that "ICT, as a modern e-learning tool, is more important than other sources of knowledge

used to stimulate students for academic achievements, because it was concluded that *success is significantly positively correlated with lectures as a stimulation for learning, indicating that those with higher overall success find lectures more stimulating for learning*. Although the level of this correlation is not high, the statistical significance was in favor of lectures instead of the use of ICT, which many previous studies found to provide wide opportunities for motivation and have good effects on the acquisition of knowledge (Susilawati & Supriyatno, 2020); contribute to independence and acquire more information (Indariani & Sulivoro, 2018); enable learning autonomy, outlined as a principle and form of learning by which it is possible to adjust the guidance of students according to their specificities, through personalized mentoring work; and present an irreplaceable style of learning and teaching for gifted students that has an exceptional motivational power for self-evaluation and self-direction towards high academic achievements (Siegle, 2003, 2005; Alibabić; Ziegler, 2021) and present an irreplaceable learning autonomy through personalized mentoring. However, we have the encouraging finding that the years of study are positively correlated with learning from additional literature and negatively correlated with learning from lecture notes. The first year of faculty was positively correlated with referring to additional literature and preparing exercises—presentations and research papers for scientific conferences and journals. This indicates that older students evaluate the stimulation of teachers to use ICT higher than younger students. However, university teaching has managed to stimulate students, eventually bringing them to the expected level. Thus, older students learn more from additional literature, while younger students learn more from lecture notes and scripts This confirms the need for more serious reform measures at lower levels of the education system, where students should have reached the necessary level of self-regulation, enabling them to join studies more easily. In addition to inadequate choice, the reason for abandoning studies is the lack of meta-cognition, learning strategies, motivational strategies, etc. (Gojkov Rajić et al. 2021a). Thus, students acquire these competencies, without which there is no academic success, only during their studies. This finding is supported by the theory of self-regulation (Bandura, 1997; Deci & Ryan, 2012) and Sternberg's (2020) theory of mental self-government, in which self-regulation has a significant place in terms of achievement, and there are several reasons for this. They should be systematically investigated. Some of them are: inadequate functioning of online devices, incompatibilities, overloading of teachers with the number of classes, colloquia, etc. and the impossibility of searching for materials that

exist on online applications, as well as the lack of time to arrange these, and the fact that using the adopted methods is easier than searching for new ones, finding contents that require restructuring, and the like.

Findings about how stimulating different ways of learning are speak in favour of the gifted and, by extension, back up the general hypothesis. *Namely, the application of several methods is more stimulating to the academically gifted than to other students, and the gifted also manifest a stronger use of e-learning along all the significant characteristics of learning, which in the research findings are related to the influence of e-learning on academic achievements (expanding knowledge according to personal interests, completion of understanding after lectures, research work or writing papers for journals or scientific meetings, and interactive tests with automatic knowledge evaluation).* This finding confirms the third hypothesis, because academically gifted students use electronic media more for self-learning, behind which already stand meta-cognitive strategies, motivational strategies, and other significant properties for self-regulated learning, which is the basis of their achievements. From a theoretical point of view, this could be considered a confirmation of Sternberg's theory of intellectual self-government, especially the ideas that view the cognitive system and its development as a self-modifying system, which is significant and focused on meta-cognition as a basic developmental change that can be learned to a good extent and shaped during education (Sternberg, 2020).

The hypothesis that the academically gifted students are more focused on e-learning of general education subjects and a foreign language, while the others are more focused on vocational and vocational-applicative subjects, was not confirmed because it turned out to be the other way around. The interpretation of this depends on the type of study. As the survey was conducted online and anonymously through the student network by involving students voluntarily, a large number of faculties from various scientific fields (including mathematics, social and humanities, medicine, and academic and vocational studies) were covered. Therefore, there is a possibility that the higher interest in vocational-applicative subjects among the academically gifted is related to the scientific field in which they study, and even though the studies are academic, vocational competences are still assumed.

In the field of foreign language learning, students have also in earlier research (Gojkov Rajić, et al., 2016a, b; 2021a) considered learning in direct communication during the regular teaching process more suitable for them.

Significant is the finding in the verification of the fifth hypothesis, which tested the assumption that teachers stimulate students to use ICT through seminary papers, making exercises-presentations based on the assignments of teachers and research papers for scientific conferences and journals, using tests with automatic evaluation, and referring to additional literature, which indicates that general success is significantly positively correlated with the teacher's stimulation for using ICT for seminary papers, references to additional literature, and preparing exercises - presentations, which indicates that students with higher academic success perceive that teachers more stimulate the use of ICT for these activities. These student perceptions confirm that this is true, but it is also a sign that they are working on it, that it suits them according to their abilities, and that the teachers keep up with the requirements of emancipatory didactics, which consider autonomy in learning as a basic condition for the advancement of the gifted (Gojkov Rajić, 2021a). There is a small number of research papers for scientific meetings and journals, although the sample also includes second- and third-degree students, which indicates the inability of teachers to devote themselves more to mentoring work with students, already burdened by the number of classes.[1]

The findings in favor of academically gifted students who evaluate ICT resources as high-quality for e-learning proved to be a confirmation of the general hypothesis, because the differences were statistically significant on items related to several aspects of hypermedia programs, as well as their technical support, and the didactic orientation of teachers in mentoring didactic instruction of students also goes in this direction. Therefore, the academically gifted expressed higher scores on the following essential aspects of e-learning: *"the program infrastructure and technical support provides an efficient, high-quality, interesting, interactive learning experience and*

[1] The standards for the accreditation of institutions and programs allow a weekly number of 12 classes of direct teaching for teachers, or as it is also called active teaching, although this term is not defined in didactics, and is not in use as a term, and for associates up to 20. The situation with associates, who are also studying, is even more difficult because they are in doctoral studies, doing research for publication in scientific journals, in order to acquire the conditions for submitting a thesis, working on a dissertation, etc. Thus, they are still taking the first steps, and with insufficient knowledge, they are pushed to hold exercises, which are not routine in all areas but require a broad knowledge of the subject in order to conduct constructive discussions that would have a motivating effect and lead to the expected outcomes in knowledge and other student competencies. In these conditions, we cannot talk about personalization as understood by the humanistic didactic current, which advocates the autonomy of learning and self-regulation as the basic outcomes and qualities of higher education.

knowledge evaluation," "enables high success criteria, the acquisition of a large fund of information on various contents, learning activities at an appropriate level and appropriate pace," "enables the encouragement of independent reading," "enables experiences in creative thinking and creative solving of multi-solution problems," "enables the development of independence, directing skills, and consistency in learning," and "enables openness to the most diverse fields of knowledge, arts, vocations, and professions". Thus, on all these items, academically gifted students had higher scores, indicating that they find ICT for e-learning more stimulating in these areas than other students. This is an indicator for teachers to introduce more program contents from hypermedia, i.e., more combined learning—direct learning and e-learning—which confirms the research findings mentioned in the introductory part of this paper (Gojkov Rajić & Prtljaga, 2016a, b). This is also supported by the confirmation of the seventh hypothesis, which found that the specifications of computers used by the students are adequate for their e-learning needs, and a positive correlation of this with general success was also found. Therefore, the academically gifted students had adequate devices and good competences for mastering hypermedia programs for the purpose of high academic outcomes. The pedagogical implications of this need no specific interpretation. Good computers, adequate hypermedia, and the training of students to use them are prerequisites for everything else that follows. Although we think that today's young people have mastered using the Internet and online communication, it is not certain that they can navigate the field of e-learning successfully, and that is the first step, which, if they stumble, can stop them, psychologically destabilize them. Failure tends to create negative patterns of behavior and goes in a direction that has caused countless gifted people to derail and never get back on track.

The eighth hypothesis tested the relation between using ICT for learning and the students' personal characteristics (personality traits, memory and reasoning competencies, motivation), which the literature finds to be significant for hypermedia models in e-learning. The finding that the use of ICT ***to expand knowledge*** based on personal interests is positively correlated with the competences of ***intellect, agreement, memory, and reasoning and with the strategies of motivation, organization, and perseverance***, and that the use of ICT ***for complementing and understanding*** after lectures is positively correlated with ***agreeableness, conscientiousness, reasoning competencies,*** and the strategies ***of motivation, organization, and perseverance,*** confirms the assumption as well as the research findings that point to this (Bach, 2007).

At the same time, it also points to the possibility of focusing more attention on some of the mentioned characteristics in an effort to personalize proceedings in mentoring (strategies of motivation and perseverance, etc.), as well as personality traits that, in cooperation with reasoning and memory competencies, can play a crucial role in supporting gifted people in crisis situations and be a defensive shield against depressive crises and withdrawal from motivational strategies of negative expectations.

5. Conclusions

In addition to the value of the findings for further research and verification of the methodological scopes of possible other approaches as well, they can have great significance not only for practitioners but also for educational policy. It is not necessary to explain this in detail, because everyone concerned is educated and experienced in these fields. Practitioners need more organization and help, enabling their efforts to manifest in the quality of higher education, especially for this to be noticeable in academically gifted students, who work harder, as it can be seen in this research, because they are self-regulated, have good motivational strategies, and have other qualities significant for academic achievement. Providing mentoring support to them would certainly affect their academic achievements significantly, although, according to the findings of this research, this support would be significant for other students as well. From the aspect of emancipatory didactics, the solution lies in relieving teachers and focusing more attention on the preparation of good hypermedia, because the findings point to the conclusion that lectures are still more stimulating for the gifted than e-learning.

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