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For publisher:
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International Journal of Cognitive Research in Science, Engineering and Education

(IJCRSEE)

EDITORIAL

International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE) is an open access international peer-reviewed, open-access journal, which provides a platform for highlighting and discussing various cognitive science issues dealing with the problems of cognition (and its evolution) within some specific subject field - philosophical, psychological, linguistic, mathematical, psychogenetic, pedagogical, ergonomic. Editorial Board strives to provide a possibility for the scientists of different fields to publish the results of their research, technical and theoretical studies. IJCRSEE is multidisciplinary in approach, and will publish a great range of papers: reports of qualitative case studies, quantitative experiments and surveys, mixed method studies, action researches, meta-analyses, discussions of conceptual and methodological issues, etc. IJCRSEE publisher is The Association for the Development of Science, Engineering and Education, Vranje, Serbia. Co-publishers are: University Business Academy, Faculty of Economics and Engineering Management in Novi Sad, Serbia and Don State Technical University, Rostov on Don, Russian Federation.

IJCRSEE particularly welcomes articles on the results of scientific research in various fields of cognitive science (psychology, artificial intelligence, linguistics, philosophy and neuroscience) catering for international and multidisciplinary audience. Readers include those in cognitive psychology, special education, education, adult education, educational psychology, school psychology, speech and language, and public policy.IJCRSEE has regular sections: Original Research, Review Articles, Studies and articles, Book Reviews, Case Studies, and is published three times a year. This journal provides an immediate open access to its contents, which makes research results available to the public based on the global exchange of knowledge. The journal also offers access to uncorrected and corrected proofs of articles before they are published.

The main aim of the Journal is to discuss global prospects and innovations concerning major issues of cognitive science, to publish new scientific results of cognitive science research, including the studies of cognitive processes, emotions, perception, memory, thinking, problem solving, planning, education and teaching, language and consciousness study, the results of studying man's cognitive development and the formation of basic cognitive skills in everyday life. The Journal seeks to stimulate the initiation of new research and ideas in cognitive science for the purpose of integration and interaction of international specialists in the development of cognitive science as interdisciplinary knowledge.

All articles are published in English and undergo a peer-review process.

The scope of IJCRSEE is focused on cognitive research both in topics covered as well as disciplinary perspective:

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- Curriculum Development
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IJCRSEE provides a platform for academics and scientists professionals to refer and discuss recent progress in the fields of their interests. Authors are encouraged to contribute articles which are not published or not under review in any other journal.

Each submitted manuscript is evaluated on the following basis: the originality of its contribution to the field of scholarly publishing, the soundness of its theory and methodology, the coherence of its analysis, its availability to readers (grammar and style). Normal turn-around time for the evaluation of manuscripts is one to two months from the date of receipt.

Submission of an original manuscript to the journal will be taken to mean that it represents original work not previously published, that is not being considered elsewhere for publication; that the author is willing to assign the copyright to the journal as per a contract that will be sent to the author just prior to the publication and, if accepted, it will be published in print and online and it will not be published elsewhere in the same form, for commercial purposes, in any language, without the consent of the publisher.

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Writing – Please write in good English (American or British usage is accepted, but not a mixture of these). For non-native English speakers, and perhaps even for some native English speakers, grammar, spelling, usage, and punctuation of the texts are very important for an effective presentation. Hence, manuscripts are expected to be written in a clear, cogent, and readily understandable by an international readership.

Manuscripts must be submitted online. Electronic submission reduces the editorial processing and reviewing time. As part of the submission process, authors are required to check off their submission compliance with all of the following items, and submissions may be returned to authors who do not adhere to the following guidelines:

The submission has not been previously published or presented to another journal for consideration (or an explanation has been provided in Comments to the Editor).

The submission file is in OpenOffice, Microsoft Word, RTF, or WordPerfect document file format.

Where available, DOIs and URLs for the references have been provided.

The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate

points, rather than at the end.

The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

If submitting to a peer-reviewed section of the journal, the instructions in Ensuring a Double Blind Review have been followed.

A manuscript goes through the peer review process. Authors submit manuscripts to Editorial office via the online system. The acknowledgement letter should be sent to the author to confirm the receipt of the manuscript. The Chief Editor first reviews manuscripts. Chief Editor is assisted by Section Editors (could also be Co- or Associated Editors). The Editor assigns a Section Editor to see the manuscript through the complete review process and return it with a recommendation or decision. The manuscript is checked to see if it meets the scope of the Journal and its formal requirements. If it is incorrect or unsuitable, the author should be informed and the manuscript filed (or returned if requested) – direct rejection. Manuscripts that are not suitable for publication in the Journal are rejected. A Rejection letter is sent to the author stating the reason for rejection. If the manuscript conforms to the aims and scope of the Journal, and formally abides by the Instructions to Authors it is sent out for review. Depending on the type of paper, it could be accepted immediately for publication (invited Editorial, Book review etc) by the Chief Editor.

Check that the manuscript has been written and styled in accordance with the Journal style; that it carries an abstract (if applicable), keywords, correct reference system etc. and check that the correct blinding system has been used. If anything is missing ask the author to complete it before the manuscript is sent out for review.

The manuscript is sent out for review. The reviewer reads and evaluates the manuscript and eventually sends a review report to the Chief Editor. The time for review can be set to 2-6 weeks depending on the discipline (more time is usually given to papers in the humanities and social sciences). Make sure to provide the reviewer with clear instructions for the work, e.g. outlined in the form of a Review report or a number of questions to be considered.

Based on the reviewers' comments the Chief Editor makes a decision to:

- Accept the manuscript without further revision
- Accept after revision
- Ask authors to resubmit
- Reject

An acceptance letter is sent to the author and the final manuscript is forwarded to production. Sometimes, the authors are requested to revise in accordance with reviewers' comments and submit the updated version or their manuscript to the Chief Editor. The time for review can be set to 2-6 weeks depending on the discipline and type of additional data, information or argument required. The authors are requested to make substantial revisions to their manuscripts and resubmit for a new evaluation. A rejection letter is sent to the author and the manuscript is archived. Reviewers might be informed about the decision.

After review a manuscript goes to the Copy Editor who will correct the manuscript concerning the correct referencing system, confirmation with the journal style and layout. When Copy Editor finishes his/her work they send manuscripts to the Layout editor.

Layout Editor is responsible for structuring the original manuscript, including figures and tables, into an article, activating necessary links and preparing the manuscript in the various formats, in our case PDF and HTML format. When Layout Editor finishes his/her job they send manuscripts to Proof Editor.

Proof Editor confirms that the manuscript has gone through all the stages and can be published.

This issue has 14 articles (12 Original researches and 2 Review articles). Our future plan is to increase the number of quality research papers from all fields of science, engineering and education. The editors seek to publish articles from a wide variety of academic disciplines and substantive fields; they are looking forward to substantial improvement of educational processes and outcomes.

Editor in Chief
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International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)
Address: Prvi maj 18, 17500 Vranje, Serbia
Phone: +381 17 400 165, + 381 63 700 4281
Web: www.ijcrsee.com
E-mail: editor@ijcrsee.com

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Learning Objectives in Older Adult Digital Education - Redefining Digital Inclusion

Łukasz Tomczyk [1], *Natalia Edisherashvili* [2]

[1]Institute of Education, Jagiellonian University, Poland, mail: lukasz.tomczyk@uj.edu.pl
[2]Institute of Education, University of Tartu, Estonia, mail: natalia.edisherashvili@ut.ee

Abstract: The article explores the redefinition of learning objectives within the context of digital education for older adults, addressing the critical need to enhance digital inclusion. It emphasizes the centrality of learning objectives as foundational elements in the design, implementation, and evaluation of educational programs. The study underscores the necessity of revising these objectives to promote the development of digital competences among older adults. As society becomes increasingly digitalized, traditional educational models must evolve to accommodate the dynamic digital landscape. The REMEDIS research initiative seeks to modernize educational frameworks and establish a more effective approach to cultivating digital skills in older populations. By employing SMART criteria and leveraging the expertise of senior and future trainers, the study identifies 12 key categories for contemporary educational objectives, including: basic computer and mobile device use, digital terminology, email communication, cybersecurity, online information retrieval, social media usage, instant messaging, culture and entertainment access, online financial management, e-commerce, smartphone software applications, and time management. The qualitative analysis of digital education objectives for older adults reveals a spectrum ranging from basic digital literacy to advanced e-service utilization, while also highlighting the importance of aligning these objectives with the practical needs of older adults.

Keywords: *Learning objectives, elderly, digital inclusion, digital skills, digital literacy.*

Introduction

Learning objectives form the basis for the planning, implementation, and evaluation of every process of formal and non-formal education (Kupisiewicz, 2012). Didactic objectives set the direction of the activities undertaken by students and teachers and are linked to educational forms, methods, and content. The creation of learning objectives is the first step in shaping educational programmes regardless of the age group, subject area, or organisational form of education. Without appropriately defined didactic objectives, it is impossible to achieve goals that build the ability to function in the modern world (Lemieux, 1997; Baschiera, 2017; Tomczyk et al., 2023). Therefore, when designing activities for older adults, attention is increasingly being paid to locating learning objectives in real conditions relating to the specifics of the target demographic (Szarota, 2004; Tomczyk, 2015), as well as taking into account their needs - in the case of this article, people in late adulthood. The focus of this paper is on redefining the learning objectives related to digital education for senior citizens. Several issues prompted the creation of this article. Firstly, the literature lacks a clear and –commonly-agreed classification of learning objectives relating to digital inclusion (Beh et al., 2018; Choudhary, 2024). Secondly, the process of setting didactic objectives that take into account the specificity of older adults' needs is now seen as a pressing requirement due to the professionalisation of education in institutions dedicated to this group (e.g. universities of the third age, seniors' clubs, organisations supporting community activation) (Mackowicz and Wnek-Gozdek, 2016). Finally, due to the intensive development of the information society, there is a need to redefine the

*Corresponding author: lukasz.tomczyk@uj.edu.pl

didactic goals and thus the content of education due to the increase in opportunities currently offered by cyberspace (e.g. the intensive development of AI, the increase in the speed of Internet connections, the digitalisation of administration and healthcare, and e-commerce) (Ziemba, 2019). Such rapid and irreversible changes require an analysis to be undertaken on the establishment of universal and variable didactic objectives that set the directions for the digital inclusion of this socially important group.

Learning goals guide the implementation of any educational programme. Learning goals define the areas of activity to be carried out by learners and condition the selection of learning content, learning resources, and forms of learning. The selection of learning objectives in the process of digital inclusion determines the results in terms of the level of participation of individual age groups in the information society (Zdjelar and Žajdela Hrustek, 2021). Educational goals and content therefore have a not insignificant impact on proficiency in the use of information and communication technologies (ICTs), as well as on attitudes towards new media (Lam and Lee, 2006), the level of techno-stress (Akyıldız Munusturlar and Hastürk, 2023; Salo et al., 2022), and the enhancement or reduction of self-motivation to learn about the possibilities offered by cyberspace (Stojić, 2017). Appropriately planned learning objectives, i.e. selected according to the needs of the target group, timeliness, and relevance, provide an opportunity to reduce the level of digital exclusion and thus professionalise the education process of senior citizens in the area of new media use (Zadražilová and Vizváry, 2021; Koppel and Langer, 2020).

Why is there now a need to redefine the aims of new media geragogy education? One answer can be found in the data for the 27 member states of the European Union, which shows that only one in four people aged 65 to 74 has at least basic digital skills (European Union Agency for Fundamental Rights, 2023). The latest EUROSTAT data show that the largest share of this group (more than 30%) is made up of people whose digital competences could not be assessed because they have not used the internet in the last 3 months. About 10% of the group possess no digital competences at all. 20% of this group have limited digital competences, meaning that only two of the five indicators were assessed at a basic level or higher. A small percentage (around 5%) have narrow digital competence, where three of the five indicators are at basic level or above. A negligible percentage (less than 5%) show low digital competence (four out of the five indicators at basic level). Less than 10 per cent of this age group reaches the basic level, where all indicators are assessed at basic level or above (Eurostat, 2024). At the same time, it is important to be aware that EUROSTAT data do not include senior groups aged 75 and over, where the rates of systematic use of new media, as well as the level of digital and media literacy, are at a lower level than their counterparts in the 65-74 age category. The scale of digital exclusion in Europe is one of the main arguments in favour of the need to redefine models of educational inclusion, as well as to strengthen the non-formal education sector aimed at senior citizens.

Digital education for seniors is characterised by a high level of voluntarism in the choice of learning objectives and content as evidenced, among other things, by the multiplicity and diversity of typologies in this field. In this regard, it is worth considering some of the current methodological frameworks to highlight how greatly the approaches concerning the digital inclusion process for older people vary. One popular standard aimed at older people is ICDL (ECDL) E-Citizen (Inceoglu, 2005; Tattersall et al., 2006). The approach proposed by the International Computer Driving Licence at E-Citizen level implies that learning objectives should include: operation of a computer and simple programs (e.g. starting, working in the operating system, creating files and folders, saving data), the basics of the Internet (e.g. using a web browser), the basics of Internet mail (e.g. understanding relevant e-mail, using one's own e-mail account efficiently), searching for information (e.g. using the right keywords, copying information from websites), and handling online services (using various e-services to meet the needs of daily life) (Leahy and Dolan, 2010; Tristán-López and Ylizaliturri-Salcedo, 2014). The ICDL E-Citizen standard delineates the very elementary areas of digital competence that contemporary users should have to make basic use of the possibilities of cyberspace. E-Citizen has also become the basis in many countries for government programmes that focus on minimising digital exclusion among groups with digital deficits. It is also worth mentioning that this standard makes it possible to obtain certificates that provide official confirmation of this key competence.

The Digital Competence Framework for Citizens (DigComp) presents a nuanced approach to defining learning objectives. The latest iteration, DigComp 2.2, delineates five principal domains of digital competence, further subdivided into 21 specific categories, each serving as a scaffold for indicators of digital competence (Vuorikari et al., 2022). DigComp 2.2 encompasses the following domains: "(1) Infor-

mation and Data Literacy (including browsing, searching for, and filtering data, evaluating data and digital content, and managing information), (2) Communication and Collaboration (covering interaction, sharing, civic engagement, collaboration, netiquette, and digital identity management through digital technologies), (3) Digital Content Creation (encompassing digital content development, content integration, copyright and licensing, and programming), (4) Safety (focusing on device protection, data and privacy protection, health and well-being, and environmental protection), and (5) Problem Solving (including technical problem-solving, identifying technological needs and responses, creatively applying digital technologies, and recognizing gaps in digital competence)".

Crucially, DigComp 2.2 is designed to facilitate the adaptation of learning objectives and content based on the proficiency levels of different learner groups, with the specification of eight levels of advancement. However, not all the domains within this framework are optimally aligned with the learning needs of senior citizens. This population often requires tailored approaches due to the unique challenges associated with digital inclusion and the distinct needs that new media can fulfill in their lives.

In examining digital and media competences suitable for users of contemporary ICT—particularly senior citizens—the Media and Information Literate (MIL) Citizens Framework developed by UNESCO (2021) provides a valuable reference. This model emphasizes the cultivation of interrelated knowledge and skills across several key areas: "(1) Understanding the Role of Information, Media, and Digital Communications in Sustainable Development and Democracy, (2) Understanding Content and its Uses, (3) Accessing Information Effectively with Ethical Practice, (4) Critically Evaluating Information, Sources, and Ethics, (5) Applying Digital and Traditional Media Formats, (6) Situating Information, Media, and Digital Content in Sociocultural Contexts, and (7) Promoting Media and Information Literacy (MIL) among Learners/Citizens and Managing Required Changes".

The UNESCO framework offers a comprehensive approach to delineating educational objectives that enhance individuals' abilities to acquire, interpret, and process information. This model places a strong emphasis on the pivotal role that information circulation and reception play in everyday life. Nonetheless, as with DigComp 2.2, the MIL framework is extensive and may not fully align with the specific needs of older adults. Implementing these typologies within educational practice can present challenges, owing not only to their complexity but also to the necessity of developing solutions grounded in practical, community-based needs.

Recognizing the need for targeted pedagogical support for educators working with digitally marginalized groups, along with insights from recent research networks aimed at optimizing educational practices (Martinez et al., 2023; Vissenberg et al., 2023), a decision was made to conduct localized research. This research seeks to refine learning objectives, with a particular focus on the digital and media competences pertinent to older adults.

Methodology

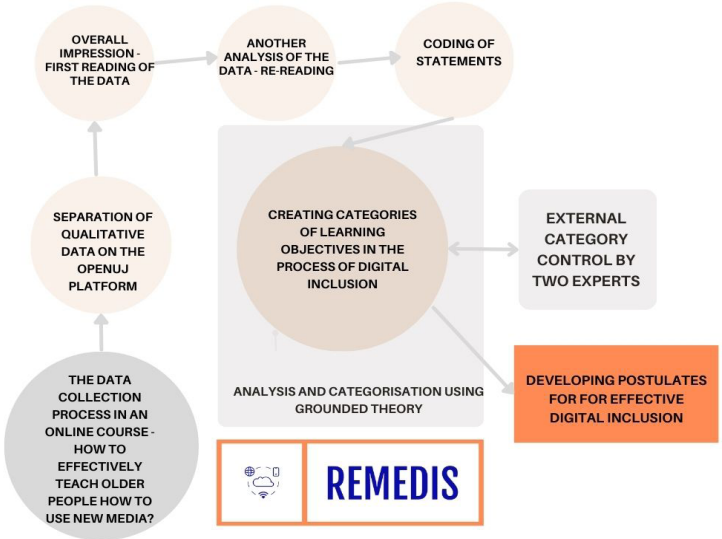
Aim and subject of the research

The aim of the research is to redefine the didactic objectives related to the formation of digital competences among senior citizens. The objective stems from the need to modernise the educational framework in institutions that deal with the digital inclusion of people in late adulthood. The objective is also linked to the dynamic transformation of the information society, which has an impact on the reshaping of learning objectives and therefore on the definition of the process of digital inclusion. The research objective was also determined by the implementation of the international project REMEDIS - Redefining Media Literacy and Digital Literacy in Europe, which was supported by the National Science Centre. The activities carried out as part of the project not only had the character of a diagnosis of the components of the didactic framework determining the directions of digital education of older adults, but also represent a possible practical guideline for trainers and educators of older people. The research objective took the form of the following question - what elements should currently the theoretical framework comprise that defines didactic goals in the process of effective digital inclusion? The subject for the question thus posed was the responses of experts, trainers, and potential educators of older people participating in the online course 'How to effectively teach older adults how to use new media'.

Research procedure

The research was conducted using the Open UJ online platform, which hosted an online course related to the methodology of effective digital inclusion. The course was based on the model of digital inclusion developed by the Polish research team of the REMEDIS project (Tomczyk, 2015) covering modules related to the preparation, implementation, and evaluation of the effectiveness of non-formal education addressed to older adults. The course 'How to effectively teach older adults how to use new media' in its structure included a number of problem tasks for the students, which covered different stages of activities relating to digital inclusion. One of the tasks, based on the PBL methodology, concerned the development of an up-to-date and relevant selection of learning objectives relating to the formation of digital and media competences. Course participants thus not only improved their knowledge of senior education methodology, but also participated in a research process that made it possible to redefine learning objectives using the knowledge they had gathered. This activity provided an opportunity to harness the potential of the cumulative wisdom of the trainers, future trainers, and people interested in the topic of digital inclusion. The course was conducted between February 2024 and September 2024 and the research generated 66 responses that met the data validity criteria. The definition of the learning objectives was based on SMART assumptions, so responses were checked against the following requirements: (1) specificity; (2) measurability; (3) achievability; (4) realism; and (5) timeliness (Do et al., 2024). The data collected were subjected to content analysis using grounded theory (Strauss and Corbin, 1990; Krippendorff, 2019). The content analysis involved reading all the participants' statements several times and discarding statements that were not related to the research problem (though none of the responses fell under this category). Subsequently, the participants' statements were categorised, i.e. logically separate areas defining the learning objectives emerged. The process of creating a new category took place in the absence of a learning area relevant to the respondent's statement. The categories were illustrated through the sample statements of the course participants. The process of analysis and categorisation was carried out by one expert, while the final result in the form of a ready-made map of learning goal categories was evaluated by two external researchers working in the field of digital inclusion. The entire research procedure is illustrated in Figure 1.

Figure 1. Research procedure: collection, analysis, categorisation of data



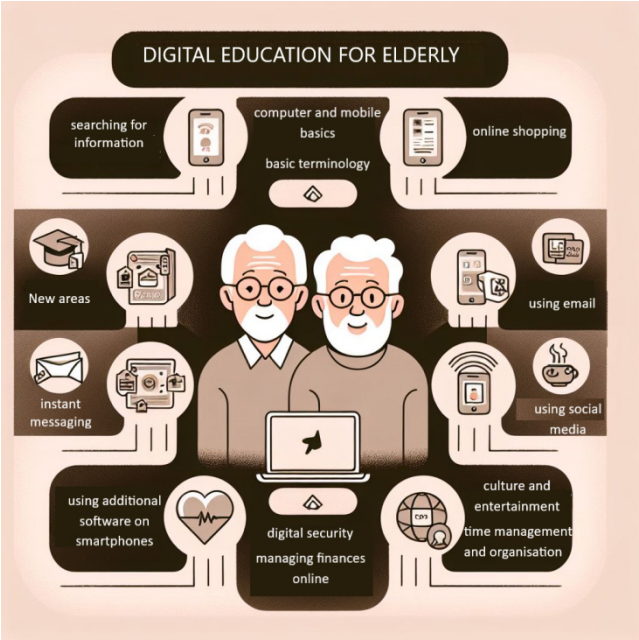
Research ethics

The research was carried out with due consideration of the ethics of social science research. The respondents' answers were stripped of any data that could lead to personal identification. The data were collected in anonymous form (using the MOOC platform). The purpose of the research and the methods of data processing were presented to the respondents, who were also informed that they could opt out of the research at any time. The entire procedure was approved by the Ethics Committee of the University of Leuven - approval number REMEDIS - G-2022-6106-R2(MAR).

Findings

Based on the analysis and categorisation of the responses, 12 main learning objectives were identified. The learning objectives indicated should be considered separately in some situations (e.g. basics of computer and mobile device use, use of basic digital terminology) and thus depending on the stage of learning to use new media reached by the student. Conversely, some objectives overlap with other areas (e.g. use of email, digital safety). Thus, at a secondary level, the achievement of one learning objective enables the achievement of further learning objectives (e.g. use of e-banking, social networks). The 12 learning goals presented in Figure 12 should be categorised as general goals, which, depending on the circumstances (e.g. specific features of the computer lab, size of the group, needs of older adults), are used to set specific goals that include available and appropriate hardware and software resources. A summary of the categories is presented in Graphic 2.

Figure 2 Goals of digital education for seniors



Source: Developed using the Co-Pilot tool

Results

Computer and mobile basics

When setting the learning objectives for digital education, the respondents first pay attention to issues relating to the basics of using ICT. The respondents are aware that the ability to switch a device on and off, to open and close a piece of software, and to understand the functioning of the graphic user interface are prerequisites for the efficient use of new media. The objectives listed in the statements below are a boundary condition for further objectives.

> 'To teach how to use the basic functions of a computer and smartphone: learning to start and shut down the device, learning to use the keyboard and mouse or the touchscreen'.

> 'Participants will be able to operate the computer and mobile devices in terms of basic functions, such as starting up, shutting down, opening programs, etc.'

The basics of operating a computer and mobile devices is a target defined for people who are completely digitally excluded and therefore have no previous exposure to ICT. All later stages of ICT education rely on the skills acquired here.

Basic terminology in the digital world

Directly linked to the above category is another set of objectives related to the ability to use basic terminology. The use of ICT necessitates an expansion of the lexical stock to include terms related to IT equipment, the Internet, and websites. In the initial stage of digital inclusion, this process is very intensive if only because of the complexity of the activities taking place in cyberspace or the phased inclusion of more and more new e-services requiring the expansion of basic terminology.

'Understanding basic terms related to computers, internet and software.'

'Participants will be able to list and explain key digital terms.'

To the above objectives, one respondent adds the valuable idea of linking terminology to specific activities.

'Provide clear definitions and examples for each concept in the form of presentations and practical exercises.'

In the process of forming media and digital competence, building a good knowledge of the most common language used in ICT is an essential early step. However, this fact seems to be overlooked in many educational programmes and often appears only to be included as a tangential feature in training older adults to use hardware and software and to navigate the operating system of their device.

Using e-mail

Among the basic learning objectives, the respondents highlight another elementary issue, which is the ability to use e-mail. Today, having one's own e-mail account is a boundary condition for using other e-services (e.g. shopping, logging in to e-services). Without the ability to log in to email, receive and send emails, or send attachments, the use of cyberspace is severely limited.

'Teaching the use of e-mail: preparing, sending and receiving e-mails, adding attachments to messages'.

'Practical exercises on preparing, sending and receiving emails, as well as education on securing an email account.'

'Teach senior citizens to use basic online communication tools such as email and chat rooms.'

Using email is one of the elementary goals of digital education for older adults. This objective can be broken down into several operational objectives related to email use. The realisation of this objective starts with setting up an e-mail account and then shaping the login and logout process. In the next stage of the process, more elaborate possibilities related to the effective use of email come into play.

Digital security

One of the overarching goals of digital education is to ensure the safety and security of ICT users. The ability to protect one's own data and to secure devices and software against malware and similar negative phenomena is one of the basic components of digital literacy. The ability to anticipate negative phenomena is now a starting point in the use of the Internet being universal for all e-services.

'Ensuring awareness of risk and safe use of the Internet: identifying potential risks such as online fraud.'

'Increasing digital safety awareness: Educating senior citizens about online threats such as phishing, malware and online scams.'

Digital safety is an elaborate learning objective consisting of a number of specific objectives defined by the level of digital and media competence. This overall learning objective is found in combination with other objectives and co-occurs at almost every stage of the digital inclusion process. Given the increase in the number and complexity of risks, this objective should be implemented throughout the learning and teaching process for senior citizens, starting with simple activities (e.g. logging into an e-mail account or SNS) and moving on to more complex activities such as e-banking and e-shopping.

Searching for information on the Internet

Among the other learning objectives included in the foundations of digital education is information retrieval. This general objective is essential for meeting the needs of seniors and is pursued along with learning the basics of the Internet. Information retrieval is an activity that can be carried out using a variety of online tools and provides an opportunity for trainers to design a range of teaching forms using diversified forms of information access.

'Searching for information using search engines'.

'Seniors will be able to use search engines, read online news and browse websites'.

Information search as a general learning objective can have specific objectives in the form of shaping seniors' ability to use simple search engines as well as more advanced e-services, such as scientific repositories, newsgroups, AI-based tools. Searching for information is therefore a general objective that, like digital security, can be developed depending on the level of proficiency in using ICT.

Use of social media

The use of social media is now considered a basic activity for obtaining information and communicating with the wider world, as well as for disseminating private and professional information. Social networking sites (SNS) are a natural channel for socialisation and communication among the younger generations, though in many cases they represent terra incognita for older generations. According to the respondents, however, this area should be one of the main objectives of digital education, though access to and use of SNS should be done safely and securely, with this showing the interpenetration of educational goals.

'Teaching the use of social media: creating an account on social media platforms, posting, sharing content and commenting'.

'Organising interactive sessions where senior citizens can practice the principles of safe social media use'

'Teaching senior citizens how to use the most popular apps to keep in touch with loved ones - facebook, messenger, whatsapp, skype'

The use of SNS is now an extension of the basic or previous forms of communication in cyberspace, such as chat programs and email. The objective presented is achievable with the previously mentioned skills related to ICT basics. SNS, despite being multimedia and thus a relatively intuitive e-service, require a broader knowledge of online profiles and online information sharing mechanisms, as well as awareness of information persistence in SNS, identity theft, manipulation in SNS, self-creation through SNS, and other aspects. It is therefore suggested that this objective should be pursued following on from the attainment of baseline digital and media competences and linked to the needs of older people.

Using instant messaging

One of the natural needs of senior citizens is to communicate with loved ones. This area was noted in the respondents' statements in the form of an objective defined as the ability to select and use an instant messenger. This objective can be met by a diverse range of communicators and should be selected based on a realistic diagnosis of the popularity of individual applications. In other words, the transfer of this didactic objective into educational content should be characterised by the highest level of praxeology.

'Teaching senior citizens to use instant messaging: Senior citizens will be able to recognise different applications for communication'.

'Teaching senior citizens to use the most popular applications with which they can contact their loved ones - messenger, whatsapp, skype'

The ability to use instant messaging is now counted among the basics of ICT use. This objective also provides an incentive for many older adults to undertake educational activities, not least because of the rapid transfer of many communication processes in a mediated manner through free digital tools.

Culture and entertainment

Among the general objectives of digital education, the respondents highlighted the important category of cultural participation and the ludic aspect mediated by ICT. The responses in this area combine the needs of everyday life with the opportunities that cyberspace now offers. The goal of using entertainment resources is achievable at different levels of sophistication, and at a variety of cost points, starting at zero.

'Broadening the cultural perspective to include the online space. To familiarise senior citizens with the digital potential in this area. Movies, series, ebooks, online magazines'.

'Senior citizens become acquainted with new sites, applications, software that broaden their knowledge on topics of interest'.

'Thanks to new sites, the older adult comes into contact with people sharing similar interests'

This area is universal and fits the needs of almost every senior citizen. The ludic dimension of ICT use is an activity that applies not only to computers but also to mobile devices and can be used with the Bring Your Own Device - BYOD concept in mind.

Online financial management

Among the general objectives, there is the question of forming skills and knowledge related to the use of e-banking. This objective overrides other ICT mediated skills, e.g. online payments, online shopping, and admission reservations. Today's stage of development of the information society makes this skill a prerequisite for the full use of e-services.

'Log in to a bank account online and check the balance and transaction history'.

'Master the use of a banking application'.

Managing online finances is a natural issue for digital natives, while for digital immigrants it can be a limitation due to a lack of trust in new technologies, fear of being scammed, and inadequate levels of basic digital competences related to cyber security.

Online shopping

Some objectives build inextricably from others; online shopping is only truly feasible if the user is acquainted with the demands of electronic banking. The respondents suggest that here, as in other cases, it is important for topics to progress according to the logic both of increasing difficulty or complexity, and increasing need for fundamental competences.

'Online shopping nowadays is not only an option but sometimes a necessity'.

'Presenting the benefits of using online shops'.

'Teaching seniors how to use online shops on their own, positively influencing the reception of courses teaching modern technology'

'Replacing visits and queues at the shop for using convenient applications in the comfort of the home'

According to the respondents, using e-commerce is not only about shaping the ability to find a product online and to purchase it, but also about forming attitudes related to paying attention to the benefits of this activity. Online shopping skills as a goal of digital education can also be implemented to a limited extent without the use of online payments (especially for senior citizens with high levels of anxiety) with the use of cash on delivery, or collecting the order in a bricks-and-mortar shop.

Use of additional software on smartphones

Today's information society is characterised by a high degree of smartphone use. These devices allow simple communication needs to be met as well as enabling a range of other activities to be performed. The respondents highlight the need for digital education not only in terms of using these devices by making calls and receiving text messages, but above all in terms of being able to install additional software to extend the functionality of the smartphone.

'Learning about basic mobile applications: installing and updating applications'.

'Acquisition of smartphone skills by senior citizens in the area of at least 10 applications within 2 months'.

Paying attention to extending the functionality of smartphones is an important element in creating modern and relevant digital education goals for senior citizens. Having the ability to install additional software – as well as knowing that this is possible to begin with - significantly expands the possibilities of the smartphone, enabling increased independence for the user and opportunities for older people to function in today's information society. However, it is important to be aware that this area requires the possession of basic smartphone skills (core competences), as well as proficient use of e-mail, as well as the ability to assess the usefulness of potential software available in external repositories.

Time management and organisation

According to the respondents, it is worthwhile for senior citizens to expand their field of activity using ICT to include online calendars. This objective is linked to online communication and also allows for the improved organisation of daily life.

'Participants will be able to use the basic functions of applications such as calendars and instant messaging'.

'Participants will be able to transfer money online and make appointments using an online calendar.'

As with the other objectives presented in the empirical section, it should be noted that the use of this category of software requires basic digital competence. In the case of time management and organisation, senior citizens should have developed other skills beforehand, such as the use of email, the ability to log in or use instant messaging - if meetings are to be planned and carried out online.

Discussion

The redefinition of digital and media competences is now a necessity due to the rapidly developing information society (Webster, 2014), which is transforming the catalogue of requisite knowledge and skills related to the use of ICT (Novković Cvetković et al., 2018). Permanent changes caused by the dynamic development of e-services and the possibilities of access to devices (e.g. smartphones, tablets) force a reflection on current and adequate indicators of knowledge and skills in handling new media (Tomczyk, 2024). The revision of new media literacy curricula applies to both formal education and non-formal education (D'Ambrosio and Boriati, 2023; Korpela et al., 2023). One example of the intensive changes taking place in the aims, content, and forms of education is digital education for senior citizens (Vercruyssen et al., 2023). It is senior citizens who are still one of the most digitally excluded social groups (Tomczyk et al., 2023); this demographic requires special attention due to the slow transformations associated with the intensity and uses of ICTs (Quialheiro et al., 2023; Martínez-Alcalá et al., 2019). The conditions described in the empirical section due to the rapid technological changes and the still unsatisfactory use of ICT in this age group force the question of the effectiveness of digital education.

One of the determinants of the effectiveness of contemporary digital inclusion is the selection of appropriate educational goals. Based on the opinions of people interested in the topic of digital inclusion, the trainers and future trainers identified 12 main goals of contemporary digital education for senior citizens. These objectives coincide with existing frameworks for the development of digital competences (Vuorikari et al., 2016; Caena and Redecker, 2019; Hammoda and Foli, 2024), so are themselves an extension of existing approaches to the translation of theoretical assumptions into practice (Kluzer and Priego, 2018). The differentiating factor of the 12 areas and their principal learning objectives presented in this article is that it looks at the process of building digital competences by narrowing the analysis to the group of oldest ICT users, which is not obvious for a general framework of digital competences. Secondly, the proposed model is based on the accumulated knowledge of experts dealing with the topic of digital learning for senior citizens from the perspective of bottom-up activities. Thirdly, the objectives outlined can serve as a practical reference point for building original educational programmes implemented in Universities of the Third Age, seniors' clubs, and other institutions that operate bottom-up, without direct reference to elaborate strategies and documents (e.g. the European Digital Competence Framework).

Based on the responses, 12 main learning objectives were identified, which include both the basics

of ICT use (computers, smart phones, Internet services), as well as more advanced skills that require the achievement of previous objectives. As an example of how competences increase in complexity or difficulty of acquisition (Szarota, 2004; Luppi, 2009), there are objectives related to the basics of using computers and mobile devices, the formation of basic terminology concerning the digital world, and the use of e-mail. These three learning objectives now form the basis for effective use of the opportunities offered by cyberspace. Mastering the basic vocabulary of hardware and software is the starting point for further, more complex activities. However, it should be emphasised that these activities are not only carried out at a basic level, as the reinforcement of lexical resources concerning new media is also built up as older adults encounter the use of any new software or hardware. Among the basic learning objectives that remain relevant throughout is the use of email (Sanecka, 2014). This skill is counted as an elementary objective since it is impossible to achieve advanced digital and media competences without the ability to log in to email, receive and send email, and add and forward attachments via email (Tomczyk, 2015).

The respondents also identified digital safety as one of the core categories. This area forms the basis of competence in using new technologies regardless of the metric age of e-service users (Guillén-Gámez et al., 2024). Digital security is a goal that should be achievable while learning about the specifics of each e-service. However, it should be added that, in the case of senior citizens, too much focus on this objective alone may lead to the cultivation of fears that may prove counter-productive to the assumptions that characterise the digital inclusion process.

Another category of objectives identified by the trainers was searching for information on the Internet. This goal is one of the basic activities in all age groups, but in the case of senior citizens it takes on particular importance due to the specific type of needs, e.g. health, economic, that new media can satisfy (Sayago and Blat, 2007; Jung et al., 2011). Information retrieval takes on a new meaning when the possibilities offered by generative artificial intelligence are taken into account (Qian et al., 2021; Czaja and Ceruso, 2022). This area in relation to the digital and media competences of senior citizens is wholly new territory and represents a new dimension of competence that trainers of older adults should take into account when planning programmes.

Another important area in the goal of digital education for senior citizens is online communication. Contact with others can be mediated through social networks as well as instant messaging. Both solutions are typical for the younger generation of ICT users and are not primarily associated with senior citizens (Maier et al., 2011; Nef et al., 2013). Nevertheless, from the perspective of the trainers of older people, the inclusion of this area in digital education becomes essential due to the communication possibilities these approaches represent, and also because of the wish to confer access to the specific type of information that social networks and instant messaging offer. This area also appears to be extremely important from the perspective of enhancing senior citizens' cost-free communication with loved ones.

Among the goals of digital education, the respondents also highlighted culture and entertainment. The Internet can enable fast and free access to ludic digital content (Hilt and Lipschultz, 2004). Thanks to the development of video on demand technology and the proliferation of online magazines and digital books, many new possibilities for entertainment are open to users with the appropriate competences – thus making this an important area in the development of educational programs for older adults.

More advanced uses include online financial management and online shopping. Due to the growing older population and changes in attitudes towards treating senior citizens as valuable customers (the so-called silver economy), this area of digital competence seems extremely promising, as has already been highlighted many times in non-educational publications (Haiteng et al., 2021; Ganguly et al., 2024). However, the digital education of older adults regarding the e-commerce area requires the formation of basic digital competences, as well as knowledge of security, ensuring that senior citizens are protected from dishonest sellers or the hacking of their online accounts.

An advanced goal of digital education for senior citizens is also to extend the capabilities of their smartphones by installing additional software. Older adults are the group with the lowest level of digital competence (Vidal, 2019; Jeong and Bae, 2022), so this goal should be classified as ambitious but possible and necessary to achieve given the potential offered by the devices. The use of additional software by senior citizens also shatters the myth that not all possibilities of the modern digital world are available to older adults.

Among the atypical, and therefore less common goals of digital education is the inclusion of aspects related to learning software for time management and organisation of personal activities. This activity is

primarily intended to foster the free-time activities of senior citizens and encourage the use of solutions popular with other age groups.

Conclusions

The study focused on twelve essential domains crucial for the skills development of older adults, differentiating between basic and advanced layers of skills. General skills in digital tools such as using personal computers and mobile devices, a knowledge of basic digital vocabulary, and emailing are examples of primary competences. There must be a focus on these skills as they lay the groundwork for interacting with digital tools and platforms. Among other things, senior citizens who do not know how to use email will struggle because many aspects of online services require creating accounts or communicating through e-mail. In contrast, advanced competences involve skills that might include online banking and business transactions as well as the appropriate use of social media tools. Though these much more advanced skills have significant benefits, the real-world relevance to older adults needs to be considered. Focusing too much on complicated activities—such as running complex online banking systems or learning the many features of social media—can lead to frustration and hence demotivation. Digital literacy programs, therefore, need to prioritize skills that have a meaningful and positive impact on participants' existing abilities and daily routines.

How educational content is organized and what is focused on is just as critical. Ensuring a gradual approach is thus very important. Programs should proceed step by step, starting from the fundamentals and then moving onto more complicated topics so as to avoid overburdening older adults who may feel overwhelmed with learning new digital skills. A supportive learning environment is needed, one that respects where individuals start and that develops them at their own pace to become confident and competent in using digital technologies effectively.

These results show that what is urgently needed is a prompt re-conceptualization of how digital literacy initiatives for older adults are developed. Holistic programs tailored to the needs of this age group will have positive impacts on individual well-being and social inclusion. In these ways, efforts that empower older adults to participate in a digitally active society not only reduce disparities in basic digital skills but also contribute to social cohesion. These require clear, practical learning objectives and the use of adaptive teaching methods that respond to the diverse needs of older learners.

Conflict of interests

The authors declare no conflict of interest.

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Author Contributions

Łukasz Tomczyk: conceptualization, methodology, data collecting, writing – original draft, formal analysis, writing – review and editing. Natalia Edisherashvili: abstract, review, editing and conclusions.

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Effectiveness of Ethnoecological-STEM Project-Based Learning Model to Improve Critical Thinking Skills, Creativity, and Science Concept Mastery

M. Hidayatur Rohman[1], *Putut Marwoto*[1]*, *Sunyoto Eko Nugroho*[1], *Supriyadi Supriyadi*[1]

[1]Department of Science Education, Universitas Negeri Semarang, Central Java, Indonesia,
e-mail: hidayat80@students.unnes.ac.id; pmarwoto@mail.unnes.ac.id; ekonuphysed@mail.unnes.ac.id; supriyadi@mail.unnes.ac.id

Abstract: Students' ability to master critical thinking skills and creativity is often found in current learning. This research aims to test the effectiveness of the Ethnoecological-Science, Technology, Engineering and Mathematics based on Project Based Learning (E-STEM PjBL) learning model in improving mastery of science concepts and critical thinking skills as well as the creativity of prospective science teachers. This model is an innovative project-based learning model integrated with Ethnoecology-STEM in the Environmental Physics course with a project on the use of water hyacinth with the following syntax: Learn, Discuss, Perform, Elaborate, Convey, Practice, Evaluate, and Use. The research method used was quasi-experimental with a one-group pretest-posttest design. The research subjects were 31 science education students at Universitas Islam Negeri Salatiga, Central Java, Indonesia. Data collection techniques use test instruments and observation sheets. The instrument was validated empirically by four experts and analyzed using Aiken's V formula. Data was analyzed using SPSS on concept mastery test data with the Paired-Sample t-test, and critical thinking skills test data with the Wilcoxon Signed Ranks Test. The average N-Gain value is obtained for each data point, while the creativity data is the average creativity of two observers. The research results showed a significant and quite effective increase in science concepts mastery, critical thinking skills, and creativity in the good and very good categories. This research concludes that the application of the E-STEM PjBL model is effective in increasing mastery of science concepts, critical thinking skills, and creativity of prospective science teachers.

Keywords: *Project-based learning, ethnoecological-stem, science concept mastery, critical thinking skills, creativity.*

Introduction

Creative thinking is the ability of students to develop and convey new ideas openly and responsively, and it can be applied in life (Yusliani et al., 2019) or a series of processes for understanding problems, making guesses, hypothesizing about problems, looking for answers, proposing evidence, and reporting results to be applied in the creation process (Birgili, 2015). Critical thinking is considered the new basis for 21st-century learning (Trilling and Fadel, 2009), while creative thinking (creativity) has also been seen as an important basis for students (Gube and Lajoie, 2020a; Ritter and Mostert, 2016; Srikongchan et al., 2021). People who think scientifically must be able to think creatively (Suratno et al., 2019). Critical thinking and creativity need to be improved because it is closely related to students' success in mastering concepts. Ulger (2018) argues that students' critical thinking and creativity styles are related to their cognitive abilities. Critical thinking skills and creativity can be achieved by updating the quality of learning, helping students develop participation, emphasizing project-based learning, encouraging collaboration and communication, increasing students' involvement and motivation, cultivating creativity and innovation in learning, using appropriate learning tools, and designing learning activities that are relevant to the real world (Fatmawati et al., 2019; Gube and Lajoie, 2020b; Jayadi et al., 2020)

Science education aims to study not only the content but also the nature of science: science as a cognitive (knowledge), epistemic (scientific practice), and social-institutional (scientific ethos or attitude)

*Corresponding author: pmarwoto@mail.unnes.ac.id

system (Akgun and Kaya, 2020; Dagher and Erduran, 2016). Bloom et al. (1956) stated in their theory of Bloom's taxonomy that educational goals must always refer to three domains: the cognitive domain (knowledge or thought processes), the affective domain (values or attitudes), and the psychomotor domain (skills). Education in the current century is facing an era of openness or globalization marked by progress in science and technology (Jayadi et al., 2020; Rahayu, 2017; Van Laar et al., 2017), often called 21st-century education. By the above thinking, the goal of 21st-century education is not only to prepare students to pass exams but also to foster learning in a way that can be transferred to their future personal, cultural, professional, academic, and civic lives (Tierney et al., 2022). Redhana (2019) believes that 21st-century education prepares human resources who master various skills to survive in the 21st century. 21st-century education must be oriented toward mastering 21st-century skills (Jayadi et al., 2020).

21st-century skills as a result of learning are divided into 3 (three) categories: learning and innovation skills or 21st-century 4C skills (Critical thinking, Communication, Collaboration, and Creativity) (Astuti et al., 2019; Santi et al., 2021), information and communication technology literacy skills, and life and career skills (Prayogi and Estetika, 2019; Van Laar et al., 2017). Therefore, critical thinking skills and creativity are fundamental in science learning in the 21st century (Mulyono et al., 2023) because they can be used to solve real-life problems (Amaliah et al., 2020; Budi and Ghofar, 2017).

21st-century education applies many student-centered learning models, including project-based learning (PjBL) (Redhana, 2019). The PjBL model is a teaching approach built on actual learning activities and tasks in a "constructivist" learning environment created in groups where students build their knowledge and educators are facilitators (Goodman et al., 2010). A vital characteristic of the PjBL model is that students can apply various skills to completing real and useful tasks (Bagheri et al., 2013; Malawati and Sahyar, 2016). The PjBL model can provide authentic experiences for students to develop a correct understanding of scientific processes and is recommended as an effective learning model to be applied at the tertiary level (Wurdinger and Qureshi, 2015).

Furthermore, the PjBL model can improve 21st-century 4C skills by integrating the STEM approach (Santi et al., 2021). STEM incorporates transdisciplinary learning, meaning students learn by blending actual scientific disciplines and solving problems in real contexts (Suganda et al., 2020). STEM learning in science can improve students' creativity or 21st-century skills. The STEM approach is increasingly popular and is used to measure creativity (Anindya and Wusqo, 2020), problem-solving (Ozkan and Umdu, 2020; Sun and Jeong, 2015), concept understanding (Liliawati et al., 2018; Yakman and Lee, 2012), understanding in science, technology, engineering, and arts, learning motivation, learning achievement, and critical thinking (Yakman and Lee, 2012). STEM learning can make science learning more interesting (Conradty and Bogner, 2019).

The facts in the field are that there are still problems in getting used to using the PjBL model which is integrated with STEM. This field study is an observation of 37 (thirty-seven) science teachers at Junior High Schools (SMP) in Semarang Regency regarding the use of the project-based learning model (PjBL) as the main choice in the learning process. From the observation results, data showed that there was still little use of the PjBL model as the main choice, namely only 5 teachers (13.5%), while 16 teachers (43.2%) used the discovery learning model and the other 16 teachers (43.2%) used the problem-based learning (PBL). The application of STEM integration in science learning, which is a combination of various scientific disciplines, is also still low, namely only 24.3% answered often, while the majority answered rarely as much as 54.1%, and some never applied as much as 21.6%. Therefore, it is necessary to prepare science education students at the tertiary level as prospective science teachers to be familiar with and skilled in using the STEM-integrated PjBL learning model.

This research focuses on developing a learning model described by Jayadi et al. (2020). The model innovation developed integrates the project-based learning (PjBL) model and Ethnoecological-STEM (Etno-STEM), named the E-STEM PjBL model. The Ethno-STEM approach can be interpreted as building scientific concepts through local wisdom and integrating them with STEM (Sartika et al., 2022)

Needs analysis, expert validation, and limited trials related to developing the E-STEM PjBL model were conducted. The results of the needs analysis produced the following novelty in this research: the syntax of the E-STEM PjBL model (Learn, Discuss, Do, Elaborate, Convey, Practice, Evaluate, and Use), the E-STEM PjBL Learning Module, and instruments to measure 21st-century skills (critical thinking and creativity).

Based on this background, this study is the result of a wide-scale trial of the E-STEM PjBL model with the syntax of Learn, Discuss, Do, Elaborate, Convey, Practice, Evaluate, and Use in Environmental Physics lectures for science education students at Salatiga State Islamic University in the 2022/2023 academic year. The trial aims to test the effectiveness of the E-STEM PjBL learning model in improving mastery of science concepts and critical thinking skills and creativity of prospective science teachers. The results of the trial in this study are expected to contribute to science education, namely the syntax of E-STEM PjBL can also be used as an alternative learning model in other project-based science courses (physics, chemistry, biology).

Materials and Methods

Research Design

This research used a quasi-experimental research method (Creswell and Creswell, 2018; Leavy, 2017) with a one-group pretest-posttest design in a class of students in the Science Education study program, totaling 31 students for a large-scale trial and 13 students for a limited-scale trial. The large-scale trial, involved 2 science lecturers as proof-readers and observers, namely the researcher and a science lecturer who was willing to be a proof-reader and observer, while on a limited-scale, it was carried out by researchers. This one-group pretest-posttest design was used to investigate the effectiveness of the E-STEM PjBL model to improve science concept mastery and critical thinking skills, while students' creativity skills were carried out through observation sheets.

Research Procedure

The research was carried out by following the syntax of the development model, namely Learn, Discuss, Perform, Elaborate, Convey, Practice, Evaluate and Use. The syntax of this model is derived from the PjBL syntax according to The George Lucas Educational Foundation (2005) and the PjBL-STEAM learning syntax according to Laboy-Rush (2010). The combined syntax can be reviewed in Table 1.

Table 1. *Syntax Formulation of E-STEAM PjBL*

Stages	PjBL (Lucas)	PjBL-STEAM (Laboy-Rush)	Syntax PjBL E-STEAM (researchers)
First	Start with the essential question	Reflection (providing a problem and inspiration to begin investigation)	Learn (study the given problem and ask challenging questions)
Second	Design a plan for the project	Research (starting research/ finding relevant sources of information)	Discuss (discuss the topic, design, and project schedule)
Third	Create a schedule	Discovery (solving a problem through a project)	Perform (carry out the project according to the agreed design and schedule)
Fourth	Monitor the students and the progress of the project	Application (applying concepts to the project and testing the project)	Elaborate (elaborate the application of concepts to the project, bring out creativity with communication and collaboration)
Fifth	Assess the outcome	Communication (project presentation/feedback)	Convey (present the results of project implementation)
Sixth	Evaluate the experience		Practice (demonstrate the results of the project in accordance with work procedures)
Seventh			Evaluate (evaluate the results and experience of carrying out the project)
Eighth			Use (implement the project in life)

The research begined with an explanation of the model and research objectives, then students were given a pre-test on mastery of science concepts and critical thinking skills. The research continued with the implementation of the learning model by the E-STEM PjBL syntax and each student was given a learning module. Classes are held in a hybrid manner, namely offline and online via Google Classroom. Online is only used for collecting project results, project-making videos, and student worksheets.

Research Instrument

The results of the needs analysis related to the development of the E-STEM PjBL model produced the E-STEM PjBL model syntax (i.e., Learn, Discuss, Peform, Elaborate, Convey, Practice, Evaluate and Use), E-STEM PjBL learning modules, and instruments to measure science concept mastery, 21st-century skills, including critical thinking and creativity. Learning tools in model books and learning modules were designed based on theory through literature review and field studies and were presented at the 2023 International Conference on Science, Education, and Technology (ISET) at Universitas Negeri Semarang (Rohman et al., 2023). Several instruments were developed to test this model's effectiveness, including expert validation sheets, science concept mastery test sheets, critical thinking skills test sheets, and creativity skills observation sheets.

Sample and Data Collection

The research was conducted on final students of the Science Education study program at Universitas Islam Negeri Salatiga, Central Java, Indonesia for the 2022/2023 academic year for 1 semester or 6 months. The first half of the semester (first 3 months) was used for limited trials with 13 students by making small classes, and then the final half of the semester (last 3 months) was used for trials in learning in 31 students for regular classes. Data collection techniques using test instruments and observation sheets. The instrument was validated empirically by four experts and analyzed using Aiken's V formula. Data on science concept mastery was taken using a description test, data on critical thinking skills used a multiple-choice test equipped with reasons, and data on creativity used an observation sheet.

Analyzing of Data

Research data was analyzed using Excel and SPSS programs. Data from expert validation was analyzed using the Aiken's V (Eq.1) formula using the Excel program. Aiken's V formula (Aiken, 1985) used as follows:

$$V = \frac{\sum s}{n(c-1)} \quad (1)$$

Description:
V = validity value
s = r-lo
r = expert's preferred category score
lo = lowest assessment score
n = number of experts
c = highest assessment score

Most of the research data was analyzed using the SPSS program, including validity and reliability, descriptive analysis, normality test, independent sample t-test, and non-parametric tests Wilcoxon. Test normality using the Shapiro-Wilk test because the sample data is only 31 students or less than 100 people. If the data is normally distributed, a parametric test is carried out, whereas if it is not normally distributed, the data is analyzed using a non-parametric test. All values obtained are interpreted at a significance level of 0.05. To answer the research objectives, pre-test and post-test data on mastery of science concepts and critical thinking skills were analyzed using the N-gain test (Hake, 1998) and N-gain percentage (Hake, 1998) as in Table 2 and Table 3, namely to determine the effectiveness of implementing the E-STEM PjBL model. The creativity skills data were analyzed for validity and reliability and the average assessment from 2 observers was interpreted using the creativity skills assessment criteria.

Table 2. *N-gain Achievement Level Criteria (<g>)*

Average <g> value	Criteria
<g> < 0,3	Low
0,3 < <g> ≤ 0,7	Moderate
0,7 ≥ <g>	High

Table 2 reveals the criteria for assessing creativity skills. When the g-value is less than 0.3, the criterion is low. Then, if the g-value is between more than 0.3 to less than equal to 0.7 then the criterion is medium. Next, if the g value is more than equal to 7 then the g value is high.

Table 3. *Criteria for N-gain Effectiveness Levels*

N-Gain (%)	Criteria
< 40	Ineffective
40 - 55	Less effective
56 - 75	Effective enough
> 75	Effective

From Table 3, it can be seen that when the percentage of the N Gain value is less than 40 %, the criterion is ineffective. Furthermore, when the N Gain percentage is at 40-55 % then it can be categorised as less effective. When the value of 56-75 can be said to be quite effective and if the value is less than 75 then the category is effective.

Results

Effectiveness of the E-STEM PjBL Model in Improving Science Concept Mastery

Science concept mastery is increased by applying the E-STEM PjBL model. Students' initial knowledge is measured through a pre-test. On the other hand, students' final science concept mastery after learning with the E-STEM PjBL model syntax is measured through a post-test. The science concept mastery test was first given to a limited class of 13 randomly selected students. The pre-test and post-test results were tested for normality using the Shapiro-Wilk test, with the Ho testing criteria (distribution of data does not deviate from the normal distribution). Ho is rejected if the sig value ≤ α 0.05, or data is normally distributed if the sig value > α 0.05. The results of the Shapiro-Wilk normality test obtained a pre-test significance value of 0.776 and a post-test of 0.083 (Table 6), all >α 0.05 so that Ho was accepted or the pre-test and post-test data were normally distributed. The aim of testing it in this limited class is to get input regarding the validity and reliability of the questions. The results of the analysis using SPSS obtained questions at a very reliable level with a Cronbach's Alpha value of 0.893 and obtained 12 valid questions. Three questions were invalid because the difficulty level was high and included questions with different strengths from the poor question category (less than 0,2). Invalid questions were not used because the subject matter of the questions still contained representative indicators. Another reason was the sequential research time.

Table 4. *Normality Test Results and Reliability Statistics for Limited Class Science Concept Mastery*

Data	Shapiro-Wilk test		Cronbach's Alpha
Pre-test	Sig.(2-tailed) 0,776>0,05	Data is normally distributed	0,893 >0,80 – 1,00 Data is Very Reliable
Post-test	Sig.(2-tailed) 0,083>0,05	Data is normally distributed	

The 12 test questions were then tested in a larger class with 31 students. The pre-test and post-test results on the large-scale test were also tested for normality using the Shapiro-Wilk test. The results of the Shapiro-Wilk normality test (Table 5) obtained a pre-test significance value of 0.122 and a post-test of 0.186, all greater than α 0.05 so that Ho was accepted or the pre-test and post-test data were normally distributed. The data met the requirements for analysis using parametric statistics. The next stage of statistical testing is the paired sample t-test, which determines the significance of increasing students' science concept mastery. The criterion used is if the t-test has a sig value < α 0.05, then Ho is rejected, and H1 is accepted (Ho = there is no difference in concept mastery scores before and after the E-STEM PjBL learning model is applied and H1 = there is a difference in concept mastery scores before and after

the E-STEM PjBL learning model is applied). Based on the t-test results, the sig value is 0.000, which means it is smaller than α 0.05, then Ho is rejected, and H1 is accepted. It means there is a significant increase in concept mastery of prospective science teachers in Environmental Physics material.

Table 5. *Results of Normality Test, Paired Sample T-test, and N-Gain Score for Science Concept Mastery in Experimental Class*

Data	Shapiro-Wilk Test		Paired-Sample T-Test		N-Gain score	Conclusion
Pre-test	Sig.(2-tailed) 0,122>0,05	Data is normally distributed	Sig. (2-tailed) 0,000<0,05	Both data are correlated	0,5809	Modium Achievement
Post-tets	Sig.(2-tailed) 0,186>0,05	Data is normally distributed	Sig. (2-tailed) 0,000<0,05	There is a significant difference.	58,09%	The upgrade is quite effective

The N-Gain test results obtained an average of 0.58 or 58.1% using the criteria in Tables 2 and 3. The effectiveness of the E- STEM PjBL model on concept mastery is in the medium category and is quite effective in increasing science concept mastery.

Effectiveness of the E- STEM PjBL Model in Improving Critical Thinking Skills

The increase in students' critical thinking skills due to implementing the E-STEM PjBL model is measured through pre-test and post-test. The results of the pre-test and post-test were tested for normality using the Shapiro-Wilk test (because the data is less than 100), with the Ho testing criteria (distribution of data does not deviate from the normal distribution), namely, Ho is rejected if the sig value ≤ α 0.05 or data normally distributed if the sig value. > α 0.05. The results of the Shapiro-Wilk normality test (Table 6) obtained a pre-test significance value of 0.369, greater than α 0.05 (normally distributed pre-test data), and a post-test of 0.006 smaller than α 0.05 (post-test data not normally distributed). The data does not meet the requirements for analysis using a parametric test, so a non-parametric test will be carried out using the Wilcoxon signed ranks test.

Table 6. *Results of Normality Test, Paired Sample T-test, and N-Gain Score for Critical Thinking Skills in Experimental Class*

Data	Shapiro-Wilk Test		Wilcoxon Signed Ranks Test			N-Gain score	Conclusion
Pre-test	Sig.(2-tailed) 0,369>0,05	Data is normally distributed	Asymp. Sig. (2-tailed) ,000<0,05	Both data are orrelated	Mean Rank: Positive Ranks 16	0,6091	Moderate Achievement
Post-tets	Sig.(2-tailed) 0,006<0,05	Data is not normally distributed	Asymp. Sig. (2-tailed) ,000<0,05	There is a ignificant ifference.		60,91%	The upgrade is quite effective.

Table 6 shows that the mean is a positive rank with an average of 16, meaning an increase between the pre-test and post-test results. The Wilcoxon Test can prove this with Asymp Sig < α 0.05 criteria, Ho is rejected, and H1 is accepted (Ho = there is no difference in the value of critical thinking skills before and after implementing the E-STEM PjBL learning model and H1 = there is a difference in the value of thinking skills critical before and after implementing the E-STEM PjBL learning model). Based on Wilcoxon Test results, the Asymp Sig value of 0.000 is obtained, which means it is smaller than α 0.05, so Ho is rejected, and H1 is accepted. The conclusion is that there is a significant increase in the critical thinking skills of prospective science teachers in Environmental Physics material. The N-Gain test results obtained an average of 0.60 or 60.91% (Table 6) using the criteria in Table 2 and 3. The effectiveness of the E-STEM PjBL model on critical thinking skills is in the medium category, and it is quite effective in improving the critical thinking skills of prospective science teachers. The post-test results are also interpreted according to assessing critical thinking skills, as in Table 7.

Table 7. *Post-test results of Critical Thinking Skills According to Observation Aspect*

Observation Aspect	Percentage of Total Critical Thinking Skills Score
Give a simple explanation	72,28 %
Build basic skills	70,56%
Make conclusions	56,45%
Make further explanations	59,68%
Organize strategies and techniques	64,31%

According to observation aspect, Table 7 conveys that students mostly master the aspect of providing simple explanations with total critical thinking skills 72,28 %. Then, in sequence, they build basic skills, organize strategies and techniques, make further explanations, and conclude.

Effectiveness of the E-STEM PjBL model in Improving Creativity

Creativity skills refer to thinking creatively, working, and creating innovations (Trilling and Fadel, 2009). The results of the assessment of creativity by two observers for 31 students in four aspects are shown in Table 8.

Table 8. *Observation Results of Creativity*

Variable	Observer 1	Observer 2	Average	Category
Fluency of thinking	3.18	3.19	3.19	Good
Flexibility	3.17	3.18	3.18	Good
Elaboration	3.30	3.28	3.29	Very good
Originality	3.15	3.18	3.17	Good

Table 8 shows that the students' fluency in the thinking aspect is 3.19, meaning that the effectiveness of implementing the E- STEM PjBL model in improving the creativity fluency skills of prospective science teachers is in the good category. Increasing the flexibility of creativity obtained a score of 3.18 or a good category. The aspect of increasing elaboration in creativity obtained a score of 3.29 or a very good category. The aspect of increasing originality in creativity obtained a score of 3.18 or a good category. The conclusion that can be drawn is that the effectiveness of implementing the E- STEM PjBL model in improving creativity skills or creativity, in general, is in a good category.

Discussions

Based on the research results, innovation in developing a learning model that integrates the project-based learning model (PjBL) with the disciplines of Ethnoecology and STEM (E-STEM PjBL model) has been proven to make a positive and significant contribution to the learning success of prospective science teachers. This can be seen from the assessment results of science concept mastery, which show a significant increase. Applying the E-STEM PjBL model has proven effective in increasing science concept mastery. Students master science concepts not only through reading the material in the module but also through the experience gained while carrying out the project. While carrying out the project, students will also develop scientific attitudes due to the scientific methods that students apply when working on the project. The findings in this research are from previous research, which confirms that project-based learning can increase mastery of concepts (Hanif et al., 2019; Yamin et al., 2017) and problem solving ability (Andanawarih et al., 2019)

can cultivate high-level thinking in implementing scientific learning (observing, associating, trying, discussing, and communicating) (Santi et al., 2020). This shows that the E-STEM PjBL model is in line with the nature of science: science as a cognitive, epistemic (scientific method), and social-institutional (scientific attitude) system (Akgun and Kaya, 2020; Erduran and Dagher, 2014). This model is also in line with (Bloom et al., 1956), who stated in Bloom's taxonomy that educational goals must always refer to three domains: the cognitive domain (knowledge or thought processes), the affective domain (values or attitudes), and the psychomotor domain (skills).

It is also line with the objective of this research to reveal the effectiveness of the E- STEM PjBL model in improving the critical thinking skills of prospective science teachers. The critical thinking skills studied include five aspects: 1) providing simple explanations, 2) building basic skills, 3) concluding, 4) making further explanations, and 5) organizing strategies and techniques (Ennis, 2013). Based on the results of the pre-test and post-test, there are significant differences, meaning that applying the E- STEM PjBL model in learning has proven effective in improving critical thinking skills. Then, in sequence, they build basic skills, organize strategies and techniques, make further explanations, and conclude. The application of the PjBL model makes an excellent contribution to increasing scientific literacy, critical thinking abilities (Muhibbuddin et al., 2020), and other essential skills, such as collaboration, communication, creativity, and critical thinking (Allison, 2018; Samsudi et al., 2019). STEM can develop critical thinking in real-world problems, make science learning easier to increase students' motivation (Miller and Dumford, 2016), and quality human resources (Anwar et al., 2023).

Applying the Etnoecological-STEM PjBL model with the project of utilizing water hyacinth plants, besides increasing science concept mastery and critical thinking skills, is also expected to increase students' creativity through critical thinking skills.

Figure 1. *Water hyacinth plants*

The research results show that the application of the E-STEM PjBL model is effective in the good category in improving the creativity of prospective science teachers. Creativity can be seen in four aspects: fluency of thinking, flexibility of thinking, elaboration, and originality (Guilford, 1956). The elaboration aspect is a skill that students very well master, while fluency of thinking, flexibility, and originality are also mastered by many students. This is in line with the characteristics of the E-STEM PjBL model, which can be seen in its syntax: learn, discuss, do, elaborate, convey, practice, evaluate, and use.

The aspect of fluency of thinking will be widely trained and needed in steps 1 and 2: students study science concepts, find ideas, and discuss the findings in group discussions. The flexibility aspect is mostly trained in steps 3 and 5 when implementing projects according to the schedule and project design and in delivering project results. The elaboration aspect is mostly trained in steps 4 and 6, namely when elaborating during the project creation process and practicing the final results of project work. Aspects of originality are often trained in steps 7 and 8, because in the evaluation stage and using projects in everyday life, students must be able to argue, answer, and present them to others. This research results align with (Sumarni and Kadarwati, 2020), who stated that the Etno-STEM project-based learning model can improve critical thinking and creativity. Therefore, the PjBL model can improve creative and critical thinking skills (Allison, 2018; Samsudi et al., 2019). STEM education can foster problem-solving skills (Yuliari and Hanim, 2020) and creativity skills (Buinicontro, 2018).

Conclusions

The research concludes that the innovative E-STEM PjBL model implemented in the Environmental Physics course has been proven to improve students' science concept mastery, critical thinking skills, and creativity through creativity. Science concept mastery is obtained through material in modules, internet

media, and when elaborating science concepts in project work. Students' critical thinking skills and creativity, seen in several aspects, have been covered at every step in the syntax of the E- STEM PjBL model (learn, discuss, do, elaborate, convey, practice, evaluate, and use). Students' creativity can also be seen while working on projects or products, starting from arranging schedules, designing, working on, and demonstrating projects.

The integration of the PjBL model with the disciplines of Ethnoecology and STEM education allows for accompanying impacts on learning. Ethnoecology integration can foster an environmentally caring character, while STEM education can improve students' ability to utilize technological advances in learning. For prospective science teachers, it is essential to master science concepts and be skilled in scientific methods that require critical thinking skills and creativity, so prospective science teachers will ultimately develop scientific attitudes.

The syntax from the innovation in the E-STEM PjBL model can be applied to environmental physics and other science courses with the potential for projects that students can carry out, for example basic physics, mechanics, or biology or chemistry courses. Then, this paper is expected to be used to train student teachers in practicing other 21st century skills such as communication, collaboration, and environmental awareness.

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Conflict of interests

The authors declare no conflict of interest.

Author Contributions

Conceptualization, M.H.R., S.E.N. and P.M.; methodology, S.E.N. and S.; formal analysis, S.E.N.; writing—original draft preparation, M.H.R.; writing—review and editing, S.E.N., S. and M.H.R.; supervision, P.M. All authors have read and agreed to the published version of the manuscript.

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Appendices

1. Students' worksheet

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2) PURPOSE
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3) PROBLEM FORMULATION
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4) TOOLS AND MATERIALS
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5) STEP WORK
……

6) ACTIVITY SCHEDULE
……

7) ETHNOECOLOGY-CAL STEAM INTEGRATED PROJECT DESCRIPTION
……

8) LITERATURE REVIEW RESULTS
……

9) PROJECT DESIGN DRAFT
……

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……

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……

2. Video project

3. Project result

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Russian and Chinese Students: Proactive Behaviour and Economic Activity Characteristics

Olga B. Mikhailova[1*], *Elizaveta S. Farennikova*[2]

[1]Chair of the Psychology and Pedagogy Department, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University) Moscow, Russia, e-mail: olga00241@yandex.ru
[2]Master's student of the Department of Psychology and Pedagogy, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), e-mail: 21elfa@mail.ru

Abstract: The relevance of the study of young people's economic behaviour features is beyond doubt, because the younger generation is the future social capital and economically active population of any country. The purpose of the presented study was to identify the specifics of proactive behaviour and economic activity (as indicators of economic behaviour), their demonstration and interrelation among Russian and Chinese students. One hundred and two Russian and Chinese students took part in the study. The following techniques were used: 1) "Proactive behaviour" Methodology by A.I. Yerzin; 2) "Questionnaire of economic activity" by E.V. Zabelina and Yu.V. Chestyunina; 3) "Questionnaire of subjective economic well-being" by V.A. Khashchenko; 4) "Monetary attitudes" Questionnaire by B. Klonts and T. Klonts adapted by D.A. Bayazitova and T.A. Lapshova. Mathematical analysis methods: Mann-Whitney U-test and Spearman's rank correlation coefficient. The results showed that the indicators of proactive behaviour demonstrated by the Russian students were higher than those demonstrated by Chinese students. The cognitive economic activity indicators were higher among the Chinese students. The Chinese students appeared to be more vigilant and careful with finances. The Russian students showed better results in experiencing a lack of financial resources. The specificity of economic behavior in Russian students is manifested through internal behavioral determination and constructive proactivity. Chinese students demonstrate cognitive economic activity and responsibility in relation to money. Based on the acquired results, the paper presents recommendations for the Russian and Chinese students' economic behaviour development and correction.

Keywords: *proactive behaviour, economic activity, attitude to money, Russian and Chinese students.*

Introduction

The problem of studying economic behavior is one of the pressing problems of the last decade. Foreign researchers study economic behaviour through psychology of debt behaviour (S. E. Lea, P. Webley & C. M. Walker, etc.), saving behaviour (B.W. Roberts, J.B. Hirsh), consumer behaviour (J. Akerlof and R. Shiller, J. Keynes), etc. (Pozdnyakov, Zhuravlev, 2017; Gorchakova, 2021)

Russian scientists of the Moscow scientific school (A.L. Zhuravlev, V.P. Poznyakov, A.B. Kupreichenko, T.V. Drobysheva, V.A. Khashchenko, N.A. Zhuravleva) paid attention mainly to the study of economic consciousness. According to N.A. Zhuravleva, the system of values of a modern person is connected with the attitude towards money (Zhuravleva, 2023).

Scientists from the St. Petersburg School of Psychology of Economic Behavior (D.A. Bayazitova, T.A. Lapshova, O.S. Deyneka, E.V. Zabelina, etc.) research in various social groups, studying attitudes toward money against the background of value systems of representatives of different generations (Deineka, 2004; Saltykova, Deyneka, 2022).

Analysing the main directions of research within the domestic economic psychology framework in A.L. Zhuravlev's scientific school, it can be concluded that significant results have been achieved in

*Corresponding author: olga00241@yandex.ru

studies of economic consciousness, economic values, economic identity, socialization, as well as of entrepreneurial activity. Nevertheless, noting the variety of research directions of Russian scientists, A.L. Zhuravlev and A.B. Kupreichenko pointed out the complex interrelation of economic consciousness and economic behaviour that exist inseparably from each other (Zhuravlev, Kupreichenko, 2009).

Over the past few years, there has been increased interest in the proactivity phenomenon in psychological science. As one of the fundamental personal characteristics, on the one hand, and as a complex model of behaviour, on the other, proactivity has a significant impact on the effective personality functioning in the modern world, ensuring not only their response to external stimuli, but also the manifestation of initiative in shaping one's own future (Yerzin, 2012; Yerzin, 2014; Li, Fay, Frese, Harms and Gao, 2014; Zhang, Lu and Li, 2018; Lin, Lu, Chen and Wu, 2022; Teye-Kwadjo and de Bruin, 2022).

A number of works by foreign researchers, such as Bateman, T.S. (1993), Crant, J.M. (2000), Frese, M. and Fay, D. (2001), Parker, S.K. and Collins, C.G. (2010), have been devoted to the study of the projectivity phenomenon (Luo, Huang and Gao, 2022).

Considering the degree of proactivity concept elaboration in foreign psychological science, we can talk about a fairly large number of scientific studies on this topic (Thompson, 2005; Luo, Huang and Gao, 2022). In general, foreign authors apply several approaches to the study of productivity. Thus, proactivity was considered: 1) from the standpoint of the concept of individual differences (Bateman and Crant, 1993); 2) within the framework of behavioural approach (Frese, Kring, Soose and Zempel, 1996; Parker, Williams and Turner, 2006); 3) within the framework of the concept of achieving the goal, which foreign psychological scientists began to develop relatively recently (Fay and Frese, 2001; Grant and Ashford, 2008; Bindl, Parker, Totterdell and Hagger-Johnson, 2012).

Based on the colleagues' methodological developments, Russian authors, such as E.S. Starchenkova (2012) considered proactivity as a coping strategy that allows managing stressful situations. A.I. Yerzin made a significant contribution to the development of the proactivity concept in Russian literature, highlighting its structure, as well as its manifestation characteristics (Yerzin and Yepanchintseva, 2016). Nevertheless, despite a sufficient number of methodological developments of the proactivity concept, the peculiarities of its manifestation remain unexplored both in different social groups and in different cultures' representatives (Yuspahruddin, Abbas, Pahala, Eliyana and Yazid, 2024).

Relatively recently, economic activity provoked interest in psychological research. Although this concept is found quite rarely in the foreign authors' works, within the framework of Russian psychology it was developed by Zhuravlev A.L., and Poznyakov V.P. (2004), Zhuravlev A.L. and Kupreichenko A.B (2009), Korosteleva T.V. and Kurdyukova N.A. (2009), Romanova N.V. (2009), Zabelina E.V. and Chestyunina Yu. V., (2020). Nevertheless, there is a lack of scientific papers devoted to the study of economic activity characteristics among representatives of various social groups and cultures. Despite the fact that a few studies have revealed the level of economic activity among young students (Zabelina, Deyneka and Yagnakova, 2020; Zabelina and Chestyunina, 2020), its characteristics and its correlation with other phenomena remain unexplored.

Speaking about the need to study the characteristics of economic activity in various social groups, it can be noted that the study of students' economic activity is particularly relevant. Students are the future social capital of society and determine its economic behavior in the future (Mikhailova, 2015; Stošić, 2017; You, 2019; Kudinov, Mikhailova, Kudinov and Farennikova, 2023). At the same time, the students' economic activity, manifested in their interaction with economic objects, is one of the factors determining their financial well-being, in particular, and their implementation in the professional and economic sphere, in general (Zabelina and Chestyunina, 2020).

Thus, the study of Russian and foreign students' proactive behaviour and economic activity will reveal the cultural characteristics of these phenomena manifestation, which determined the purpose of our study.

Materials and Methods

The study sample consisted of 102 Russian and Chinese students aged 20 to 26 years: 51 Russian and 51 Chinese students of the 3rd – 4th year, Bachelor program and 1st – 2nd year, Master course of the Philological Department at the Patrice Lumumba Peoples' Friendship University of Russia.

The empirical data were obtained using the following techniques: 1) "Proactive behaviour" method

by A.I. Yerzin (Yerzin, Antokhin, 2015); 2) The questionnaire on economic activity by E.V. Zabelina and Yu.V. Chestyunina (Zabelina, Chestyunina, 2020); 3) The questionnaire on subjective economic well-being by V.A. Khashchenko (Khashchenko, 2011); 4) "Monetary attitudes" questionnaire by B. Klonts and T. Klonts adapted by D.A. Bayazitova, T.A. Lapshova (Bayazitova, Lapshova, 2017). All the techniques presented to the Chinese students were translated into Chinese using the double-blind translation method with the participation of native Chinese speakers.

The empirical data obtained during the above methods application were processed using the Mann-Whitney U-test and Spearman's rank correlation coefficient.

Results and Discussions

The results of the data study, by A.I. Yerzin's "Proactive behaviour" method, based on average values, using the Mann-Whitney U-test, showed significant differences between Russian and Chinese students on the following scales: *forecasting certain behaviour consequences; internal locus of control; spontaneity; general index of proactivity; constructive proactivity* (Table 1).

Table 1. *The results of the analysis of differences in the level of proactive behaviour indicators among the Russian and the Chinese students (n = 102)*

Methodics scale	Average value (Russian students)	Average value (Chinese students)	**Mann-Whitney U-test**	**p-level**
Awareness of one's actions	31.4	30.4	1112.5	0.207
Predicting certain behaviour consequences	28.8	27.1	954	**0.020***
Internal locus of control	33.7	29.4	622	**0.000****
Spontaneity	29.6	26.0	715.5	**0.000****
Autonomy in decision-making	30.9	30.7	1242.5	0.697
Meta-motivation	31.4	29.8	1024	0.063
Internal determination of behavior	29.6	29.6	1265	0.812
Productivity index	215.4	203.1	857.5	**0.003****
Constructive proactivity	27.9	25.9	969.5	**0.026***
Destructive proactivity	20.9	22.2	1158.5	0.341

Note: * - significance level p < .05; ** - significance level p < .01

The differences obtained on all the scales are higher among the Russian students. Such results can be explained by the fact that it is quite difficult for international students to show predictable behaviour and prepare in advance for difficult situations in a new cultural environment.

The indicator of proactive behaviour on the scale of *forecasting the certain behaviour consequences* among the Russian students is significantly higher because it is more difficult for Chinese students to predict the possible situation development, since in the Chinese culture context these situations might develop by another scenario, different from the Russian reality.

Proactive behaviour indicators on the scales of *internal locus of control* and *spontaneity* among Chinese students are lower again influenced by foreign cultural environment. This is manifested in the fact that these students more often limit their needs and interests, focusing primarily on situational factors.

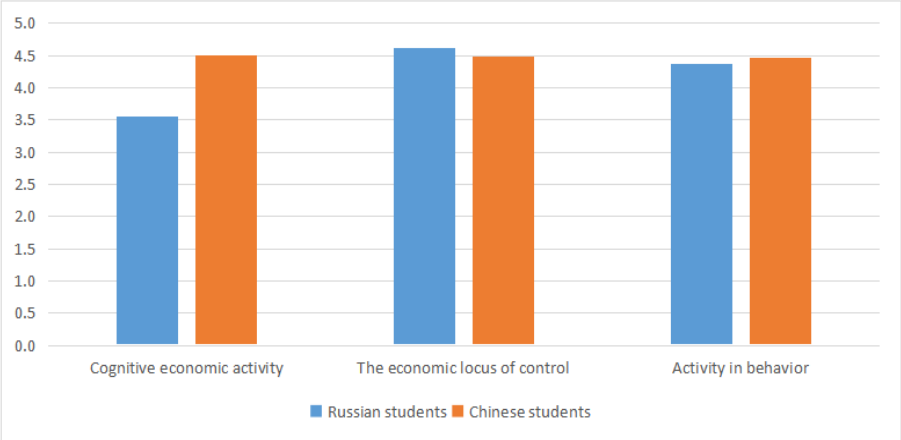
Accordingly, Chinese students demonstrated lower *constructive proactivity* because they are less focused on constructive interaction, since there are psychological and communicative barriers in communication.

Thus, the Russian students' overall level of productivity is significantly higher than that of the Chinese students and this is due to the fact that the Russian students are in their native cultural and linguistic environment. The Russian students, to a greater extent than the Chinese students, tend to act consciously under certain circumstances, and also prefer to influence difficult situations rather than adapt to them. In addition, the lower level of the Chinese students' proactivity may be related to the peculiarities of the Chinese mentality. For example, the Chinese students are more focused on following rules and regula-

tions which may limit their proactive behaviour.

However, a comparative analysis of the average values using the "Economic Activity Questionnaire" method by E.V. Zabelina and Yu.V. Chestyunina showed that the results on the *cognitive economic activity* scale among the Chinese students are significantly higher than those among the Russian ones (Figure 1).

Figure 1. Average values of economic activity indicators for the Russian and Chinese students (n = 102)



The results of a comparative analysis using the Mann-Whitney U-test also showed significant differences in the scale of *cognitive economic activity* between the Russian and Chinese students (Table 2).

Table 2. *Indicators of significant differences in economic activity characteristics among the Russian and Chinese students (n = 102)*

Methodics scale	Average value (Russian students)	Average value (Chinese students)	Mann-Whitney U-test	p-level
Cognitive economic activity	3.6	4.5	751	**0.000****
Economic locus of control	4.6	4.5	1224.5	0.610
Enthusiasm	4.4	4.5	1290	0.944

Note: * - significance level p < .05; ** - significance level p < .01

The Chinese students, to a greater extent than the Russian students, are active in searching for information related to the economic sphere. Probably, Chinese culture representatives are more involved in the economic and financial systems, being more enterprising by personal characteristics than the Russian students. In addition, they have to think more carefully about the specifics in the economic situation in a foreign cultural environment, to consider and to control their economic activity on the unknown territory.

The results of the average values on the scales of *economic locus of control* and *enthusiasm* showed no significant differences in both groups of respondents (Table 2). Still, according to the average values, the *economic locus of control* indicators among Russian students were slightly higher (Figure 1). Of course, these results are related to the fact that it is much easier for Russian students to exercise economic control in the conditions of their native country's economy.

The results of the analysis of significant differences by means of the Mann-Whitney U-test by V.A. Khashchenko's "Questionnaire of Subjective Economic Well-being" are presented in Table 3.

Table 3. *The results of the analysis of differences in the level of subjective economic well-being among the Russian and Chinese students (n = 102)*

Methodics scale	Average value (Russian students)	Average value (Chinese students)	Mann-Whitney U-test	p-level
Index of economic optimism and confidence	20.1	20.5	1165	0.361
Financial Deprivation Index	14.3	15.9	877.5	**0.004****
Index of current family well-being	12.7	11.8	1024.5	0.062
Index of subjective adequate correlation of income to the individual needs and demands	13.7	13.9	1269	0.831
Index of Economic Anxiety	21.4	19.7	1117.5	0.220
Integral (general) index	82.1	81.8	1268.5	0.830
Index of economic optimism and confidence	20.1	20.5	1165	0.361

Note: * - significance level p < .05; ** - significance level p < .01

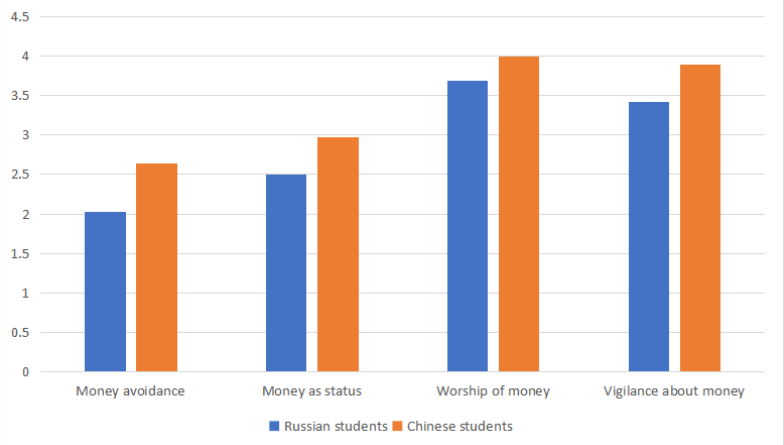
According to the results of the comparative analysis, significant differences on the *financial deprivation* scale were revealed. The values on this scale for Chinese students are close to high, while for Russian students they stay at an average level. Since the indicators of the *financial deprivation* scale have the opposite value, in this case, the Russian students are experiencing a lack of financial resources to a greater extent than the Chinese students. The Chinese students tend to assess their level of material prosperity as close to high. Perhaps, the Chinese students feel more financially secure in Russia than the Russian students. In Chinese families, parents often provide full tuition and accommodation for their children studying abroad.

Both the Russian and the Chinese students demonstrate a close to high level of expression of such subjective economic well-being indicators as *economic optimism* and *confidence*, and there are no significant differences in this indicator manifestation in the both groups of respondents (Table 3). This is reflected in the fact that the Russian and the Chinese students have a sufficiently positive assessment of the conditions, necessary for their financial well-being growth.

The Russian and Chinese students tend to assume that, in the near future, the material standard of their lives, as well as in their families' lives, will increase rather than decrease, or at least remain the same. Moreover, the both groups of students assess both current and future economic conditions in their country as relatively favourable for improving their financial well-being.

Based on the analysis of the average values obtained using the "Monetary Attitudes" methodology by B. Klonts and T. Klonts, all the methodology scales revealed differences between the Russian and the Chinese students (Figure 2).

Figure 2. The average indicators values by the "Monetary Attitudes" methodology (B. Klonts and T. Klonts) among Russian and Chinese students (n = 102)



The analysis of the differences' significance using the Mann-Whitney U-test revealed significant differences in the level of indicators of attitude to money (Table 4).

Table 4. *The results of the analysis of differences in indicators of attitude to money among the Russian and Chinese students (n = 102)*

Methodics scale	Average value (Russian students)	Average value (Chinese students)	Mann-Whitney U-test	p-level
Money avoidance	2.03	2.64	716.5	0.000**
Money as status	2.50	2.97	906.5	0.008**
The worship of money	3.68	4.00	1017.5	0.058
Vigilance about money	3.42	3.90	885	0.005**

Note: * - significance level p < .05; ** - significance level p < .01

The indicators on the *money avoidance* scale are more pronounced among the Chinese students than among the Russian ones. The Chinese students are more likely to avoid money-related issues, which may be due to social desirability and the inherent focus on economy typical of Chinese culture representatives (Table 4).

The obtained differences allow us to assume that financial status and socio-economic status are more important for the value system of Chinese students. In Chinese culture, the assessment of a person's status is quite high. Kmiv students are more vigilant in using money. This is explained by their caution in using money in Russia.

The specifics of the Russian students' economic behaviour are expressed in the multiplicity of significant correlations between the *cognitive economic activity* scale and the scales of *awareness of one's actions, forecasting certain behaviour consequences, internal determination of behaviour, constructive proactivity* and *general index of proactivity* (Table 5).

Table 5. *The results of correlation analysis on the "Proactive Behaviour" test, "Economic Activity Questionnaire", "Subjective Economic Well-being Questionnaire" and "Monetary Attitudes Questionnaire" in the group of Russian students (n = 51)*

Methodics scale	Awareness of one's activities	Forecasting certain behaviour consequences	Inner control locus	Spontaneity	Autonomy in decision-making	Meta-motivation	Inner behaviour determination	Constructive proactivity	Destructive proactivity	General index of proactivity
Cognitive economic activity	**.327***	**.306***	.149	.224	.198	.244	**.351***	**.340***	.262	**.400****
Economic locus of control	.165	.09	**.398****	-.008	**.320***	.08	.115	.232	.007	.202
Enthusiasm	.058	.115	.056	.224	**.412****	**.306***	.184	**.300***	**.293***	.117
Index of economic optimism and confidence	.273	.147	.25	.253	.176	.103	**.392****	**.292***	.035	**.401****
Index of Financial Deprivation	.122	.09	.012	.083	.126	.192	**.290***	.193	.191	.067
Integral (general) index of subjective economic well-being	.256	.089	.167	.069	.107	.122	**.352***	.211	.138	.252

Note: * - significance level p < .05; ** - significance level p < .01

Much of the Russian students' economic behaviour can be explained by the internal behaviour determination as evidenced by the significant intercorrelations of the *internal behaviour determination*

scales, *economic optimism* and *confidence* index, *financial deprivation* index and the *integral index of subjective economic well-being*.

The specificity of the Russian students' enthusiasm is expressed by significant connection with such indicators as *autonomy in decision-making, meta-motivation, constructive proactivity* and *destructive proactivity*. The correlation of *economic optimism and confidence* index with the scales of *internal behaviour determination*, *constructive proactivity*, and *the general index of proactivity* characterize the Russian students as a group whose economic behaviour is associated with internal psychological conditions conducive to constructive activity and a general active and responsible position independent of external circumstances.

It should be noted that in the group of Russian students, there were no correlations between the "Monetary attitudes" scales by B. Klonts and T. Klonts with the scales of other methods.

Unlike the group of Russian students, the indicators of the Chinese students' economic behaviour specifics have their own pronounced interrelations (Table 6).

Table 6. *The results of correlation analysis on the "Proactive Behaviour" test, "Economic Activity Questionnaire", "Subjective Economic Well-being Questionnaire" and "Monetary Attitudes Questionnaire" in the group of Chinese students (n = 51)*

Methodics scale	Awareness of one's actions	Forecasting of certain behaviour consequences	Internal control locus	Spontaneity	Autonomy in decision-making	Meta-motivation	BInternal behaviour determination	Constructive proactivity	Destructive proactivity	General index of proactivity
Cognitive economic activity	**.336***	**.312***	.176	**.444****	**.286***	**.535****	**.484****	**.517****	**.406****	**.280***
Economic locus of control	**.325***	**.300***	**.383****	.099	.079	.160	**.319***	**.317***	.240	**.310***
Enthusiasm	**.353***	**.389****	**.295***	**.503****	**.515****	**.444****	**.628****	**.628****	**.351***	**.428****
Integral (general) index of subjective economic well-being	.184	.125	**.326***	**.321***	.269	**.302***	.124	**.359****	.189	.150
Money Avoidance	.095	**.386****	.198	.069	-.050	-.017	.254	.221	-.060	**.515****
Money as status	.139	**.451****	.262	.225	-.049	.067	**.297***	.259	-.027	**.503****
The worship of money	.089	**.384****	.202	**.367****	.076	.223	.220	.176	.031	**.277***
Vigilance about money	.255	.256	**.385****	.011	.122	.000	.275	.162	.061	.101

Note: * - significance level p < .05; ** - significance level p

The results illustrated in Table 6 show that in the group of Chinese students, the correlation of the *cognitive economic activity* scale with the scales of other methods are much more pronounced. The connections of the *cognitive economic activity* scale with such scales as *spontaneity, meta-motivation, internal determination of behaviour, constructive proactivity, destructive proactivity* are especially obvious.

The general index of Chinese students' proactivity, as well as that of Russian students, correlates with the scale of *cognitive economic activity*. This is reflected in the fact that Russian and Chinese students tend to actively influence circumstances and strive to improve their knowledge in the economic field. The correlation analysis shows that the Chinese students' results are a lot correlated in the *economic locus of control* scale with other scales of methods (*awareness of one's actions, forecasting certain behaviour consequences, internal locus of control, internal determination of behaviour, constructive proactivity*) (Table 6).

The Chinese students' economic activity expressed by the *enthusiasm* scale demonstrated a much greater number of correlations with the scales of other methods. The results obtained allow us to assert that the Chinese students' economic behaviour specifics are expressed more actively than that of Russian students in terms of the economic locus of control, enthusiasm and attitude to money.

Interesting results were obtained in the group of Chinese students on the correlation of scales in

the "Monetary Attitudes" methodology by B. Klonts and T. Klonts with scales of other methods. Significant correlations of *money avoidance* scales and *money as status* with *forecasting certain behaviour consequences* scales and *general index of proactivity* were found. Chinese students are more conscious and responsible about money. In addition, in the group of Chinese students, significant correlations were found between the scale of *money worship* and the *forecasting certain behaviour consequences* and *spontaneity* scales, which indicates inconsistency in their attitude to money in proactive behaviour indicators. The results obtained suggest that Chinese students' indicators of economic behaviour are more significantly expressed by cognitive economic activity, economic locus of control and enthusiasm, compared with the Russian students. The Chinese students are much more clearly demonstrating their attitude towards money in terms of proactive behaviour and economic activity.

Probably, predicting various scenarios in the monetary sphere, the Chinese students strive for saving and avoid discussing financial issues that could potentially harm them, as well as choose those models of financial behaviour that could ensure their financial success.

Conclusion

Summarizing the results of the study, we can note that despite the lower rates of proactive behaviour among the Chinese students, they are prone to cognitive analysis and choose a behaviour model that will allow them to achieve the desired result. This may be due to the fact that it is more difficult for Chinese students to predict future events since they study abroad.

Among Chinese students, it is more common to believe that some situations in one way or another depend not only on their actions and behaviour. The Chinese students are less focused on interacting with others than the Russian students. These differences may be due to the Chinese students' life specifics in a different culture.

Despite their more pronounced proactive behaviour, Russian students are less likely to analyse their economic activity than Chinese students. Despite worries about financial well-being, the Russian students show less activity aimed at economic awareness and a more rational attitude towards money. The Russian students are probably less involved in the economic and financial systems.

Based on the results obtained in our study, we can offer the following recommendations for the students' economic behaviour development and correction:

1. Conducting psychological work to increase the level of proactive behaviour in Chinese students studying in Russia. This can be implemented within the framework of measures for the Chinese students' adaptation in Russian educational institutions, their international communication and economic literacy development.

2. Increasing the Chinese students' constructive proactivity level within the framework of students' professional associations, as well as through the inclusion of Chinese students in various extracurricular activities aimed at both communication and expanding their knowledge about Russian culture.

3. Development of the cognitive economic activity level, financial literacy and entrepreneurship among Russian students. To this end, it is possible to hold educational events where students learn about the importance of studying the economic sphere for everyday life and for their personal success. It would be reasonable to organize various lectures and seminars where students can learn about current issues in the economic sphere and get practical recommendations for managing personal economic well-being.

4. Psychological services at the universities need to monitor possible problems that students face in the economic sphere when trying to improve their financial situation, as well as to provide students with psychological assistance in resolving these problems both in groups and via personal consultations.

Author Contributions

Conceptualization, Mikhailova O.B. and Farennikova E.S.; methodology, Mikhailova O.B. and Farennikova E.S.; formal analysis, Mikhailova O.B. and Farennikova E.S.; writing—original draft preparation, Mikhailova O.B. and Farennikova E.S.; writing—review and editing, Mikhailova O.B. and Farennikova E.S. All authors have read and agreed to the published version of the manuscript.

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Conflict of interests

The authors declare no conflict of interest.

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The Implementation of Environmental Topics in the First Cycle of Primary Education from the Teachers' Perspective

Ana D. Spasić Stošić[1*], *Ivana D. Tasić Mitić*[1], *Aleksandar M. Stojadinović*[1], *Tatjana B. Milosavljević Đukić*[1]

[1]University of Niš, Pedagogical Faculty, Vranje, Serbia
e-mail: anastosic974@gmail.com; ivana.tasic82@yahoo.com; stojadinovicaleksandar@gmail.com; tatjanamdj74@gmail.com

Abstract: This paper presents the findings of a study aimed at exploring teachers' perspectives on environmental education for students in the first to fourth grades of primary school. The issue of environmental education for primary school students has gained significant attention in recent decades and is now seen as an educational necessity. The study's objectives focus on understanding teachers' views on the importance of teaching environmental topics in the first cycle of primary education and evaluating the school's ability to support such teaching. The research was conducted through a survey involving 455 teachers from thirty-five primary schools across eight cities in the Republic of Serbia, using a questionnaire designed specifically for this study. The questionnaire featured a series of questions and rating scales based on a five-point Likert scale. Although there are some differences in respondents' opinions based on factors such as work experience, school location, and the number of environmental seminars attended, the data suggest that teachers generally have positive views on the importance of including environmental topics in the first cycle of primary education. They also express favorable opinions about the conditions necessary to achieve the goals of environmental education in their schools. Teachers recognize the importance of studying environmental topics, not only for gaining knowledge, skills, and experiences but also for fostering students' environmental awareness. The capacity of schools to support environmental education is most strongly influenced by extracurricular activities and various educational programs. This research highlights the crucial role of primary schools in meeting the goals of environmental education and lays the groundwork for further studies in this area, particularly focusing on teachers' professional development and the acquisition of environmental competencies.

Keywords: *environmental education, environmental topics, environmental awareness, teacher, student*

Introduction

Environmental education is a crucial activity focused on fostering and developing environmental awareness in all individuals. A strong sense of environmental awareness is the foundation for cultivating a responsible attitude toward oneself and the environment, establishing effective systems for environmental protection and improvement, and adhering to the principles of sustainable living. The growing environmental crisis, ongoing ecological challenges, and the rapid advancement of scientific discoveries, digital technologies, and new forms of literacy-including environmental literacy-have led to the recognition that environmental education is now a key component of the general culture and education of modern individuals.

Given these developments, environmental education at all levels of education, from preschool to university, is becoming increasingly important within contemporary educational systems. It contributes to understanding the fundamental principles of sustainable development, fostering students' environmental awareness, and preparing them to actively engage in environmental preservation (Stanišić, 2009; Erdogan and Ok, 2011; Chawla and Derr, 2012; Stevenson et al., 2013; Boeve-de Pauw et al., 2015; Ardoin et al., 2018; Boca and Saraçlı, 2019; Rohayati, Safrina, and Purwanto, 2021; Stanišić, 2021; Marušić, Stanišić and Savić, 2022; Cincera, Kroufek, and Bogner, 2023; Stanišić, Maksić, and Nenadić, 2023; Suralin, 2023).

*Corresponding author: anastosic974@gmail.com

It is important to highlight that early exposure to environmental topics helps shape a responsible attitude toward nature in children, which can later translate into environmentally responsible behaviors (Brun, 2001; Kundačina, 2010; Erdogan and Ok, 2011; Chawla and Derr, 2012; Ardoin and Bowers, 2020).

Hardly any significant international gathering dedicated to the protection and improvement of the human environment fails to emphasize the crucial role of environmental education. The issues related to global environmental threats, the measures undertaken on this front in various countries, and recommendations from numerous global, international, and regional scientific and professional gatherings have all contributed to the adoption of appropriate measures for environmental protection in the Republic of Serbia as well. A number of these measures pertain to education and the need to adapt the teaching process at all levels to align with the goals and objectives of environmental protection. There is a particular emphasis on the necessity of creating curricula that will enable preschools and schools to educate students on protecting and enhancing their immediate environment. This is especially relevant for primary school-aged students, who are in a period of rapid development, when they shape their needs, interests, habits, and values (Mitić and Stanojević, 2014).

Primary schools play a crucial role in the development of students' environmental awareness and culture. Through its entire environment, including components such as the teaching process, curricula, key participants in education, curricular and extracurricular activities, classrooms as learning spaces, didactic materials, textbooks, and the school's cultural activities, it significantly contributes to environmental education (Kundačina, 2010).

In the Republic of Serbia, the first cycle of primary education does not have a separate subject dedicated solely to environmental topics. Instead, these topics are integrated into two mandatory subjects. In grades 1 and 2, environmental content is covered within *The World Around Us*, while in grades 3 and 4, *Nature and Society* addresses these themes (Spasić Stošić, 2017; Stanišić, Maksić and Nenadić, 2023). These core subjects lay the foundation for developing natural science competencies, which are essential for understanding the many complex phenomena, processes, principles, and laws found in nature and society. They also provide the groundwork for achieving the objectives of environmental education, helping students acquire knowledge, values, attitudes, and pro-environmental behaviors. In grades 1 and 2, *The World Around Us* covers environmental topics as part of lessons on the diversity of nature, human activities, health and safety, and social rules (Curriculum for the Second Grade of Primary Education, 2018). In grades 3 and 4, *Nature and Society* builds upon and expands the previous topics, introducing new subjects such as the physical and chemical properties of materials, living and non-living nature, natural phenomena, recycling, sustainable consumption, and the relationship between humans and the environment (Curriculum for the Third Grade of Primary Education, 2019; Curriculum for the Fourth Grade of Primary Education, 2019).

To achieve the objectives of environmental education, schools not only cover environmental topics in mandatory subjects but also organize extracurricular and out-of-school activities aimed at fostering students' ecological awareness and culture (Regulation on the Plan of Teaching and Learning for the First Cycle of Primary Education and the Curriculum for the First Grade of Primary Education, 2017). Teachers and students engage in a wide range of such activities, including commemorating important environmental dates, cleaning the school building and grounds, planting trees and flowers, organizing local environmental clean-up and beautification projects, collecting materials for recycling, monitoring water and air pollution in the local community, setting up environmental exhibitions of artwork, posters, and photos, hosting lectures, quizzes, and competitions, and participating in contests organized by various environmental protection organizations, among others. These activities are particularly valuable as they encourage the voluntary and self-aware participation of students in extracurricular endeavors based on their interests, fostering cooperation, socialization, competition, and communal life.

It is important to note that instruction that integrates environmental topics helps develop essential skills in students, such as critical thinking, problem-solving, and decision-making—skills crucial for addressing the complex challenges of today (Jukić, 2011; Ardoin et al., 2018; Maksić, 2021). Furthermore, studies indicate that students who undergo an education system focused on environmental education tend to form positive attitudes and values toward nature, contributing to the development of generations ready to take concrete actions to protect the environment (Manoli, Johnson, and Dunlap, 2007; Stanišić, 2009).

However, despite the importance of environmental education, its implementation in schools is influ-

enced by various factors, such as available resources, teaching materials, and teacher training. Research has shown that disparities in the effectiveness of environmental education arise based on the availability of resources in schools and the level of support provided to educators by the community and educational institutions (Ballantyne and Packer, 2009; Stevenson et al., 2013). For instance, schools that successfully incorporate environmental topics into their curriculum often benefit from teacher seminars and training, which allow them to implement these educational programs more effectively (Rickinson, 2001; Boeve-de Pauw and Van Petegem, 2011; Suralin, 2023).

Experiential learning, school projects, and environmental conservation initiatives have proven to be key contributors to enhancing students' environmental awareness and fostering pro-environmental behavior, thereby helping achieve the primary goals of environmental education (Ballantyne and Packer, 2009). These activities not only complement the school curriculum but also foster a sense of responsibility and community engagement, both of which are crucial for the preservation of natural resources. Both theoretical and practical approaches emphasize the importance of an interdisciplinary teaching method, integrating environmental topics with subjects like science, social studies, and art, which helps students develop a comprehensive understanding of environmental issues (Stevenson et al., 2013; Stanišić, Maksić and Nenadić, 2023; Suralin, 2023). This approach allows students to explore the roles of individuals and society in environmental protection from different angles, contributing to their overall development.

Considering the vital role of primary schools in shaping students' environmental awareness and culture, a study was conducted to assess the importance of teaching environmental topics in primary schools in Serbia and to evaluate the current conditions influencing their implementation.

Materials and Methods

The goal of the research was to explore teachers' perspectives on environmental education for students in grades 1 through 4 of primary school, recognizing its role as a crucial component of institutional education and an essential part of modern cultural and educational development. The research focused on assessing teachers' views regarding the significance of environmental topics in the first cycle of primary education, evaluating the conditions for achieving the objectives of environmental education at their schools, and identifying differences in teachers' opinions based on factors such as teaching experience, school location, and the number of professional seminars attended related to environmental education.

The research sample was drawn from primary school teachers across eight cities in Serbia that host teacher education faculties or departments: Vranje, Kosovska Mitrovica, Jagodina, Užice, Belgrade, Sombor, Novi Pazar, and Negotin. A total of 455 teachers from thirty-five primary schools participated in the study. The sample was representative of the research's scope, characteristics, and conditions. Of the respondents, 87.3% were female, and 12.7% were male. The largest group of teachers had between 21 and 30 years of work experience (151 or 33.2%). A smaller group had 11 to 20 years of experience (111 or 24.4%), while a similar number had over 30 years (100 or 22.0%) or fewer than 10 years of experience (93 or 20.4%). In terms of educational qualifications, 258 (56.7%) teachers had a higher education degree, 94 (20.7%) held a vocational degree, 95 (20.9%) had a master's degree, and 8 (1.8%) held a postgraduate master's degree. Regarding the location of the schools, 341 (74.9%) teachers were from urban areas, 65 (14.3%) from rural areas, and 49 (10.8%) from suburban areas. Concerning environmental training, 404 (88.8%) teachers reported having never attended an ecology seminar, which highlights a significant gap in professional development. Only 46 (10.1%) teachers had attended one seminar, 3 (0.7%) had attended two, and 2 (0.4%) had attended three seminars focused on ecological topics.

The research utilized theoretical analysis and the descriptive scientific research method, specifically the survey approach. A custom-designed questionnaire was employed to gather teachers' opinions, consisting of several questions and rating scales structured on a five-point Likert scale. The reliability and internal consistency of the questionnaire were verified using the Cronbach's Alpha coefficient, which was found to be 0.880 (Cronbach's Alpha = 0.880). To analyze the influences, relationships, and differences within the data, appropriate statistical methods were applied: frequencies (f), percentages (%), mean (M), standard deviation (SD), minimum and maximum values, analysis of variance (F), and one-way analysis of variance (ANOVA). Statistical significance was set at the probability level of $p \leq 0.05$ to $p \leq 0.01$, with data analysis conducted using the SPSS statistical program, version 25.

Results

The first research task aimed to determine teachers' opinions on the importance of studying environmental topics in the first cycle of primary education. Respondents were asked to indicate their level of agreement with statements regarding the significance of environmental education topics using a five-point Likert scale. It was hypothesized that teachers would express positive views on the importance of topics that support environmental protection goals. The results, presented in Table 1, show that teachers generally view the significance of studying environmental topics in the first cycle of primary education positively. The mean values (M) suggest strong agreement with the importance of these topics. Items such as "Studying environmental topics in the first cycle of primary education significantly contributes to the development of students' environmental awareness" (M = 4.54) and "By implementing topics about environmental threats and ways to protect it, younger students acquire knowledge, skills, values, experiences, and motivation to address current and future ecological issues" (M = 4.40) received high ratings. The lowest mean values in the first scale were for items 1 (M = 4.19) and 2 (M = 4.30), which still reflect very high ratings.

Table 1. Teachers' opinions on the importance of studying environmental topics

Statements on the importance of studying environmental topics in the first cycle of primary education	N	Min	Max	M	SD
1. The decisive period for environmental education is from the 1st to the 4th grade of primary school.	455	1	5	4.19	.860
2. Introducing students to the impact of humans on the environment in various forms and scopes, and understanding the contemporary trends and possibilities of science and technology for comprehensive environmental protection and improvement can be achieved through studying environmental topics.	455	2	5	4.30	.665
3. By teaching about topics focusing on environmental threats and the possibilities for its protection, younger students acquire knowledge, skills, values, experience, and determination to solve current and future environmental problems.	455	2	5	4.40	.692
4. Studying environmental topics in the first cycle of primary education significantly contributes to the development of students' environmental awareness.	455	2	5	**4.54**	.652

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation

A one-way analysis of variance (ANOVA) was conducted to examine the relationship between the independent variables—work experience, the environment in which the school is located, and the number of environmental seminars attended—and teachers' opinions on the importance of studying environmental topics in the first cycle of primary education.

When exploring the connection between work experience and teachers' views on the importance of environmental topics for grades 1 through 4, it was found that the F test values did not show statistical significance. The data in Table 2 reveal that teachers with varying levels of work experience do not significantly differ in their opinions, as indicated by the mean values ranging from M=4.19 to M=4.54. These results suggest that teachers, regardless of their years of experience, share a strong agreement on the importance of studying topics that support the goals of environmental education. Therefore, it can be concluded that, in relation to work experience, teachers assess the significance of studying environmental topics in primary education similarly.

Table 2. Teachers' opinions on the significance of studying environmental topics in the first cycle of primary education (variable: work experience)

Statements on the importance of studying environmental topics in the first cycle of primary education		N	M	SD	Min	Max	F	p
The critical period for environmental education is the period from the 1st to the 4th grade of primary school.	1-10 years	93	4.16	0.784	1	5		
	11-20 years	111	4.20	0.807	2	5		
	21-30 years.	151	4.17	0.907	1	5		
	> 30 years	100	4.23	0.920	1	5		
	Total	455	**4.19**	0.860	1	5	0.131	0.942
Introducing students to human impact on the environment in various forms and scopes, understanding contemporary trends and the possibilities of science and technology for comprehensive environmental protection and improvement, can be achieved through the study of environmental topics.	1-10 years	93	4.25	0.686	3	5		
	11-20 years	111	4.38	0.589	3	5		
	21-30 years	151	4.23	0.704	2	5		
	> 30 years	100	4.36	0.659	2	5		
	Total	455	**4.30**	0.665	2	5	1.619	0.184
By implementing topics on environmental threats and the possibilities for its protection, younger students gain knowledge, skills, values, experience, and determination to solve current and future environmental problems.	1-10 years	93	4.30	0.763	2	5		
	11-20 years	111	4.46	0.658	2	5		
	21-30 years	151	4.40	0.684	2	5		
	> 30 years	100	4.43	0.671	2	5		
	Total	455	**4.40**	0.692	2	5	0.971	0.406
Studying environmental topics in the first cycle of primary education significantly contributes to the development of students' environmental awareness.	1-10 years	93	4.38	0.658	3	5		
	11-20 years	111	4.58	0.626	3	5		
	21-30 years	151	4.60	0.655	2	5		
	> 30 years	100	4.56	0.656	2	5		
	Total	455	**4.54**	0.652	2	5	2.495	0.059

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation; F-F test; p–significance

Table 3 presents the relationship between teachers' opinions on the importance of studying environmental topics in the first cycle of primary education and the location of the school. The analysis of variance (F test values) reveals no statistical significance related to this variable, meaning that teachers' opinions on the importance of studying environmental topics are similar regardless of the school's location. Notably, teachers from rural areas provide the most positive evaluations regarding the study of environmental topics. Specifically, teachers in rural areas place greater emphasis on the period from grades 1 to 4 as crucial for achieving the goals of environmental education, with mean values of M=4.42. They also believe that teaching topics on environmental threats not only imparts knowledge, values, experience, and determination to address environmental problems (M=4.43) but also has a more significant impact on the development of students' environmental awareness (M=4.60) compared to their urban and suburban counterparts. The mean values above M=4.00 in all three categories indicate very positive views among teachers on the importance of environmental education, regardless of school location.

Table 3. Teachers' opinions on the importance of studying environmental topics in the first cycle of primary education (variable: school location)

Statements on the importance of studying environmental topics in the first cycle of primary education		N	M	SD	Min	Max	F	p
The critical period for environmental education is the period from the 1st to the 4th grade of primary school.	Urban	341	4.14	0.898	1	5		
	Suburban	49	4.20	0.790	2	5		
	Rural	65	**4.42**	0.659	2	5		
	Total	455	4.19	0.860	1	5	2.754	0.065
Introducing students to human impact on the environment in various forms and scopes, understanding contemporary trends and the possibilities of science and technology for comprehensive environmental protection and improvement, can be achieved through the study of environmental topics.	Urban	341	4.29	0.686	2	5		
	Suburban	49	4.35	0.663	2	5		
	Rural	65	4.31	0.557	3	5		
	Total	455	4.30	0.665	2	5	0.181	0.834
By implementing topics on environmental threats and the possibilities for its protection, younger students gain knowledge, skills, values, experience, and determination to solve current and future environmental problems.	Urban	341	4.40	0.702	2	5		
	Suburban	49	4.37	0.668	2	5		
	Rural	65	**4.43**	0.661	3	5		
	Total	455	4.40	0.692	2	5	0.119	0.888
Studying environmental topics in the first cycle of primary education significantly contributes to the development of students' environmental awareness.	Urban	341	4.54	0.644	2	5		
	Suburban	49	4.47	0.767	2	5		
	Rural	65	**4.60**	0.607	2	5		
	Total	455	4.54	0.652	2	5	0.564	0.569

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation; F-F test; p-significance

In examining the relationship between the number of environmental seminars attended and teachers' opinions on the importance of studying environmental topics in the first cycle of primary education, no statistically significant differences were found in respondents' assessments. Table 4 presents the teachers' views on this issue. The data show that teachers who attended only one seminar aimed at preparing them to implement environmental topics placed higher value on studying these topics in the classroom compared to other respondents. They view this period as crucial for developing positive environmental attitudes and beliefs (M=4.33), as it helps students understand human impact on the environment in various ways and the role of science and technology in protecting it (M=4.35). Moreover, they believe students gain the knowledge, skills, and readiness to tackle current and future environmental challenges (M=4.54). However, these differences were not statistically significant. The mean values across all four respondent categories (ranging from M=3.33 to M=4.56) indicate that, regardless of seminar attendance, teachers universally assess the importance of studying environmental topics related to environmental threats and protection as positively, confirming a consistency in their views.

Table 4. Teachers' opinions on the importance of studying environmental topics in the first cycle of primary education (variable: number of environmental seminars attended)

Statements on the importance of studying environmental topics in the first cycle of primary education		N	M	SD	Min	Max	F	p
The critical period for environmental education is the period from the 1st to the 4th grade of primary school.	None	404	4.17	.868	1	5		
	One	46	**4.33**	.818	2	5		
	Two	3	4.33	.577	4	5		
	Three	2	4.00	.000	4	4		
	Total	455	4.19	.860	1	5	0.493	0.687
Introducing students to human impact on the environment in various forms and scopes, understanding contemporary trends and the possibilities of science and technology for comprehensive environmental protection and improvement, can be achieved through the study of environmental topics.	None	404	4.29	.668	2	5		
	One	46	**4.35**	.674	3	5		
	Two	3	4.00	.000	4	4		
	Three	2	4.00	.000	4	4		
	Total	455	4.30	.665	2	5	0.422	0.737
By implementing topics on environmental threats and the possibilities for its protection, younger students gain knowledge, skills, values, experience, and determination to solve current and future environmental problems.	None	404	4.40	.669	2	5		
	One	46	**4.54**	.721	3	5		
	Two	3	3.33	1.155	2	4		
	Three	2	3.50	2.121	2	5		
	Total	455	4.40	.692	2	5	4.261	0.006
Studying environmental topics in the first cycle of primary education significantly contributes to the development of students' environmental awareness.	None	404	4.56	.641	2	5		
	One	46	4.46	.690	3	5		
	Two	3	3.67	.577	3	4		
	Three	2	3.50	.707	3	4		
	Total	455	4.54	.652	2	5	3.933	0.009

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation; F-F test; p-significance

Given that schools influence students' environmental education through various factors, our second research objective focused on examining teachers' opinions about the impact of specific school conditions on achieving the goals and objectives of environmental education. Participants were asked to rate their level of agreement on the influence of particular school factors on students' environmental education using a five-point Likert scale. The research hypothesis proposed that teachers would have a positive view of the conditions within their institutions that support environmental education. The teachers' assessments of school conditions that contribute to environmental protection and improvement are presented in Table 5. According to the findings, teachers generally evaluate the school conditions supporting environmental education in a similar positive light. The calculated mean values (M) for all items reflect favorable assessments of the school environment in terms of promoting students' environmental education and the protection and enhancement of the environment.

Table 5. Teachers' views on whether the school meets the conditions necessary to achieve the goals and objectives of environmental education

Statements about the school's conditions for implementing the goals and objectives of environmental education	N	Min	Max	M	SD
1. The school where I work has adequate conditions for the implementation of the goals and objectives of environmental education (teaching staff, organized school space, teaching materials, professional literature in the field of ecology...).	455	1	5	3.69	.971
2. In the school's annual work plan, sufficient attention is given to the implementation of the goals and objectives of environmental education.	455	1	5	3.86	.905
3. The school where I work organizes a sufficient variety of extracurricular activities that contribute to the development of students' environmental awareness, such as school space beautification, environmental conservation initiatives, recycling programs, observance of dates significant to environmental awareness, public lectures, exhibitions, and environmental pollution research.	455	1	5	3.97	.928
4. Environmental topics play a prominent role in the structure of students' extracurricular activities, especially within various clubs and groups.	455	1	5	3.81	.918
5. The school's educational programs (environmental protection program, cultural activities program, field trip and outdoor learning program, health care program, etc.) include sufficient content aimed at promoting environmental education and awareness among students.	455	1	5	3.97	.853
6. The school where I teach participates in environmental activities organized by institutions and organizations within the local and broader community and maintains ongoing collaboration with them.	455	1	5	3.93	.924

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation

The following section presents the results regarding the differences in teachers' opinions on the conditions for environmental education in schools, based on their work experience, the location of the school, and the number of environmental seminars they have attended.

In the study analyzing the impact of work experience on teachers' views concerning the conditions for achieving the goals of environmental education at their schools, a statistically significant difference was found in item 5 (Table 6) through one-way analysis of variance (ANOVA). The F coefficient (F=0.298) with a significance level of p=0.827 indicates that teachers with 1 to 10 years and 21 to 30 years of work experience rate the inclusion of environmental topics in the school curricula more positively than teachers in other experience categories. The data also show that no statistical significance was found in the other items, suggesting that teachers' assessments of the school conditions for environmental education are similar across different levels of work experience.

Table 6. Teachers' views on the school's conditions for achieving the goals and objectives of environmental education (variable: work experience)

Statements about the school's conditions for achieving the goals and objectives of environmental education		N	M	SD	Min	Max	F	p
The school where I work has adequate conditions for the implementation of the goals and objectives of environmental education (teaching staff, organized school space, teaching materials, professional literature in the field of ecology, etc.).	1-10 years	93	3.83	0.974	2	5		
	11-20 years	111	3.80	0.942	2	5		
	21-30 years	151	3.62	0.971	1	5		
	> 30 years	100	3.53	0.979	2	5		
	Total	455	3.69	0.971	1	5	2.285	0.078
The school's annual work plan gives sufficient attention to the implementation of the goals and objectives of environmental education.	1-10 years	93	3.94	1.030	1	5		
	11-20 years	111	3.88	0.828	2	5		
	21-30 years	151	3.85	0.912	1	5		
	> 30 years	100	3.79	0.856	2	5		
	Total	455	3.86	0.905	1	5	0.437	0.727
The school where I work organizes a sufficient variety of extracurricular activities that contribute to the development of students' environmental culture (such as school space beautification, environmental conservation campaigns, collection of secondary raw materials, marking significant environmental dates, public lectures, exhibitions, and environmental pollution research, etc.).	1-10 years	93	4.08	0.924	2	5		
	11-20 years	111	3.96	0.924	1	5		
	21-30 years	151	3.97	0.927	1	5		
	> 30 years	100	3.89	0.942	1	5		
	Total	455	3.97	0.928	1	5	0.647	0.585
Environmental topics play a prominent role in the structure of students' extracurricular activities, especially within various clubs and groups.	1-10 years	93	3.84	0.912	1	5		
	11-20 years	111	3.77	1.009	2	5		
	21-30 years	151	3.77	0.903	1	5		
	> 30 years	100	3.87	0.849	1	5		
	Total	455	3.81	0.918	1	5	0.329	0.805
The school's educational programs (environmental protection program, cultural activities program, field trip and outdoor learning program, health care program, etc.) include sufficient content aimed at promoting environmental education and awareness among students.	1-10 years	93	**3.99**	0.903	1	5		
	11-20 years	111	3.90	0.873	2	5		
	21-30 years	151	**3.99**	0.876	2	5		
	> 30 years	100	3.98	0.752	2	5		
	Total	455	3.97	0.853	1	5	**0.298**	**0.827**
The school where I teach participates in environmental activities organized by institutions and organizations within the local and broader community and maintains ongoing collaboration with them.	1-10 years	93	3.98	0.921	2	5		
	11-20 years	111	3.97	0.958	1	5		
	21-30 years	151	3.91	0.919	1	5		
	> 30 years	100	3.89	0.909	1	5		
	Total	455	3.93	0.924	1	5	0.254	0.859

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation; F-F test; p-significance

Table 7 presents the respondents' evaluations of the conditions in their schools that facilitate environmental education, considering the school location. The data indicate statistically significant differences for most items, highlighting varied opinions among teachers in urban, suburban, and rural areas regarding

the conditions that support the implementation of environmental education goals. Specifically, the mean values (M) show that teachers in suburban areas rate their schools' conditions for environmental education more positively (M=4.06). These respondents also rate their schools' organization of extracurricular activities that promote ecological culture more highly (M=4.22) and their schools' participation in community and environmental activities more favorably (M=4.00) compared to teachers in urban and rural areas. The statistical significance of these differences is confirmed by the F coefficient values. Additionally, respondents in rural areas, compared to those in urban and suburban areas, believe that their school's annual curriculum devotes substantial attention to environmental education goals (M=4.11) and that the structure of extracurricular activities is more supportive of these goals (M=4.03).

Table 7. Teachers' views on the school's conditions for achieving the goals and objectives of environmental education (variable: the school's location)

Statements about the school's conditions for achieving the goals and objectives of environmental education		N	M	SD	Min	Max	F	p
The school where I work has adequate conditions for the implementation of the goals and objectives of environmental education (teaching staff, organized school space, teaching materials, professional literature in the field of ecology, etc.).	Urban	341	3.65	0.975	1	5		
	Suburban	49	**4.06**	0.827	2	5		
	Rural	65	3.60	0.997	2	5		
	Total	455	3.69	0.971	1	5	**4.196**	**0.016**
The school's annual work plan gives sufficient attention to the implementation of the goals and objectives of environmental education.	Urban	341	3.81	0.951	1	5		
	Suburban	49	3.94	0.747	2	5		
	Rural	65	**4.11**	0.710	2	5		
	Total	455	3.86	0.905	1	5	**3.247**	**0.040**
The school where I work organizes a sufficient variety of extracurricular activities that contribute to the development of students' environmental culture (such as school space beautification, environmental conservation campaigns, collection of secondary raw materials, marking significant environmental dates, public lectures, exhibitions, and environmental pollution research, etc.).	Urban	341	3.91	0.948	1	5		
	Suburban	49	**4.22**	0.798	1	5		
	Rural	65	4.09	0.879	1	5		
	Total	455	3.97	0.928	1	5	**3.103**	**0.046**
Environmental topics play a prominent role in the structure of students' extracurricular activities, especially within various clubs and groups.	Urban	341	3.74	0.937	1	5		
	Suburban	49	3.94	0.876	2	5		
	Rural	65	**4.03**	0.809	1	5		
	Total	455	3.81	0.918	1	5	**3.245**	**0.040**
The school's educational programs (environmental protection program, cultural activities program, field trip and outdoor learning program, health care program, etc.) include sufficient content aimed at promoting environmental education and awareness among students.	Urban	341	3.92	0.875	1	5		
	Suburban	49	4.04	0.889	2	5		
	Rural	65	4.14	0.682	2	5		
	Total	455	3.97	0.853	1	5	1.942	0.145
The school where I teach participates in environmental activities organized by institutions and organizations within the local and broader community and maintains ongoing collaboration with them.	Urban	341	3.92	0.904	1	5		
	Suburban	49	**4.00**	0.935	1	5		
	Rural	65	3.97	1.030	1	5		
	Total	455	3.93	0.924	1	5	**0.223**	**0.800**

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation; F-F test; p-significance

The assessments of respondents based on the number of environmental seminars they attended are presented in Table 8. The results from the F-test reveal statistically significant differences in only two items. These differences highlight varying opinions among respondents based on their training in ecological education within the school. Teachers who attended one environmental seminar rated the inclusion of environmental education goals and objectives in the school's annual work plan (M=4.20) and in extracurricular activities (M=3.98) more positively than other respondents. However, the data do not show statistical significance for other statements regarding the school's conditions for environmental education, suggesting that teachers' evaluations of these conditions are similar regardless of the number of environmental seminars they attended.

Table 8. Teachers' opinions on the conditions of the school for the implementation of the goals and objectives of environmental education (variable: number of attended environmental seminars)

Statements Regarding School Conditions for Implementing the Goals and Objectives of Environmental Education		N	M	SD	Min	Max	F	p
1. The school where I work has adequate conditions for the implementation of the goals and objectives of environmental education (teaching staff, organized school space, teaching materials, professional literature in the field of ecology...).	None	404	3.66	.977	1	5		
	One	46	3.98	.906	2	5		
	Two	3	3.67	.577	3	4		
	Three	2	3.00	.000	3	3		
	Total	455	3.69	.971	1	5	1.842	0.139
The school's annual work plan gives sufficient attention to the implementation of the goals and objectives of environmental education.	None	404	3.84	.899	1	5		
	One	46	**4.20**	.806	2	5		
	Two	3	3.00	1.000	2	4		
	Three	2	2.00	.000	2	2		
	Total	455	3.86	.905	1	5	**6.084**	**0.000**
The school where I work organizes a sufficient variety of extracurricular activities that contribute to the development of students' environmental culture (such as school space beautification, environmental conservation campaigns, collection of secondary raw materials, marking significant environmental dates, public lectures, exhibitions, and environmental pollution research, etc.).	None	404	3.95	.932	1	5		
	One	46	4.20	.885	2	5		
	Two	3	3.67	.577	3	4		
	Three	2	3.00	.000	3	3		
	Total	455	3.97	.928	1	5	1.798	0.147
Environmental topics play a prominent role in the structure of students' extracurricular activities, especially within various clubs and groups.	None	404	3.80	.917	1	5		
	One	46	**3.98**	.882	2	5		
	Two	3	3.00	1.000	2	4		
	Three	2	2.50	.707	2	3		
	Total	455	3.81	.918	1	5	**2.694**	**0.046**
The school's educational programs (environmental protection program, cultural activities program, field trip and outdoor learning program, health care program, etc.) include sufficient content aimed at promoting environmental education and awareness among students.	None	404	3.96	.856	1	5		
	One	46	4.15	.816	2	5		
	Two	3	3.33	.577	3	4		
	Three	2	3.00	.000	3	3		
	Total	455	3.97	.853	1	5	2.171	0.091
The school where I teach participates in environmental activities organized by institutions and organizations within the local and broader community and maintains ongoing collaboration with them.	None	404	3.92	.925	1	5		
	One	46	4.17	.851	2	5		
	Two	3	3.33	1.155	2	4		
	Three	2	3.00	1.414	2	4		
	Total	455	3.93	.924	1	5	2.205	0.087

N-number of respondents; Min-minimum; Max-maximum; M-mean; SD-standard deviation; F-F-test; p-significance

Discussions

The data obtained from the first research task confirm the hypothesis that teachers positively assess the importance of studying environmental topics during the first cycle of primary education. The mean values show that respondents highly value various aspects of environmental education, with the highest ratings given to the third and fourth items: that studying environmental topics significantly contributes to the development of students' environmental awareness (M=4.54) and that students acquire the knowledge, skills, and values necessary for solving environmental problems through these topics (M=4.40). The results demonstrate strong agreement among teachers regarding the need for the early and systematic introduction of environmental topics into the curriculum, in line with contemporary environmental trends and the demands of education for sustainable development. Teachers' positive opinions can be attributed to the fact that primary school is a critical period when children are highly receptive to new knowledge, making it easier to nurture desirable environmental attitudes and beliefs. Additionally, this phase is crucial for achieving various educational and environmental goals and objectives (Brun, 2001).

When examining differences in teachers' opinions on the importance of studying environmental topics in the first cycle of primary education in relation to work experience, the results of the ANOVA analysis show no statistically significant differences based on years of teaching experience. This suggests that teachers, regardless of their years in the profession, have similar views on the importance of environmental education for students. Similarly, no significant differences were found based on the school's location, although teachers in rural areas expressed a slightly more favorable perception. Teachers working in rural schools, in particular, emphasized the importance of developing students' environmental awareness and involving them in solving environmental issues, which may reflect a closer connection to nature and heightened awareness of local environmental challenges. Regarding the number of environmental seminars attended, no statistically significant differences were observed in teachers' assessments of the importance of implementing environmental education topics. The data suggest that teachers who attended one environmental seminar expressed slightly more favorable views on the importance of studying environmental topics compared to those who did not attend any seminars. Although these differences were not statistically significant, they hint at the potential influence of additional professional development on teachers' opinions regarding the integration of environmental topics into the curriculum.

Based on the results of the research related to the first research task, it can be concluded that teachers acknowledge the importance of introducing and studying environmental topics from grades 1 to 4 in primary school. This view aligns with the developmental characteristics of children in this age group and the strategic goals of education for sustainable development.

The second research task focused on determining teachers' opinions on how specific school conditions, where they teach, influence the achievement of environmental education goals. The findings reveal that teachers have similar evaluations of the school conditions that contribute to students' environmental education. The mean values across all items, ranging from M=3.69 to M=3.97, reflect positive assessments by respondents regarding this aspect. The data indicate that extracurricular activities and the incorporation of environmental topics into various educational programs have the most substantial impact on fostering students' environmental awareness.

To determine differences in teachers' opinions based on work experience and the number of environmental seminars attended, variance analysis reveals that differences exist for only a few statements within the scale on school conditions for students' environmental education. Regarding work experience, a difference was observed only in the assessment of the representation of environmental topics in the school's curriculum. Teachers with fewer years of experience (1 to 10 years) and those with more extensive experience (21 to 30 years) rate the inclusion of environmental topics in various school programs more positively compared to other groups. The number of environmental seminars attended does not significantly affect teachers' opinions on school conditions supporting students' environmental education. However, teachers who attended one environmental seminar rate the representation of environmental topics in the annual work plan and extracurricular activities more favorably than others. This suggests that additional teacher training can lead to more positive evaluations of environmental conditions in schools, while also indicating that other factors beyond professional development may influence teachers' perceptions.

An analysis of the data regarding the location of schools revealed statistically significant differences in teachers' perceptions of how school conditions impact the implementation of environmental topics. Teachers in suburban areas rate the conditions more favorably for environmental education compared to those in urban and rural areas, particularly regarding extracurricular activities and the organization of environmental initiatives in collaboration with the local community. Teachers in rural schools also report better planning of environmental activities compared to their urban counterparts. These findings suggest that schools in suburban and rural areas may have more favorable conditions or resources for environmental activities, potentially due to the influence of the local community's involvement in environmental protection efforts.

Although there are differences in respondents' assessments of certain statements related to the independent variables examined, the results from the second research task indicate that teachers generally evaluate their school's conditions for achieving the goals and objectives of environmental education positively.

In conclusion, the data support the overall research hypothesis that primary schools play a crucial role in students' environmental education and that, through their broad potential, they significantly contribute to the development of students' environmental awareness.

Conclusions

The results of the research underscore the importance and necessity of systematically integrating environmental topics into the first cycle of primary education, as this period is a critical developmental stage for shaping students' environmental awareness. Teachers' positive attitudes toward including environmental topics in the curriculum reflect a strong consensus on the importance of these subjects for acquiring the knowledge, skills, and values necessary for environmental protection and addressing ecological challenges.

The ANOVA test results show that work experience, the number of seminars attended, and the school location have a limited impact on teachers' attitudes regarding the significance of environmental topics, suggesting consistency in their views on the importance of environmental education. However, a slightly more favorable perception among teachers in rural areas suggests that their closer connection with nature may influence their more positive attitudes toward environmental education.

Regarding the conditions necessary to achieve the goals and objectives of environmental education, most teachers consider their school's conditions satisfactory. Nonetheless, differences based on school location highlight the need for additional resources and support, particularly in urban areas. Teachers in rural and suburban schools tend to assess the conditions for environmental education more positively, particularly with regard to extracurricular activities and collaboration with the local community. This suggests that the school's context and its connection to nature play a significant role in fostering students' environmental awareness. With respect to professional development, teachers who have attended one seminar on ecology expressed more favorable attitudes, indicating that additional training may enhance the effectiveness of environmental education.

In conclusion, the analysis supports the hypothesis that primary schools, through their curriculum and extracurricular activities, play a vital role in developing environmental awareness and promoting a responsible attitude toward the environment among students. The research also paves the way for further studies, especially in exploring the impact of additional teacher education and improving institutional support, both of which could contribute to more effective achievement of environmental education goals.

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Conflict of interests

The authors declare no conflict of interest.

Author Contributions

Conceptualization, A.S.S., I.T.M., A.S., T.M.Đ.; methodology, A.S.S., I.T.M., A.S., T.M.Đ.; software, A.S.S.; formal analysis, A.S.S. and T.M.Đ.; writing—original draft preparation, A.S.S., I.T.M., A.S. and T.M.Đ.; writing—review and editing, A.S.S., I.T.M., T.M.Đ., A.S. All authors have read and agreed to the published version of the manuscript.

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The Role of Artificial Intelligence in Judicial Systems

Žaklina Spalević[1], Srđan Milosavljević[2], Dobrivoje Dubljanin[3], Gradimirka Popović[4], Milos Ilić[5]*

[1]Singidunum University Belgrade, Faculty of Tourism and Hospitality Management, Serbia, e-mail: zspalevic@singidunum.ac.rs
[2]University of Pristina in Kosovska Mitrovica, Faculty of Economics, Serbia, e-mail: srdjan.milosavljevic@pr.ac.rs
[3]University of Belgrade, Technical Faculty in Bor, Serbia,e-mail: ddubljanin@tfbor.bg.ac.rs
[4]Kosovo and Metohija Academy of Applied Studies, Serbia, e-mail: gradimirka.popovic@akademijakm.edu.rs
[5]Toplica Academy of Apllied Studies, Prokuplje, e-mail: milos.ilic.pk@gmail.com

Abstract: The problem we tried to solve relates to the application of artificial intelligence in the legal and judicial system. Given the fact that artificial intelligence (AI) is increasingly taking precedence in various areas of human existence and work, it is an undoubted fact that the legal and judicial systems have not been left out either. It is precisely for this reason that the current state of the use of artificial intelligence in the judicial system, as well as potential new solutions, was first reviewed. In addition to the current one, we focused on the application of artificial intelligence in the legal and judicial system, especially in the domain of decision-making. In this regard, in this paper we propose the use of explainable artificial intelligence, which increasingly takes place when dealing with systems in which the precision and clarity of the parameters on the basis of which a decision is made are of great importance. Looking at the advantages of using explainable artificial intelligence in the decision-making process, one gets the impression that the application of such a model of neural networks can provide the necessary and sufficient conditions for the legal system to accept the use of artificial intelligence in decision-making in the judicial system.

Keywords: *Artificial Intelligence, Explainable Artificial Intelligence, AI in Courtroom, Legal System, Decision Making.*

Introduction

The development of computer technologies, recent innovations associated with the use of large data sets, as well as the use of artificial intelligence contribute to changes at all levels of human life and work. Artificial intelligence refers to a collection of scientific approaches, principles, and methods designed to enable machines to replicate human cognitive abilities (Nakad, et al., 2015). Recent advancements aim to enable machines to carry out complex tasks that were once performed by humans. Currently, the primary use of artificial intelligence involves machine learning (ML), which depends on large volumes of data to identify patterns and make predictions, potentially driving significant innovations in institutions and society.

As part of human society, the judicial system and related court processes have also inevitably undergone a series of changes made possible by recently developed technologies (Shi, et al., 2021). Artificial intelligence is becoming an increasingly important topic in legal studies, and researchers emphasize that the judicial system cannot ignore technological advances. The Vestal intelligentsia is already considered an inevitable introduction into judicial processes. However, some experts express concern about the possibility of accessing sensitive data, including personal information, and point out that no system can fully guarantee the security of such data. There are also fears that decision-making based on algorithms may violate constitutional rights to a fair trial, especially if the parties cannot dispute the conclusions of artificial intelligence or if there is no possibility of appeal. Despite these challenges, artificial intelligence shows great potential to facilitate court processes, reduce costs and speed up the resolution of cases, especially when it comes to simpler cases (Laptev and Feyzrakhmanova, 2024).

*Corresponding author: zspalevic@singidunum.ac.rs

Seen from the perspective of the judiciary, the use of artificial intelligence can be divided into three groups: administrators of law (judges, legislators), practitioners of law (lawyers) and those subject to the law (people and organizations). Several authors argue that a key issue with using artificial intelligence in the courtroom is that it cannot replace judges, as it lacks the ability to replicate essential human qualities such as creativity, empathy, and strategic thinking (Tamošiūnienė, et al., 2024). Although artificial intelligence can communicate and respond to questions, it does not have emotional intelligence, but artificial intelligence has logical-mathematical intelligence, which is insufficient for making complex legal decisions. On the other hand, a certain number of researches believe that the correct use of artificial intelligence models can help a lot in the decision-making process. Even to the extent that there are mechanisms that can ensure that the entire decision-making process can be based on the application of artificial intelligence.

Contribution of artificial intelligence to the judicial system today is negligible. Despite the uncertainty brought by all that is new, as well as the attitude that artificial intelligence cannot replace the judge in the courtroom, it is an undeniable fact that the application of adequate tools based on artificial intelligence can greatly facilitate the work in the judiciary. The first goal of this paper is to highlight the advantages and disadvantages of some of the applications of artificial intelligence in the judicial system. Advantages and disadvantages are defined based on the analysis of existing scientific literature. In addition, the paper also provides a proposal for the application of new artificial intelligence models, such as explainable artificial intelligence, which represents a step towards achieving the one of the main goals, and that is to replace the judge in decision making process. Precisely for this reason, the goal of this paper is to point out the advantages of using models of explainable artificial intelligence in comparison to the models of artificial intelligence applicable so far.

The paper is organized as fallows: Second section at first presents findings from scientific literature, and court practice trough some of the examples of current use of artificial intelligence. In the same time advantages and disadvantages of those application are listed. In the second part of the second section the main postulates of explainable artificial intelligence are presented. The main focus is on the use of explainable artificial intelligence in judicial system. Third section presents the proposed model. This model is based on the use of explainable artificial intelligence in the judicial system. Fourth section presents the main conclusions.

Materials and methods

Judiciary institutions, compared to other institutions, have been slower to accept the novelties brought by the use of information and communication technologies. Today, case management systems, which are used to handle court cases, are already widely adopted or being implemented in many countries globally. In the most advanced justice systems, these systems have facilitated the creation of legal repositories that serve as the foundation for developing and deploying AI-driven applications. Such applications can be used for a variety of purposes, including supporting or even potentially replacing court decisions. Given the large number of cases globally, the use of artificial intelligence has significant potential to improve judicial activities. This can lead to improved access to justice, enhanced transparency and accountability, reduced costs, and faster court proceedings (Rocha & Carvalho, 2023). However, the implementation of artificial intelligence also poses risks to key justice values, such as impartiality and the protection of fundamental rights, which will be explored later in this chapter.

Current use of artificial intelligence in judicial systems

At present, the most commonly used applications of artificial intelligence in the judicial system, can be categorized in the main groups: legal research and analysis, predictive policing and risk assessment.

One of the basic applications of artificial intelligence in the judicial system is research and data analysis. Legal research and analysis involve the process of gathering, evaluating, and interpreting legal information to support legal decision-making, case preparation, and the practice of law. Legal professionals, such as attorneys, paralegals, and law students, traditionally invested a considerable amount of time and effort in libraries or legal databases to collect information (Faghiri, 2022). With the advent of technology, legal research has shifted from manual methods to computer-assisted methods. Electronic resources allowed faster and more efficient searches, but the process still required human interpretation and analysis.

Second application of artificial intelligence in the judicial system is predictive policing. Predictive policing stands at the forefront of law enforcement innovation, leveraging advanced analytics and artificial intelligence to enhance crime prevention and resource allocation (Berk, 2021) This approach moves beyond traditional reactive strategies, aiming to forecast and proactively address potential criminal activities. At its core, predictive policing employs machine learning algorithms to analyze historical crime data, identifying patterns and trends that may indicate where future incidents are likely to occur (Storbeck, 2022). This data-driven approach allows law enforcement agencies to optimize their resources and deploy officers more effectively to areas with higher predicted crime rates.

Risk assessment, as the third large group of AI applications, involves leveraging machine learning algorithms to analyze various factors and predict the likelihood of a defendant reoffending or failing to appear in court. One of the key aspects are predictive algorithms. This means that artificial intelligence algorithms analyze historical data, including criminal records, demographics, and socio-economic factors, to generate risk scores. These scores aim to assist judges and parole boards in making more informed decisions about bail, sentencing, and parole. Data-driven decision-making refers to artificial intelligence systems used in risk assessment that depend largely on data to detect patterns and correlations. Ensuring the quality and representativeness of the data is crucial to avoid reinforcing existing biases and disparities within the criminal justice system (Souza, Amilton and Nascimento, 2022). The application of artificial intelligence within the mentioned three large groups is based on different tools that can be used for the aforementioned needs. Seen from the point of view of neural networks, their application can be very different. The most commonly used neural networks for the needs of applications applicable in the judicial system, as well as cases of their use, are given in Table 1. Some of the most important advantages and disadvantages of using artificial intelligence in the judicial system are given in Table 2.

Table 1. *The list of neural networks that can be used in applications applicable in judicial system*

Neural networks	Use case
Recurrent Neural Networks	Predicting case outcomes based on historical data or analyzing the evolution of legal arguments over time.
Long Short-Term Memory Networks	Document classification, legal language translation, and context-driven analysis of case law.
Convolutional Neural Networks	Classifying legal documents, extracting features, or identifying entities (like parties or legal statutes) from case files
Graph Neural Networks	Mapping out relationships in legal precedents or analyzing networks of legal citations
Feedforward Neural Networks	Predicting the likelihood of crime occurrences based on historical data such as time, location, and type of crime.
Bayesian Neural Networks	Providing probabilistic assessments of crime predictions to help law enforcement understand the uncertainty associated with different forecasts.
Transformers	Enhancing crime prediction models by incorporating context and temporal features relevant to crime occurrences
Autoencoders	Detecting anomalies in criminal activity data or identifying cases that deviate from typical patterns

Table 2. Advantages and disadvantages of artificial intelligence application in tools for legal research and analysis, predictive policing and risk assessment in criminal justice

Advantages	Disadvantages
Efficiency and speed	Reliability and trust issues
Accuracy and consistency	Complexity and understanding
Enhanced search capabilities	Privacy and confidentiality concerns
Cost-effectiveness	Integration and adoption challenges
Comprehensive data analysis	Legal and ethical considerations
Crime prevention and resource allocation	Bias and discrimination
Data analysis and pattern recognition	Privacy and civil liberties concerns
Improved public safety	Reliability and accuracy
Enhanced investigations	Community trust and relations
Rapid processing	Bias and fairness
Objective analysis	Transparency and accountability
Enhanced predictive accuracy	Over-reliance on technology
Resource optimization	Privacy and ethical concerns
Improved public safety	Implementation challenge

Integrating these neural network models into legal research and court practices can enhance efficiency, improve accuracy, and support more informed decision-making in the judicial process. Using neural networks for the different purpose in judicial system requires careful consideration of ethical implications, such as potential biases in the data and the impact of predictions on communities. Effective models should be transparent, explainable, and subject to oversight to minimize adverse outcomes. To provide all that it is important to ensure that these models are trained carefully to avoid biases and ensure fairness in the legal context.

Explainable artificial intelligence

Given the aforementioned limitations of applying artificial intelligence in the judicial system, it can be observed that some of the biggest problems are the transparency of the process itself, as well as the comprehensibility of the obtained results. Recently, to address this issue, the use of explainable artificial intelligence (XAI) techniques has been introduced. Initially applied in various fields, explainable artificial intelligence has also found its place in law and judicial practice. These techniques aim to develop machine learning models that strike a good balance between interpretability and accuracy. By applying explainable artificial intelligence principles, it is possible to create white/gray-box machine learning models that are interpretable by design while maintaining high accuracy. Alternatively, black-box models can be made minimally interpretable when white/gray-box models cannot achieve an acceptable level of accuracy. Explainable artificial intelligence techniques are essential for understanding decision-making processes in neural network models and ensuring that their outcomes are comprehensible to humans (Sajid, et. al., 2023).

Explainable artificial intelligence is increasingly being integrated into judicial systems to improve transparency, accountability, and fairness in legal processes. Here are some key points regarding its use:

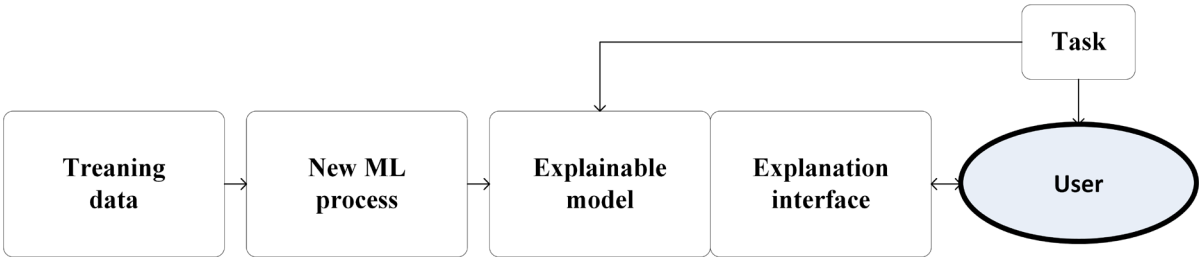
- Enhanced Decision Making: Explainable artificial intelligence can assist judges and legal professionals by providing data-driven insights and recommendations while ensuring that the rationale behind those recommendations is clear and understandable.
- Transparency: Explainable artificial intelligence helps demystify the decision-making process of AI systems, allowing legal professionals to understand how certain conclusions were reached. This transparency is crucial in the judicial context, where decisions can significantly impact individuals' lives.
- Bias Detection: Explainable artificial intelligence techniques can be employed to analyze and identify

potential biases in judicial decisions or within the AI algorithms themselves. By understanding these biases, steps can be taken to mitigate unfair outcomes.

- Legal Research: Explainable artificial intelligence can accelerate legal research by summarizing case law, providing relevant precedents, and suggesting legal arguments while explaining the logic behind its suggestions.
- Predictive Analytics: Courts may use explainable artificial intelligence for case outcome predictions, helping to manage case loads and allocate resources more efficiently. However, it's vital to ensure that these predictions are made transparently and do not inadvertently reinforce existing biases.
- Public Trust: As artificial intelligence technologies are integrated into the judiciary, explainable artificial intelligence can enhance public trust by offering clear explanations for AI-driven decisions. This ensures that users can understand how and why automated systems reach specific conclusions.
- Compliance with Regulations: Many jurisdictions are focusing on the ethical implications of artificial intelligence, and the transparency offered by explainable artificial intelligence can help address regulatory requirements concerning fairness and accountability.
- Training and Development: Judges and legal practitioners can benefit from explainable artificial Intelligence tools that provide educational resources and training, allowing them to better understand both the capabilities and limitations of artificial systems.

Explainable artificial intelligence is one of the key components of current judicial programs that are expected to enable third-wave AI systems. In this phase, machines are designed to understand the context and environment in which they function. Over time, they develop explanatory models that help them characterize real-world phenomena. Based on all that the current explainable artificial intelligence concept is shown on Figure 1.

Figure 1. Explainable artificial intelligence concept



If in the model itself the user is viewed as someone to whom the model should deliver a created decision based on the input data set, some of the advantages of using such an explainable artificial intelligence model can be defined in comparison to traditional artificial intelligence models. A comparative analysis is given in Table 3.

Table 3. *Comparison of understanding of current artificial intelligence models and explainable artificial intelligence models from the user perspective*

Current approach of artificial intelligence	Explainable artificial intelligence
User do not know why model does something	User understands why
User do not know why model did not apply something else	User understands why not
User does not know when model has succeed	User knows when model succeeds
User does not know when model fails	User knows when model fails
User does not trust in obtained results	User has the trust in obtained results
User can not know how to correct error, and improve results	User has information why model finished with error

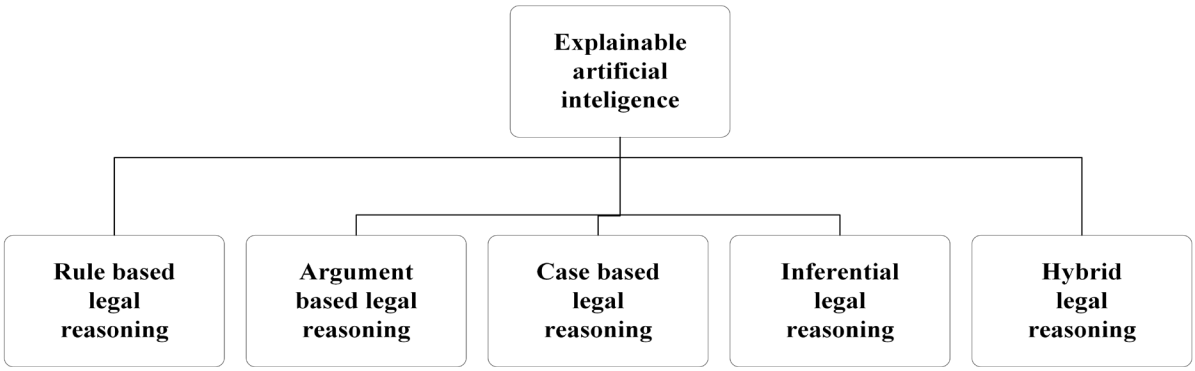
As when applying tools and models based on the principles of artificial intelligence in the judicial

system, it is most important to gain the trust of judges and other participants in the process in the results obtained. It is necessary that the results themselves be as accurate as possible. However, when it comes to decisions made in court processes, it is necessary to achieve maximum trust of the process participants in the artificial intelligence model itself. This is the reasons why the application of an explainable artificial intelligence model brings benefits in terms of trust. The very explainability of the model, transparency during the entire training process as well as during prediction or decision-making allows to overcome the barrier of mistrust and lack of privacy.

Results

By researching the available literature in which the authors deal with the problem of applying methods of explainable artificial intelligence in various fields, methods that are equally applicable in judicial practice were singled out (Richmond, 2023). These methods can be applied both for the purposes of processing large data sets and providing assistance during the processing of materials, as well as for decision-making, which creates the conditions for the application of artificial intelligence to make a decision in a judicial process. Of course, for already known ethical reasons, such a final decision would only help the judge, while its absolute or relative adoption would remain up to the judge. Selected methods of explainable artificial intelligence are shown in Figure 2.

Figure 2. Classification of explainable artificial intelligence model for legal and judicial purpose



Each of the mentioned models can be further broken down into different types of frameworks that are applicable in specific cases. Rule-based legal reasoning continues to be the most common form of legal AI systems. These systems model deductive reasoning by applying a rule of law to a specific problem to derive an answer, A. The system outputs A based on the legal principle established by the relevant authority. The core of legal reasoning involves determining which rules should be applied and how they should be interpreted (Mowbray et al., 2023). Rule-based systems consist of three key components: a set of rules (rule base), a fact base (knowledge base), and an interpreter for the rules (inference engine). The rules, which reflect the content of knowledge-based sources, are applied and matched with a set of facts to derive conclusions using the inference engine. The reasoning process relies on a series of "if–then" rule statements, which are used to explain specific patterns in a given domain, such as legal norms (El Ghosh et al., 2017). The proposed system was firstly demonstrated in a case study based on an online child care management System, ChildSafeOMS, to automate the early identification of children at risk. The authors claim that the resulting RuleRS provides an efficient and flexible solution to the problem at hand by using defeasible inference (Richmond, 2023).

Argument based legal reasoning is one of the most common legal reasoning methods in the law domain. It is based around the construction of arguments and counter-arguments, followed by the selection of the most acceptable of these. Argumentation, as opposed to deduction, is an appropriate mode for reasoning with inconsistent knowledge, based upon the construction and the comparison of arguments. It can allow for reasoning in the face of uncertainty, and identify solutions when confronted with conflicting information. In particular, it should be possible to use this approach to assess the reason why a putative fact resonates, in the form of argument, and to combine these arguments to evaluate the level of certainty.

Argumentation has strong explanatory capabilities, as it can translate the decision of an AI system to an argumentation process, which shows step-by-step how the system concludes the result (Vassiliades et al., 2021).

Legal case based reasoning applies a problem-solving approach which is not referable to strict rules (Keane and Kenny, 2019). Works in this category conform to the analogical reasoning of the court-room in which a judge reasons with instant and prior cases (drawn from a case base), finding similarities and differences between them. In legal case-based reasoning, a set of domain-specific, legally significant features is defined, and a previous case is considered relevant (and potentially binding) based on the degree of similarity between the features of the prior case and those of the current case. Legal case-based reasoning (LCBR) has been formalized for the purposes of computer reasoning as a three-step process: retrieve, revise and retain. These newer LCBR methods have brought modifications and advancements in LCBR modelling. For example, the authors in (Zheng et al. 2021) proposed a logical comparison approach, which logically generalized the formulas involved in case comparison, and their approach to identifying analogies, distinctions, and relevance. This approach is extended to HYPO-style comparisons (where distinctions and relevance are not separately characterized) and to the temporal dynamics of case-based reasoning modelling real world cases. Notably, the authors claimed that such case-based model formalism is capable of refining the comparisons inherent to case-based reasoning.

Inferential legal reasoning seeks to reason using evidential data, which refers to primary sources of evidence whose existence cannot reasonably be disputed, such as witness statements given in court or forensic expert reports presented to the fact-finder. According to some authors inferential processes, broadly understood, are simply those cognitive processes in which beliefs are formed or maintained on the basis of the information possessed". These inferential processes are usually considered equivalent to reasoning, as reasoning describes "the making or granting of assumptions called premises (starting points) and the process of moving toward conclusions. When it comes to the relation between inference/ reasoning and argumentation, Walton (1990) claims that reasoning occurs within discourse or argument, whereas other scholars attest that reasoning is discourse or argument. In either case, inferential reasoning is a requirement for argumentative discourse, and at the same time appears during it. A view of argumentation as a dynamic and dialectical type of reasoning occurring in certain contexts of dialog is thus justified under this approach. From a practitioner's perspective, legal reasoning and legal argumentation are relatively straightforward to describe and define: they involve the reasoning used by lawyers to solve a legal problem, advise a client, or justify a legal decision. Some might argue that it is simply ordinary reasoning applied within a legal context.

Hybrid legal reasoning represents integration of two or more different knowledge representation methods. The underlying assumption is that complex problems can be easier solved with hybrid systems (Hamdani et al., 2021; Marques Martins, 2020). One of the most widely used types of integration in the legal domain is the combination of rule-based and case-based reasoning approaches. The rule-based approach has the advantage of structuring the explanation according to the underlying statute or legal doctrine, but tends to be rather prescriptive and requires considerable knowledge engineering effort in constructing the rule base. Rule-based systems solve problems from the ground up, while case-based systems rely on pre-existing situations to address similar new cases. As a result, integrating both approaches is logical and frequently beneficial. Another novel hybrid model of legal reasoning was proposed in Bex and Verheij (2011), by broadening the argumentative approach to evidential reasoning, this method covers the entire reasoning process in a case, from evidence and facts to legal implications. It represents an expansion of their proposed hybrid theory of reasoning with evidence. The authors argue that the process from evidence to established facts, and from established facts to legal implications, cannot be isolated from the factual component of legal reasoning. Thus, it has been demonstrated that the categories of AI-powered legal reasoning are not discrete but offer the potential for the development of hybrid forms that fit with the different facets of legal reasoning.

There are different neural network architectures that can be utilized for explainable artificial intelligence in judicial case studies. Each of the architects is characterized by certain performances and is applicable to a certain set of data as well as at a given moment. It is particularly important, when it comes to architectures that belong to explainable artificial intelligence, that such architectures can represent certain layers of a larger network. In that case, all parameters of importance to the system user would be generated in this part of the network.

Conclusions

Artificial intelligence is increasingly becoming a key component of modern justice systems, bringing potential benefits in the form of increased efficiency, faster resolution of disputes and reduced costs. Although the judiciary is slow to adapt to technological innovations compared to other sectors. Artificial intelligence allows for the analysis of vast amounts of data and the use of advanced algorithms to enable faster and more accurate decision-making, which streamlines administrative tasks and eases the workload of courts. However, despite these advantages, there are significant challenges, including the risk of algorithmic bias, violations of fundamental rights, and issues of transparency and ethics. The solution to the mentioned problems is possible in the use of principles and techniques of explainable artificial intelligence. By applying these techniques, tools can be created that will lead to the mass use of artificial intelligence in courtrooms and legislative systems.

Author Contributions

Conceptualization, Z.S. and S.M.; methodology, Z.S and G.P.; software, D.D and M.I.; formal analysis, Z.S. and S.M.; writing—original draft preparation, Z.S. and G.P.; writing—review and editing, D.D. and S.I. All authors have read and agreed to the published version of the manuscript.

Conflict of interests

The authors declare no conflict of interest.

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Deformation of University Management in Russia in the Context of the Implementation of Managerial Ideology

Alexander Viktorovich Dyatlov[1*], *Vitaly Vladimirovich Kovalev*[1]

[1]Southern Federal University, Rostov-on-Don, Rostov Region, Russia,
email: avdyatlov@yandex.ru; vitkovalev71@gmail.com

Abstract: The article raises the issue of whether managerialism can improve the efficiency of university management. Managerial management was adopted in Russia to promote the intensification of three types of professional activity of teachers: research work, educational process and socialization of students. It was assumed that the more teachers perform various types of work within the framework of their professional employment, the more the efficiency of management will grow. For these purposes, universities began to function as a quasi-market corporation, in which each actor had their own personal KPI. Its implementation and subsequent growth of indicators were considered as a guarantee of increasing managerial efficiency. The authors express the opinion that such an approach is erroneous in relation to such types of activities where flow assessment of quality is impossible. It is an unsuccessful example of the transfer to higher education of those practices that have developed in commercial corporations. In this regard, the authors put forward a hypothesis according to which Russian universities under managerial management have partially lost their traditional goals: to teach a profession, create scientific innovations, and introduce students to culture. To confirm this hypothesis, a universal model of effective university management was developed. Four empirical indicators were defined on its basis: 1) clear articulation of goals; 2) provision of sufficient resources to achieve goals; 3) reliable system of control over the use of resources; 4) social significance of the manufactured product. A survey of university teachers in six regions of the south of Russia (sample population - 849 respondents) showed that managerial management unreasonably commercializes the professional activities of teachers, that the overwhelming majority of employees of educational organizations do not have sufficient resources to fulfill their KPIs, that there is mass falsification and imitation of the results of professional activity, that the academic community has lost its subjectivity, is under pressure from university administrations and, therefore, is unable to perform the function of proper control over the quality of educational and scientific activities. A general conclusion is made according to which under the conditions of managerial management the goals of universities have ceased to be achieved. Consequently, from an economic point of view, state financing of the overwhelming majority of Russian universities seems to be an unprofitable and unpromising undertaking.

Keywords: *management, managerialism, efficiency, university, KP, resources, imitation, falsification.*

Introduction

Over the past 10-15 years, large-scale dissatisfaction with the results of the reforms initiated after joining the Bologna system has gradually been brewing in the Russian academic community. One of the most important aspects of these reforms was the transition to a managerial management model. Managerialism is an ideology of managerial efficiency. Along with it, the assessment of education and science by quantitative indicators, massive layoffs of teachers, the liquidation of “ineffective” universities, the stimulation of competition between employees and the focus on the commercialization of the final results of professional activity have become an organic part of Russian higher education. All these phenomena were absolutely alien to Russian academic traditions, and the teaching community met them with condemnation. However, it is not so much the opportunistic behavior of teachers that should be considered important, but the extremely negative consequences that naturally arose from the incompatibility of the

*Corresponding author: avdyatlov@yandex.ru

genuine efficiency of university management with the pseudo-efficiency that was the result of the changes initiated by the managerial management model.

The very appearance of the category of "university management efficiency" in the scientific discourse was based on the assumption that managerialism objectively contributes to the growth of professional performance indicators. Before the era of managerialism, there were no grounds to study this issue. However, its claims to the ability to ensure a revolutionary increase in managerial efficiency stimulated some interest on the part of scientists. At the same time, almost all scientific studies in the designated perspective turned out to be quite similar. They are written either in a purely economic context and are aimed at the successful implementation of business projects by universities (Asaul and Kaparov, 2007; Mamanazarova, 2023; Orlova, 2021; Pastukhov, 2013), or are focused on assessing the adopted scale of target indicators (KPI) for university employees (Kosintseva, 2011; Moskvin, 2016).

A relatively recently published article by A. M. Osipov and B. Naran raises the issue that there is currently a need to abandon fragmented assessments of effectiveness, which are reduced to reports on the use of budget funds to finance education (Osipov and Naran, 2023). For an optimal understanding of the stated problem, it is necessary to develop a full-fledged theory. Since effectiveness is currently assessed exclusively within the framework of the managerial model, this article defines the goal of developing a universal concept of university management effectiveness and determining the ability of managerialism to ensure real, not imaginary, effectiveness.

Materials and Methods

Methodologically, the work is based on the theory of efficiency of the Polish economist J. Zeleniewski (Zeleniewski, 1971). In his opinion, only the management that ensures the achievement of socially significant goals set for the organization can be effective. At the same time, the scientist does not lose sight of the economic nature of efficiency, since its most important element is the reasonableness of the resources spent on achieving goals. Justifying the possibility of ensuring reasonableness, the scientist introduces the concept of "social value" into the categorical apparatus, which has not been used before in assessments. It is due to the unity of social values that the reasonableness of spending on achieving goals can be confirmed or rejected. Value acts as an integrator, uniting social activity on common axiological grounds. Thus, the professional community is able to develop uniform criteria for assessing managerial efficiency.

We believe that in the management of Russian universities, the achievement of target indicators is carried out with an excess of reasonableness of the resources expended, and the academic community does not have sufficient subjectivity to prevent target deformations of its professional activities.

To test this hypothesis, a mass survey was conducted on the topic "Efficiency of University Management in the Context of Implementing Managerial Ideology". The object of the study is teachers of universities in the south of Russia. The survey was conducted in six constituent entities of the Russian Federation: Kalmykia, Rostov Region, Krasnodar and Stavropol Krai, Republic of Crimea and the city of Sevastopol. The study involved teachers frjuom Kalmyk State University (133 respondents), Don Technical State University (138 respondents), Rostov State Medical University (59 respondents), North Caucasus Federal University (218 respondents), Pyatigorsk State University (113 respondents), Simferopol University of Economics and Management (40 respondents) and Sevastopol State University (99 respondents). Another university from Krasnodar (49 respondents) participated in the survey on the basis of complete anonymity. The total sample was 849 teachers. Time of the survey: September 2024.

Results and Discussions

Theoretical aspect of the study. First of all, it is necessary to define the author's categorical apparatus. Almost everything we need is already reflected in the title of the article. We believe that the external organization of terms should be as follows: management → efficiency → effective management → effective university management → managerial effective university management.

By management we mean purposeful activity carried out in the form of maintaining or changing the established social order (Matrosov, 2023). In the process of management, resources are selected,

the optimality of their spending is checked, personnel is monitored, and the most distinguished employees are rewarded. Thus, the management structure includes achieving goals, building the most optimal relationships between employees, finding and distributing resources, monitoring the work process, and evaluating its results.

The definition of the previous term did not cause us much difficulty. Despite the existing disagreements between scientists, it was not difficult to find a consolidated position on non-controversial grounds. The category of "efficiency" is a completely different matter.

The first problem associated with its inclusion in the subject field of our study is that efficiency arose in the semantic coordinates of economic science. In this branch of knowledge, the internal content of this concept is derived through the ratio of income and expenses. The indicator of such a ratio is profit. Therefore, we can say that in the economy, the growth of efficiency is directly proportional to the growth of profit (Shevtsova and Shumilova, 2023). At least, this is true in the short-term measurement model, without taking into account probable changes in the future. However, this understanding of efficiency is hardly applicable to non-profit organizations, which include universities. In any case, according to Russian law, even private educational organizations cannot declare the achievement of profit as the goal of their activities. And since we agreed to consider management as an activity aimed at achieving a goal, then increasing profits cannot be the goal of university management.

The solution to this case led scientists to the emergence of a new concept of efficiency, which is most often represented in the discursive practices of management. In management theory, efficiency is identified with the achievement of results (Saksina, 2017). Most often, this is various types of project reporting. But an equivalent indicator of efficiency measurement is the so-called customer satisfaction. Here, an analogy with consumer satisfaction with goods and services is clearly visible, which in commercial relations is manifested in the growth of consumption of goods and services. This approach can well be called managerial. Here, efficiency is understood as the fulfillment of target indicators and as customer satisfaction with the quality of services (benefits) produced. But this point of view cannot be considered flawless either. It is unacceptable where it is necessary to evaluate not an abstract set of goods and services, but each individual unit produced. The work of the academic community presupposes precisely a qualitative, piecemeal assessment. Moreover, by those actors who are capable of doing this. For university teachers, abstract measurement of efficiency actually acts as a provocation to reduce the quality of their work where it is impossible to check it by another teacher.

It seems to us that in order to measure the university's management achievements, the efficiency category should be based on fundamentally different grounds. The necessary semantic tool was laid down in the definition of "management". It includes "goals", "resources" and "control". Based on it, we propose the following definition of "management efficiency". This is the achievement of the goals of the management object, ensured by the optimal use of the resources used and confirmed by the professional community that the achieved results are significant for society. This definition must be combined with the category of "university" in order to concretize the excessively generalized meaning of the presented formulation.

First of all, a university is an educational organization focused on achieving three goals: creating scientific innovations, implementing professional training, and introducing young people to culture. Consequently, an increase in efficiency can only be asserted with an increase in the social usefulness of science, the graduation of well-trained specialists, and the successful socialization of students. In addition, teachers must have the necessary amount of resources capable of ensuring the achievement of the goals stated above. And, finally, teachers, possessing the necessary subjectivity, must be able to perform control functions to assess the social usefulness of what their university colleagues are doing in the field of science, education, and socialization.

Thus, the definition of effective university management depends on the three semantic coordinates presented above. If we integrate them into one definition, it can be as follows. This is the achievement of the goals of the educational organization, provided with a sufficient volume and optimal use of the resources used, and confirmed by the academic community that the achieved results are important for society.

In order to complete the construction of the author's categorical apparatus, we have to integrate the concept of managerialism into it and define the concept of "managerial effective management of the university". Here we need to show the managerial features of effective management. In other words, we must answer the question "what, within the boundaries of managerial ideology, is considered effective

management of the university as an educational organization and is there a certain degree of probability of failure to achieve this effectiveness?" The answer to this question presupposes an assessment of managerialism itself.

A subject description of managerialism is given in scientific literature quite fully (Deem, 1998). To a certain extent, several generally accepted theses can be considered axioms. First of all, managerialism in university management began to be established as a result of the transplantation of those practices that arose in large corporate business. There, its main function was reduced to increasing the motivation of personnel indifferent to the final results of the company's work. To solve this problem, strategic goals were fragmented into target indicators (KPI). In this way, the location of personal responsibility was fixed. This technology was transferred to the management practices of higher education. At the same time, with KPI, a focus on commercialization and competition came to universities. These are not so much the principles of managerialism as the transfer of corporate values to the university culture, which previously did not have them. Therefore, in university management, commercialization and competition began to determine the content and volume of KPI for teachers. Thus, competition manifests itself in the desire to do more types of work than was done before, and commercialization in the ability to sell them on the market of goods and services. It is precisely to this manifestation of success that the efficiency of university management is equated in managerialism. In other words, managerial efficiency within the boundaries of managerial ideology is achieved by fulfilling planned development indicators in the field of science, teaching and socialization of students. But to these three goals, a fourth is actually added: monetization of the results of those types of professional activity that can be monetized. Therefore, efficiency is additionally measured by the amount of money earned.

In order to assess the growth of the management efficiency of Russian universities, from the point of view of the formal logic of managerialism, we only need to measure the growth of indicators for science, education, upbringing and profitability. This is usually what the management of Russian educational institutions does. However, not everything is as simple and straightforward as it seems in the plans of the reformers. Such logic works only where the product has a standardized nature, or where there is an external consumer capable of assessing the quality. The university does not have anything like this, and the final result of its activities can only be properly assessed by the teachers themselves, that is, the academic community. Initiating managerial reforms in the field of higher education, the reformers obviously proceeded from the fact that an increase in quantity will not lead to a decrease in quality. It was also assumed that all the prescribed KPI indicators are properly supported by resources. However, neither one nor the other can be considered an axiom. Are teachers ready to reduce the quality of their work due to the pressure to increase the number? Do they have all the necessary resources to meet the development indicators? Does the academic community participate as a free subject in assessing the quality of education and science? All the above questions need to be established empirically. The growth of quantitative indicators in itself does not indicate the growth of management efficiency. Management activity is based on clearly defined goals. If the goals are not achieved, then there is no efficiency for all the parameters defined above, regardless of the quantitative increase.

Empirical aspect of the research

We will make the achievement of the university's goals in the final part of the article. For now, let us outline the goals in question. Three classic goals are still relevant in Russian universities: professional training, scientific innovation, and student socialization. They are clearly stated in all the charters of the educational organizations in which we conducted the study. Additionally, after the change in the management paradigm, the fourth goal became relevant: profit growth from all types of activities. This goal is not stated in the local documents of educational organizations, but it is actually established in the regulatory acts of state governing bodies. These primarily include Order of the Ministry of Science and Higher Education of the Russian Federation dated 01.11.2021 No. 996 "On approval of the Procedure for holding a competition for the distribution of admission control figures for specialties and areas of training ..." and Order of the Ministry of Science and Higher Education of the Russian Federation dated 01.02.2022 No. 92 "On approval of performance indicators of federal budgetary and autonomous educational institutions of higher education ...". In the first document, four of the seven KPIs for the rector directly relate to financial indicators, the achievement of which provides the head of the educational organization with the opportu-

nity to receive large financial bonuses from the state. The second defines the terms of financing, among which the leading role is played by the commercial solvency of the university. Refusal of financing is actually equivalent to the closure of the higher educational institution. In this regard, it can be said that the new fourth goal - making a profit, in the conditions of managerial management becomes the leading one.

Let us emphasize once again that the financial activity of Russian universities is derived from three traditional goals. They are not legally allowed to engage in entrepreneurship. In this regard, university administrations began to focus on a sharp increase in scientific research and demonstrate indifference to educational work. This change in priorities is associated with the understanding that financial results can only be achieved through science. This is the source of the focus on grants, government assignments, business contracts, collaborations with commercial organizations, etc. Russian universities were tasked with becoming major scientific centers in their own regions and even on a global scale.

From this position we need to return to our interpretation of the category “the effectiveness of university management” and establish whether the teachers have sufficient resources to be outstanding scientists. As we remember, the goals of any management activity can be achieved only if there are resources that facilitate this process. Let us dwell on three of their varieties: motivational, temporal and intellectual. Let us begin with the assessment of motivation.

Table 1. *Do you have an internal and stable need to engage in scientific activity (no more than two answer options) / Your academic degree, %*

Do you have an internal and persistent need to engage in scientific activity?	What is your academic degree?			
	Doctor of Science	Candidate of Sciences	Without a degree	Total
1. Yes, combining scientific and educational activities improves the quality of my teaching work.	77.2	39.3	37.2	42.4
2. I do science from time to time, mainly to improve my teaching rating	15.2	43.6	37.2	38.5
3. No, I think it is wrong to impose mandatory participation in scientific activities on every teacher.	9.8	25.2	32.7	26.4

Teachers are unconditionally oriented towards science only in the academic group of “Doctors of Science”. Among candidates of science, as well as teachers who do not have an academic degree, the desire for scientific activity is not strongly expressed. This must be taken into account when assessing the ability to achieve high results in this area.

The presented data are consistent with those obtained in the study of the intellectual resource. The management of Russian universities proceeds from the assumption that all teachers are quite capable of being successful in the scientific field, it is enough to organize fair bonuses for the fulfillment of indicators. The study showed that this assumption is erroneous.

Table 2. *Are all teachers capable of productively engaging in science (no more than three answer options) / Your academic degree, %*

Are all teachers capable of productively engaging in science?	What is your academic degree?			
	Doctor of Science	Candidate of Sciences	Without a degree	Total
1. No, most teachers are focused on educational activities.	58.9	49.5	48.8	49.9
2. No, in educational institutions, science that has social utility has always been done by only a few people	31.1	40.8	27.5	35.2
3. No, there have always been few scientists capable of contributing to the development of science.	42.2	40.6	31.1	37.4
4. Yes, following the development of mass education, science also became mass	1.1	2.8	8.7	4.7
5. Yes, for productive scientific work it is necessary to create fair bonuses for performance indicators	12.2	12.1	15.9	13.3
6. Yes, most teachers have sufficient ability to contribute to the development of science	7.8	10.4	17.7	12.9

As you might expect, the teaching corps in the context of mass education was formed precisely as a community for professional training. During the times of the Russian Empire, indeed, every teacher was a scientist. Many became world-famous researchers. But in Tsarist Russia there were only 11 universities. At present, there are 1056. And each one must become a leading scientific center. It is hard to imagine that there would be enough for everyone to have at least one scientist per branch of science.

The overwhelming majority of teachers are so deeply integrated into educational activities that they do not have the time resources for other types of work.

Table 3. *Do you have enough working time to combine scientific and educational work (no more than two answer options) / Your academic degree, %*

Do you have enough working time to combine scientific and educational work?	What is your academic degree?			
	Doctor of Science	Candidate of Sciences	Without a degree	Total
1. Yes, at my work the necessary conditions for this have been created in general	21.1	5.9	9.9	8.8
2. Yes, if you use planning of all types of work wisely	26.7	21.5	27.4	24.1
3. No, if the teaching load is not reduced, then scientific activity will be formal.	55.6	56.8	41.9	51.5
4. No, you need to do one thing at a time, and for me, education is a priority.	12.2	30.2	34.3	29.8

Each of the three identified academic groups has a deficit of time for research. The situation is slightly better for doctors of science. They have a smaller classroom load and no obligations to participate in events to educate students. It is in this group that education is least of all considered a priority compared to science. Nevertheless, the deficit of time is perceived as significant even by doctors of science, which is obviously caused by the obligations to publish in greater volumes than other academic groups. In general, in all categories of respondents, the most popular given value was *if the teaching load is not reduced, then scientific activity will be formal* (51.5% by median). In essence, this situation leads to a false dilemma: either reduce the amount of time for teaching students and productively engage in science, or do not change the teaching load for teachers and engage in the creation of scientific simulacra. In fact, any of the two choices will have negative values. The choice in favor of science will lead to the degradation of education (while the majority of teachers will not come up with anything socially useful in the field of scientific research); the choice in favor of education will become a source of falsifications in scientific work.

It should be acknowledged that the majority of Russian teachers do not have the necessary resources to create scientific discoveries that are significant for social development. As a rule, they are ordinary teachers of specialized subjects who ended up in higher education due to the high demand for higher education in the late modern era. Their plans at the stage of entering the profession did not extend beyond classroom work with students. The state is trying to make scientists out of them, believing that this is the shortest path to increasing the efficiency of university management.

Based on the above conclusion, it can be assumed that the growth of quantitative indicators objectively leads to a decrease in the quality of scientific research. Consequently, the academic community, through its social practices, should suppress this kind of activity and orient colleagues to refuse to replace science with scientificity. However, this could be possible if professional groups (dissertation councils, editorial boards of journals, experts in assessing grant applications, etc.) filtered out manufacturing defects. To do this, they must have professional subjectivity. Thus, we need to establish the presence of teachers' ability to act in accordance with the rules of professional ethics and the ability to withstand pressure from university administrations.

Within the academic community, editorial boards of journals have always played a significant role. The possibility of publishing scientific achievements or other significant events in the world of science depended on their professional work. The standard of their activity can be presented as follows: an objective selection of manuscripts received by the journal in the form of scientific correspondence and their timely publication with possible payment of an author's fee. Since the introduction of managerial management, the situation has changed radically. It has become economically unprofitable to maintain "free" journals. They have become a source of expenses for the university, which turned out to be unacceptable from

the point of view of achieving financial performance indicators. First of all, author's fees were abolished. Currently, most scientific journals, at least in the social and humanitarian sphere, do not provide free publishing services. They either work entirely on a commercial basis, or act in a mixed format, accepting remuneration from authors through payment in "envelopes". Without a doubt, such a practice shifts the focus of target orientations from science to economics. According to the authors' personal observations, editorial boards do not meet in almost all the journals from the Higher Attestation Commission list that we know of, and management decisions are made behind the scenes. Is it any wonder that, according to 38.1% of our respondents, quality assessment is not carried out in paid journals? For some of the teaching staff, this is even convenient. More than half of the teachers are quite ready to consciously publish in "junk" journals that do not conduct scientific quality assessment: 20.1% – because high-ranking journals are unavailable; 16.6% – because they see no point in dividing journals into categories; 13.6% – because they are focused on formal rather than academic rating. Such a situation is possible only because university management literally forces its employees to increase publication activity. The practice of qualifying publications for postgraduate and doctoral students also indirectly leads to this. The original logic of the "old" professional culture was that the presence of a large number of publications was an indicator of recognition of the scientific validity of a dissertation. Nowadays, this is largely a reflection of the financial capabilities of the applicant for an academic degree.

Thus, the editorial boards of journals not only do not counteract the growth of deformations in the world of Russian science, but directly contribute to it, since they set themselves purely commercial goals that have nothing in common with the interests of science. There is an urgent request from teachers for paid publications. This is due to the fact that most of the manuscripts they create have no scientific value. Consequently, no scientific journal with a high reputation will publish them. It is possible to support intensive pseudo-scientific activity only through publishing houses that do not have proper verification of scientific quality. In such a situation, a ban on the provision of paid publishing services seems logical, but it completely contradicts the guidelines of managerial management for the monetization of science.

The most important place in the structure of academic practices is occupied by expert commissions that determine the winners of competitive applications for grants.

Table 4. *How objectively are grant applications selected (no more than two answer options) / Your academic degree, %*

How objective is the selection of grant applications?	What is your academic degree?			
	Doctor of Science	Candidate of Sciences	Without a degree	Total
1. Experts evaluate applications impartially and select the best ones	15.7	14.1	24.0	17.9
2. Most of the applications are selected in advance by agreement with the management of the funds.	37.1	27.8	16.8	24.8
3. The management of the funds is corrupt, and this prevents a fair selection of applications	13.5	7.8	7.8	8.3
4. It is almost impossible for participants from regional universities to win the competition	44.9	29.5	12.3	24.8
5. I find it difficult to answer	20.2	38.4	47.9	39.9

It is no coincidence that our attention has shifted to the management of foundations and expert committees for evaluating applications. Grants have replaced direct funding of science. They seem to reflect all the signs of commercialization and competitiveness, which are the basis of corporate managerialism. When they were introduced, it was assumed that, on the basis of fair competition, funding would be received by those research teams that develop relevant and scientifically sound applications. However, in real practice, everything turned out somewhat differently than planned. Fair competition did not work out. Most of the financial flows are distributed behind the scenes, through personal or corrupt connections. This can easily be understood from the results obtained in the academic group of "Doctors of Science", as well as from the most informed part of the candidates of science. As a result, instead of fair funding of science, the principle of shadow distribution of resources was established. Of course, it is extremely difficult to achieve fairness and honesty in this area. But the loss of subjectivity on the part of experts and

the management of foundations, in addition to general manifestations, also has purely managerial origins. Universities vitally need to earn money. Their direct funding from the state depends on it. Therefore, most of the illegal manipulations with grant finances are carried out in the form of secret conspiracies, the purpose of which is to identify winning applications by violating the competitive procedure. If there were no administrative pressure from the state, the scale of the problem would be significantly reduced.

When assessing the subjectivity of the academic community, one cannot ignore the commissions responsible for the selection of postgraduate students and control over postgraduate training.

Table 5. *Rate the quality of selection of candidates for admission to postgraduate studies in your structural unit (any number of answers) / Your academic degree, %*

Assess the quality of selection of candidates for admission to postgraduate studies in your structural unit	What is your academic degree?			
	Doctor of Science	Candidate of Sciences	Without a degree	Total
1. The most deserving students are generally admitted to graduate school	16.7	32.5	38.7	33.2
2. People go to graduate school to avoid serving in the army	43.3	33.8	32.8	34.3
3. Postgraduate studies are entered through personal connections	18.9	17.3	17.5	17.4
4. It is generally not the best students who enter graduate school	54.4	30.8	26.2	31.5
5. Real talents won't want to go to graduate school	17.8	12.0	11.5	12.4
6. Real talents won't be able to get into graduate school	6.7	1.7	5.7	3.6

According to the data obtained through the survey, significant shortcomings in the work of teachers can be seen already at the stage of selection of postgraduate students. Particular attention should be paid to the point of view of doctors of science, since it is this academic group that is mainly engaged in postgraduate training and acts as scientific supervisors of postgraduate students. 54.4% of the surveyed doctors of science are convinced that not the best students enter postgraduate studies. Meanwhile, if we expect scientific discoveries from each teacher, active and meaningful involvement in the life of the scientific community, the best should study in postgraduate studies. The same applies to professional training. It should be carried out in the status of teachers by the most talented graduates. Meanwhile, the strongest motive among those who chose to continue their studies in postgraduate studies is the unwillingness to serve in the army (43.3%). Only 16.7% of doctors of science noted that the best enter postgraduate studies.

If the situation, in general, is assessed correctly by respondents and negative processes have been steadily ongoing for several years, then there is a violation of the historically established order of reproduction of scientific and teaching staff. This means that talented professors and associate professors are being replaced by mediocre ones, lowering the professional level of the academic community.

It is logical to ask about the reasons for this state of affairs. It is difficult to estimate the scale, but managerial management makes a significant contribution to the development of this negative trend. Russian postgraduate studies are replenished through state and commercial funding. There are many more postgraduate students of the latter type. As a rule, they all just imitate their studies and work on their PhD dissertations. But they cannot be expelled, since this step will lead to a decrease in the financial indicators of the educational organization. As a result, the administration puts pressure on everyone who certifies their work. A postgraduate student who pays for his education is not expelled even if he has academic debts in all subjects, and professors are forced to give them clearly undeserved grades.

Even dissertation councils are under pressure. 24% of respondents noted that deans of Russian universities are forcing professors to lower the quality requirements for postgraduate dissertations, since the previous quality standards are too complex for new generations of postgraduate students. The number of postgraduate students receiving an academic degree is steadily falling. Currently, only 11% of all those admitted to postgraduate studies become candidates of science. This is sharply worsening the KPI results of university management. In order to somehow save the situation with falling indicators, postgraduate students are allowed to defend dissertations based on scientific reports.

In an interim conclusion, it can be noted that the process of reducing the subjectivity of the aca-

demic community in Russian universities is currently underway. Managerial management, turning science and education into a quasi-market institution, is if not the only, then a very important factor in the deformation of professional culture. This raises the question of the ability of academic councils, editorial boards of journals, dissertation councils, expert commissions and other forms of the academic community to counteract manipulations with indicators for scientific work.

Some of the results of our survey indicate that the Russian academic community has distanced itself from quality control of its activities. This statement can be verified by turning to the analysis of the goals of the functioning of universities. Earlier in the article, we pointed out four target benchmarks. Let us dwell in more detail on scientific work, since changes in the educational process and socialization are extremely difficult to assess.

Table 6. *Does stimulating the growth of quantitative indicators for scientific work lead to a decrease in its quality (one answer option) / Your academic degree, %*

Does stimulating the growth of quantitative indicators for scientific work lead to a decrease in its quality?	What is your academic degree?			
	Doctor of Science	Candidate of Sciences	Without a degree	Total
1. Yes, real science is disappearing and being filled with imitation	52.2	54.5	42.6	50.2
2. No, the number of scientific papers is growing, and their quality, in general, remains high	10.0	12.7	23.0	16.0
3. Quantitative indicators can reflect an improvement in the quality of scientific work if they are not used as a tool for external incentives	37.8	32.8	34.4	33.8

The results of managerial management are assessed by respondents mainly in negative tones. This is especially noticeable in the academic group of “Doctors of Science”, from whom the maximum increase in scientific knowledge is expected. In such a status, their opinions should be considered as expert. And if this is so, then it must be recognized that the increase in the intensity of scientific activity has led to the creation of a product that does not have social utility. This is evidenced by a number of other survey results. More than half of Doctors of Science (50.3%) and over a third of Candidates of Science (34.4%) believe that the quality of educational literature has significantly decreased after points began to be awarded to teachers for its publication. In addition, 27.8% of Doctors of Science and 21.8% of Candidates of Science are convinced that it has significant shortcomings. On another issue, 37.2% of respondents believe that the increase in publication activity is only an imitation of scientific activity. 31.2% also do not see a positive meaning in the gross production of science, but are forced to follow the “rules of the game”. It is significant that only 9% of respondents expect to earn money from publications, the vast majority of whom are young teachers without an academic degree (24–30 years old).

A paradoxical situation is developing. Being a community capable of assessing the scientific work of their colleagues, Russian scientists express negative judgments, but only in a sociological survey, when they are guaranteed the safety of anonymity of statements. However, in their professional activities, they do not prevent the publication of low-quality manuscripts, vote for dissertations that have no scientific value, accept mediocre students into postgraduate studies, etc. In other words, they have a dual subjectivity. Professionalism has not yet been completely lost, but there is no longer any political will to demonstrate it. Therefore, the leading strategy of behavior is demonstrating loyalty to the administration, even when this administration forces them to make decisions that contradict professional ethics. As a result, Russian universities mostly produce scientific products that have no social utility.

Conclusions

In conclusion, in accordance with the stated goal, we need to answer the question of whether managerialism ensures real, and not imaginary, efficiency of university management in Russia. To do this, let us once again turn to the model of effective management that we have developed. It includes several components: 1) clear articulation of goals; 2) provision of sufficient resources to achieve goals; 3) a reliable system of control over the use of resources; 4) the social significance of the product produced. If we

look at how effective managers from science and education integrate their management into the listed elements, the results will be somewhat discouraging.

1. Managerialism defines goals for teachers that are exogenous to education and science. And the issue is not only in managerialism itself, but also in its Russian features. Universities in Russia are almost entirely financed by the state. Therefore, in real management practices, the term “effective manager” is identified with the word “bureaucrat”. The only difference is that officials have effective contracts. Fulfillment of contractual KPIs becomes a condition for maintaining a position or even career growth in the event of significant overfulfillment of target indicators. Therefore, teachers are under enormous administrative pressure to achieve the development targets set by the state at any cost. Particular emphasis has been placed on meeting financial indicators, since they are more difficult to falsify than indicators for science. As a result, universities are gradually turning into quasi-commercial corporations fighting with each other for state money.

2. The study showed that failure to achieve goals is predetermined by a lack of resources. The state sets tasks for university management that cannot be solved under the current resource conditions. But due to the fact that ineffective universities cease to be funded, the administration and teachers adapt to the given rules, sharply reducing the quality of their work in favor of increasing the quantity. Paid publications, correspondence conferences, “junk” journals (including in the Scopus and Web of Science databases), inflated grades for students, false authorship, falsification of empirical data, plagiarism, etc. have become the norm. Honest scientists and teachers are at great risk of ending up in the cohort of the ineffective - and therefore dismissed.

3. In Russian universities, managerialism has broken the system of control over the resources used, which is also used to assess the quality of science and education. In management practices, such forms of the academic community as academic councils, departments, educational and methodological councils, editorial boards of journals, dissertation councils, examination committees, etc. continue to exist. However, the survey showed that teachers have lost their subjectivity under managerial management. All of the above structures have little say. This is directly related to the change in the status of a teacher. Under the new conditions, he or she is required to contribute to the effectiveness of the entire university. And if this contribution is insignificant in terms of measurable quantitative indicators, then the management is effectively obliged not to renew contractual relations with him or her. Not only can a university be closed for inefficiency, but an employee is also subject to dismissal for the same reason. The fear of being ineffective is transmitted along all levels of the management chain, reaching the teacher as an ordinary executor of a “state assignment”. In the managerial management model, competitive elections have turned from a simple formality into an instrument for forcing employees to commit actions that contradict professional ethics. It is this instrument that, on the one hand, ensures loyalty to the management, and on the other hand, turns the work of departments, editorial boards, and dissertation councils into imitation. Due to the insufficient volume of resources, teachers have no other way to adapt to the management situation.

4. And finally, the result of such activity is the release of a “product” that does not have the properties of social utility. The quality of education, scientific work, and educational efforts has sharply decreased. But, most importantly, in most cases the management is satisfied with such a result. Reports are made up of quantitative units. And the university administration can bear some responsibility for quality only on formal grounds. In reality, quality has always been assessed by the teachers themselves, since only they, and not officials, are able to establish it. Fearing being fired, teachers have removed themselves from quality control. At present, all those who previously assessed the results of the scientific or educational process in a collegial form have turned into a resource for the reproduction of reporting units.

In conclusion of our analysis, we note that due to the policy of state managerialism, the real efficiency of management of Russian universities has been completely replaced by pseudo-efficient management practices. It is impossible to establish exactly what the real efficiency is now, since it is hidden by false reports and the career ambitions of the bureaucracy. But there is no doubt that under the conditions of managerial management, the goals of universities have ceased to be achieved. Consequently, from an economic point of view, state financing of the overwhelming majority of such universities seems to be an unprofitable and unpromising undertaking.

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Conflict of interests

The authors declare no conflict of interest.

Author Contributions

A. V. Dyatlov and V. V. Kovalev – GED; A. V. Dyatlov – software, SEG; A. V. Dyatlov and V. V. Kovalev – original draft preparation, GED and SECG; A. V. Dyatlov – review and editing, TEC and SEG All authors have read and agreed with the published version of the manuscript.

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Understanding Student Attitudes toward GenAI Tools: A Comparative Study of Serbia and Austria

Slobodan Adžić[1*], *Tijana Savić Tot*[1], *Vladimir Vukovic*[2], *Pavle Radanov*[3], *Jelena Avakumović*[4]

[1]University Union Nikola Tesla, Faculty of Management FAM, Sremski Karlovci, Serbia,
e-mail: s.adzic@famns.edu.rs; tijana.savictot@famns.edu.rs
[2]University of Applied Sciences Campus Wien, Wien, Austria, e-mail: vladimir.vukovic@edu.fh-campuswien.ac.at
[3]Metropolitan University in Belgrade, Faculty of Management, Belgrade, Serbia, e-mail: pavle.radanov@metropolitan.ac.rs
[4]College of Academic Studies Dositej, Department of Business Economics, Belgrade, Serbia,
e-mail: jelena.avakumovic@vsdositej.edu.rs

Abstract: This study explores university students' attitudes toward generative AI technology and tools in two European countries. Driven by the increasing integration of AI in education and the limited research on student perceptions, particularly in European contexts, this study aimed to understand how students view GenAI and its implications for higher education. The study employed a quantitative approach, using surveys to collect data on student attitudes toward AI across different fields of study, genders, and countries. A key innovation of this research is the development of a novel "Attitude toward AI" scale, designed to provide a robust and theoretically grounded instrument for measuring student perceptions of GenAI. The scale offers a valuable tool for evaluating the effectiveness of AI integration in education. The results showed that students' attitudes toward AI differed significantly based on their field of study and gender. Male students in technical sciences had the most positive attitudes toward AI adoption, indicating their potential to drive positive changes in AI implementation. While the effect size was small, this finding underscores the importance of considering individual factors when designing interventions to promote AI acceptance. The study underscored how prior experience shapes positive attitudes, highlighting the need for resources to familiarize students with GenAI and its ethics. The "Attitude toward AI" scale is a significant contribution addressing the lack of reliable instruments for assessing student perceptions of GenAI, enabling deeper understanding of factors influencing students' adoption, informing targeted interventions for different student groups. Further research is needed on GenAI's long-term impact.

Keywords: *artificial intelligence, ChatGPT, GenAI tools, student attitudes, attitudes scale.*

Introduction

The artificial intelligence market is projected to grow from approximately $200 billion in 2023 to over $1.8 trillion by 2030. GenAI, an AI technique capable of generating various content types (e.g., text, videos, images), is expected to see further significant advancements (Dwivedi et al., 2023; Kasneci et al., 2023). One prominent example is ChatGPT, a GenAI-powered chatbot trained to generate human-like text and perform natural language processing tasks such as text completion, conversation generation, and translation (Baidoo-Anu and Ansah, 2023). ChatGPT's rapid adoption is evidenced by its user base reaching one million within five days and 100 million within a month of its release. Currently, it boasts 180 million users and 14 billion views (approximately 1.5 billion visits per month), solidifying its position as a leading AI application (Duarte, 2024).

The growth of generative AI techniques and tools has disrupted numerous industries, including education, as AI integration in education is gaining momentum. A growing number of academic institu-

*Corresponding author: s.adzic@famns.edu.rs

tions and organizations are embracing this technology (Abdaljaleel et al., 2024; Bannister et al., 2023; Chan and Zhou, 2023a; Kasneci et al., 2023; Michel-Villarreal et al., 2023; Yuk Chan, 2023). Sectors like manufacturing and healthcare have already undergone significant transformation through the incorporation of AI-based solutions, and the education sector is exhibiting a similar trend (Habibi et al., 2023; Yuk Chan, 2023). The open-access release of these tools in late 2022 and early 2023 has sparked substantial shifts in teaching and learning, leading to a rapid expansion of research on their integration into education (Kadaruddin, 2023; Woodford, 2023). The rapid and widespread adoption of GenAI technologies has prompted extensive research exploring the implications and potential of integrating generative AI into educational settings, particularly from the perspectives of key stakeholders: educators, policymakers, and students (Kadaruddin, 2023). GenAI tools like ChatGPT are driving innovation in education, reshaping how students learn, teachers instruct, and institutions operate (Al-Zahrani, 2024; Al-Zahrani and Alasmari, 2024; Chiu, 2024).

One of the key trends of implementing GenAI in education is the development of Individual Adaptive Learning Systems, which use AI algorithms to tailor learning experiences to the unique needs and preferences of individual students (Ezzaim et al., 2024). These systems can analyze student data, identify learning gaps, and provide personalized content and feedback, potentially improving learning outcomes and student engagement (Ezzaim et al., 2024). A Global Student Survey of 11,816 students across 15 countries revealed that up to 40% used GenAI tools, primarily to accelerate learning (Chan and Zhou, 2023c). Despite widespread student adoption, usage patterns vary, and students believe institutions should provide clearer guidance on acceptable GenAI use. Students generally view GenAI positively, appreciating its potential for personalized learning support, writing assistance, and research capabilities (Chan and Zhou, 2023c). GenAI tools can aid researchers in identifying ideas, synthesizing information, and summarizing text, thus improving data analysis, writing composition, and publication efficiency (Berg, 2023; Kitamura, 2023; Van Dis et al., 2023). These tools, particularly text-to-text AI generators like ChatGPT, can benefit students, especially non-native speakers, by generating ideas and providing writing feedback. GenAI can also enhance learning assessment by providing tools for grading and feedback (Crompton and Burke, 2023; Gombert et al., 2024).

Another prominent trend is the integration of AI-based tools that assist teachers in administrative tasks, such as grading, evaluation, and class management. By automating these time-consuming responsibilities, AI enables educators to focus more on teaching and student-centered activities, potentially enhancing the overall quality of education. A 2023 study by Mizumoto and Eguchi demonstrated that ChatGPT can reduce grading time, maintain scoring consistency, and offer instant feedback, potentially transforming higher education by improving student outcomes and revolutionizing teaching and learning (Mizumoto and Eguchi, 2023). Previous research also suggests that AI-based chatbots for learning support can improve student learning achievement, self-efficacy, attitudes, and motivation (Boateng et al., 2022; Lee et al., 2022; Yan et al., 2022). Furthermore, AI-powered Institute Administration Systems are being developed to streamline various administrative processes, such as student enrollment, inquiries, and data management. These systems can help reduce the workload on administrative staff, allowing institutions to allocate resources more efficiently (Murdan and Halkhoree, 2024; Zhang and Goyal, 2024).

In addition to the technological advancements, the educational implications of AI adoption are far-reaching. AI-powered systems can provide personalized feedback and recommendations, fostering a more inclusive and effective learning environment. Moreover, the integration of AI in education can potentially bridge learning gaps, particularly for students with diverse needs or backgrounds (Murdan and Halkhoree, 2024; Zhang and Goyal, 2024).

Despite the potential benefits of GenAI in education, concerns exist regarding accuracy, transparency, privacy, ethics, holistic competencies, career prospects, and human values (Abdaljaleel et al., 2024; Bulut et al., 2024; Chan and Hu, 2023; Peres et al., 2023). Debate focuses on the challenges for teachers, who are expected to integrate this technology (Ferrell et al., 2024; Xu et al., 2024). A study of the top 50 higher education institutions found fewer than half have publicly available guidelines on GenAI, covering academic integrity, assessment design, and student communication (Moorhouse et al., 2023). Generative AI presents both transformative potential and significant challenges for higher education. While the integration of GenAI tools offers opportunities to enhance learning and teaching, concerns persist regarding accuracy, transparency, privacy, ethical implications, impact on holistic competencies and career prospects, and alignment with human values (Abdaljaleel et al., 2024; Bulut et al., 2024; Chan and Hu, 2023;

Moorhouse et al., 2023; Peres et al., 2023)

Existing research on GenAI adoption in education often prioritizes educator perspectives, overlooking the crucial need to understand student experiences and perceptions (Chiu, 2024; Dotan et al., 2024; Shailendra et al., 2024). Investigating student attitudes toward such tools is an initial step to ensure their effective implementation and ongoing improvement in the educational setting. While a substantial body of research has examined tertiary students' perceptions in this area, students' specific views and experiences of GenAI tools remain relatively underexplored (Bosch et al., 2023; Kelly et al., 2023a). Existing research on student perceptions of GenAI tools in higher education frequently focuses on broader technological aspects as well as specific applications using the technology acceptance model (TAM) (Almassaad et al., 2024; Kong et al., 2024). Further research is needed on student perceptions and experiences with GenAI tools, particularly in European contexts as existing studies primarily focus on Western countries (Bannister et al., 2023) and often lack specific investigation into the impact of demographic factors like gender, field of study, and year of study on student perceptions of GenAI (Almassaad et al., 2024; Baidoo-Anu and Ansah, 2023; Chan and Hu, 2023). Moreover, existing research often lacks validated measurement instruments for measuring students attitudes toward AI (Bosch et al., 2023; Kelly et al., 2023a).

This study addresses several key research gaps: a lack of research focusing specifically on student perceptions of generative AI tools, particularly in the European context; a need for a deeper understanding of how demographic factors shape student attitudes toward AI; the absence of validated instruments to measure student attitudes toward AI; and the need for more context-specific research on AI adoption in European higher education, as demonstrated by the comparative approach examining the Serbian and Austrian settings. The AI readiness index ranks Serbia 58th and Austria 15th out of 181 countries (Statista, 2024). Serbia is an Eastern European developing country with a forecasted continuous increase in GDP between 2023 and 2028, totaling 33.3 billion U.S. dollars (+44.39 percent) (O'Neill, 2024b). Austria, on the other hand, is a Western European developed country with an average GDP forecasted to increase by a total of 1.2 percentage points between 2023 and 2028 (O'Neill, 2024a). As developed countries have successfully implemented artificial intelligence, while developing countries are still in the preliminary stages of implementation, it is interesting to compare students' attitudes toward the use of AI tools. Developing countries face various obstacles when implementing artificial intelligence in higher education, including weak infrastructure, limited information access, a lack of institutional support, insufficient resources, and poor technological skills (Cui and Alias, 2024). A comparison of these two countries, which differ not only in their significant ranking level of the AI index but also in their level of economy, will allow us to gain insight into potential similarities and differences in students' attitudes toward GenAI tools. This comparative approach allows for insights into the potential impact of cultural and educational contexts on student perceptions, contributing to the development of effective GenAI integration strategies in higher education.

The study aims to investigate university student attitudes toward AI and GenAI tools in two distinct European countries: Serbia and Austria. Specifically, it examines:

1. Student usage of GenAI tools for academic work: This explores how students are currently utilizing these tools in their studies.
2. Overall attitudes toward AI in education: This assesses students' general perceptions and opinions about the role of AI in education.
3. The influence of demographic factors: This investigates how characteristics such as gender, field of study, and year of study impact student attitudes toward AI and GenAI tools.

The first objective of our study is to investigate the use of AI tools for academic purposes, as outlined in the literature above. We selected thirteen questions to design a research scale that assesses students' overall comprehension of artificial intelligence tools. The purpose of the newly developed AI tools scale is to examine which AI tools students use. The authors' second objective was to examine university students' attitudes toward AI. To identify these attitudes, the authors developed the Attitudes toward AI scale, a behavioristic scale commonly used in the literature (Bruner II, 2019) that measures attitudes between two opposing poles. These contrasting attitudes can be classified as negative versus positive (Baek and Yoon, 2017; Xie and Keh, 2016) or bad versus good (Fischer et al., 2010). The literature contains several articles that explain the positive and negative aspects of AI development, which can serve as a basis for constructing the attitudes toward AI scale in this study. Khakurel et al. (2018), Floridi et al. (2021), Makridakis (2017), and Huh et al. (2023) all expressed positive views on the emergence of AI tools

(Floridi et al., 2021; Huh et al., 2023; Khakurel et al., 2018; Makridakis, 2017). They argue that AI represents a remarkable technological advancement and an opportunity for the development of human society. However, it is important to note that these views are subjective and should be clearly marked. Negative views of AI development include concerns about its potential dangers to humanity and the need for strict limitations and control (Amann and Stachowicz-Stanusch, 2020; Turchin, 2019; Wendehorst, 2020).

By addressing these aims, the study seeks to contribute empirical evidence to the ongoing discussion surrounding AI in higher education and inform the development of effective strategies for integrating GenAI into educational practices. Additionally, the research introduces and validates a new "AI Attitudes Scale.

Literature review

The impact of students' perceptions and experiences of technological innovations, such as GenAI, in educational settings on their likelihood of using the tool and its incorporation into the learning process has been studied (Abdaljaleel et al., 2024; Alzahrani, 2023; Atlas, 2023; Chan and Zhou, 2023b; Crompton and Burke, 2023; Michel-Villarreal et al., 2023; Pradana et al., 2023; von Garrel and Mayer, 2023). Adopting a deep approach to learning, which involves seeking understanding and making connections between concepts, is more likely when students have positive self-perceptions and a supportive learning environment. On the other hand, individuals who are dissatisfied with their education or doubt their abilities may approach learning superficially, focusing solely on memorizing information and meeting qualifications (Parra-Díaz et al., 2024). Research has investigated students' perceptions of GenAI in higher education, including their experiences with the technology and the variables that affect their views, such as gender, discipline, and year of study (Alzahrani, 2023; Baidoo-Anu and Ansah, 2023; Chan and Zhou, 2023c; Elkhodr et al., 2023; Bosch et al., 2023).

A Rhodes University study of 1471 South African students found they were overwhelmingly positive about digital and AI tools' potential to facilitate their university progress (Bosch et al., 2023). Respondents said these tools could help clarify academic concepts, formulate ideas, structure essays, improve writing, save time, check spelling/grammar, clarify instructions, find sources, summarize texts, guide non-English speakers, and assist with referencing and plagiarism. The language is clear, objective, and formal. Many students found AI tools like ChatGPT helpful for clarifying concepts they couldn't fully grasp or that weren't properly explained. Most AI tool users were English speakers, with first-years using them for referencing, plagiarism checks, and grammar. On plagiarism, students didn't consider AI tool use as plagiarism, though those unfamiliar with ChatGPT were more likely to view it as such. This study provides insights into how underrepresented Global South students use AI to enhance learning, though self-reported, cross-sectional data limit generalizability. Students' conflicted AI views reflect a complex reality, making firm conclusions difficult. The results may not apply to different educational environments.

A Hong Kong study of 399 undergraduate and postgraduate students across disciplines found a moderate positive correlation between frequency of use and understanding of GenAI technologies (Chan and Hu, 2023). Students generally demonstrated good understanding and ease of use, but expressed concerns about the impact on university education value. Significant differences emerged between frequent and infrequent users. Overall, the results suggest students have a positive attitude toward GenAI's potential for personalized learning, writing assistance, and research, but also express concerns about privacy, ethics, and holistic skill development. The mixed-methods approach provides comprehensive insights, with the Hong Kong focus adding regional context. However, limitations include small sample size, self-reported bias, and lack of longitudinal or learning outcome data. The findings can inform strategies for integrating GenAI and addressing ethical issues, with broader implications.

Using expectancy-value theory, Chan and Zou (2023) investigated students' intention to use GenAI in an educational setting. They examined the influence of knowledge, familiarity, perceived value, and cost. The study was conducted among 405 university students in Hong Kong. The results showed that students' perceptions of the utility of GenAI had the greatest impact on their intentions to use these technologies. Most participants acknowledged the potential benefits of GenAI in the workplace, including improved learning outcomes such as enhanced academic achievement and digital competence. Students also found utility in features such as boosted productivity, instantaneous individualized feedback, and assistance with idea generation (Chan and Zhou, 2023c). This study contributes significantly by creating a validated instrument based on Expectancy Value Theory to assess student perceptions of generative

AI. Using a rigorous approach, the study demonstrates the instrument's reliability and validity, making it a useful tool for future research. The findings emphasize the importance of perceived value and cost in determining students' GenAI use intentions, which are critical for successful GenAI integration. However, the study's shortcomings include a sample that may not adequately represent the larger population, a cross-sectional methodology, and self-reported data biases. The assessment and insights can be used to guide initiatives aimed at encouraging students to have favorable attitudes toward GenAI and to use it responsibly. Despite its limitations, the study makes a significant contribution by providing a solid tool for measuring student impressions of GenAI.

A comparative study examined university students' attitudes and perceptions toward artificial intelligence, focusing on business and education majors (Almaraz-López et al., 2023). The findings revealed that students in both fields recognize AI's importance for their future careers. However, business students hold a more optimistic view, perceiving AI as a threat that could replace some professional roles. As students advance, their perception of AI's benefits increases while risks decrease. The surveyed population, including economics, business, and education students, is not well-versed in AI concepts and terminology. Though students see advantages like data analysis and personalized learning, they acknowledge limitations, such as relying on generated content accuracy. The study provides insights by comparing perspectives across disciplines, using a mixed-methods approach. The emphasis on academic fields allows for nuanced comparisons and field-specific AI concerns. The verified survey enhances the study's rigor. However, the single-institution sample and self-reported data limit generalizability and introduce bias. More coding and reliability details for the qualitative analysis would be beneficial, and the AI focus may restrict practical applications. The findings are important for educators, developers, and politicians interested in how students perceive AI across disciplines. Field-specific insights can guide specialized AI integration tactics. The comparative approach provides insights into how disciplinary environments impact student perspectives. Despite limitations, the study offers valuable insights into student AI perceptions across fields, which can strengthen future research on AI's role in higher education.

A recent study of 2,240 university students in Arab countries examined factors influencing their attitudes and usage of ChatGPT(Abdaljaleel et al., 2024). Key determinants were ease of use, positive technology attitude, social influence, perceived usefulness, behavioral/cognitive factors, low perceived risks, and low anxiety. This study offers valuable insights into student perceptions and use of ChatGPT across multiple countries. Strengths include a large, multinational sample and the TAME-ChatGPT instrument for evaluating adoption determinants. Critical elements found to impact ChatGPT adoption were perceived ease of use, utility, attitude toward technology, social influence, and behavioral/cognitive characteristics. This information is crucial for effectively integrating AI tools into education. However, the study has limitations. The convenience sampling method may introduce selection bias, limiting generalizability. The cross-sectional design restricts causal analysis and tracking of attitude/usage changes. Self-reported data raises concerns about biases. Additionally, differences in participants' ChatGPT experience were not accounted for. The findings are relevant to educational institutions and policymakers seeking to understand and address ChatGPT uptake issues. The identified determinants can guide focused interventions and strategies for responsible, effective AI integration in education. Despite these limitations, the study provides valuable insights into factors influencing university students' attitudes and usage of ChatGPT.

Parissi et al.'s (2023) research sheds light on how students' research skills influence AI acceptance (Parissi et al., 2023). Skilled students, who can define demands, design methods, and critically evaluate, are more likely to investigate and effectively use AI, assessing its trustworthiness and limitations. In contrast, less experienced students may fail to integrate AI due to unfamiliarity or difficulties assessing AI-generated content. These diverse reading levels present both opportunities and challenges for AI in education. Highly literate pupils can use AI to complete complex tasks, but there are restrictions and worries about AI's integrity. AI can help less literate children develop basic skills, but it also risks disinformation and over-reliance, needing cautious review. This necessitates incorporating AI literacy with information literacy instruction. Addressing ethical issues around plagiarism, privacy, and responsible AI use is crucial. Guidance on selecting appropriate AI tools will empower students to navigate the evolving AI landscape. By addressing challenges and opportunities, educators can equip students at all levels to use AI responsibly and ethically. The study uses a qualitative approach, observing seven students solving three information problems over a semester. A key finding is that the didactic intervention, based on the Big6 model and online search tools, led to students utilizing a greater variety of actions to locate information. The study

highlights the positive influence of structured information literacy training on students' search behaviors. It doesn't directly address AI or GenAI tools, but its focus on information-seeking behavior is relevant in the broader context of how students engage with information, including that generated by AI.

Lavidas et al.'s (2024) study on AI usage among Greek humanities and social sciences students sheds light on the elements that drive AI adoption in academia (Lavidas et al., 2024). Using the Unified Theory of Acceptance and Use of technological model, the researchers discovered that expected performance, prior technological habits, and enjoyment had a substantial impact on students' intents to use AI. Students who believed AI may improve their academic performance, were familiar with technology-mediated learning, and found AI tools enjoyable were more likely to show a desire to utilize them. Furthermore, the study found that behavioral intention, habit, and conducive settings were strong predictors of actual AI use. This emphasises the need of not only promoting positive views toward AI, but also providing the essential infrastructure and support for its effective implementation. Notably, the study discovered no moderating effects of gender or years of study on the connection between UTAUT components and AI usage intentions or behavior. The authors speculate that the sample's homogeneity may have contributed to this finding, underlining the need for further study with more diverse populations to investigate potential moderating influences. It's important to recall that the study's concentration on arts and social sciences students at a Greek institution restricts the generalizability of its results. More research in varied cultural and academic settings is required to acquire a more complete knowledge of the elements that influence AI adoption in higher education.

Aravantinos et al. (2024) propose a thorough review of AI applications in primary education, which provides significant insights into developing trends (Aravantinos et al., 2024). Their analysis categorizes research aims, learning material, outcomes, and pedagogical methodologies, offering a snapshot of the current situation. However, the study had certain drawbacks. The methodical methodology that follows PRISMA principles promotes methodological rigor and replicability. The emphasis on primary education covers an important, although frequently disregarded aspect of AI integration, providing insights into early acceptance. The complete categorization provides a foundation for understanding the various AI applications in this setting.

The dependence on the SCOPUS database may exclude relevant studies, resulting in publication bias. The insufficient empirical evidence limits conclusions regarding AI's usefulness, focusing on what is investigated rather than how effectively it works. The restricted age range may not convey AI's varied impact during the elementary school years. The lack of contextual analysis hinders our understanding of aspects such as teacher training, resources, and demographics, all of which may influence AI adoption. The findings are useful for educators, academics, and policymakers interested in AI in primary education. The study's framework can help to shape future research, teaching, and policies. It emphasizes the necessity for additional empirical research to assess AI tools and solutions. Further study should broaden the database search, focus empirical investigations, investigate contextual factors, and carry out longitudinal studies. Addressing these limitations will provide a more comprehensive understanding of AI's potential and challenges in primary education.

Recent studies explore students' attitudes towards generative AI (GenAI) in higher education across various cultural contexts. Students generally exhibit positive perceptions of GenAI, recognizing its potential for personalized learning, writing assistance, and research support (Chan and Hu, 2023). However, concerns about accuracy, privacy, and ethical issues persist (Chan and Hu, 2023; Yusuf et al., 2024). Gender, degree level, and prior AI knowledge influence students' perceptions of GenAI tools' efficiency, interaction, and affect (Daher and Hussein, 2024). Cultural dimensions significantly correlate with views on GenAI benefits and concerns, highlighting the need for culturally responsive policies (Yusuf et al., 2024).

Yusuf et al. (2024) make substantial contributions to understanding the cross-cultural implications of GenAI in higher education (Yusuf et al., 2024). Their large-scale survey of 1217 participants from 76 countries offers a comprehensive view of student usage, benefits, and concerns. The study's multicultural perspective is a crucial strength, allowing for a more nuanced understanding of how cultural influences influence views and use of GenAI. The complete data collected on many elements of GenAI usage, such as awareness, familiarity, prior experience, intended use, perceived benefits, and concerns, provides a holistic picture of student interaction with this technology. Critically, the work addresses ethical issues surrounding GenAI, such as academic dishonesty and the need for ethical rules. Regardless of its strengths,

the study's approach deserves consideration. While the huge sample size is favorable, online surveys have disadvantages, such as self-selection bias and potential disparities in answer quality between ethnic groups, which must be noted. The findings' generalizability to all cultural contexts may be limited, necessitating additional research focused on specific locations or cultural groupings. The scope of the research may also limit the depth of analysis of certain cultural factors. Future research could explore more into the precise cultural reasons underlying the observed disparities in views and behavior. Finally, while the study raises concerns and benefits, more research on the practical implications for educators and policymakers is required.

The Bannister et al., 2024 study includes numerous significant contributions (Bannister et al., 2024). It focuses on the frequently ignored interactions of overseas students with generative AI in higher education. By examining academic integrity regulations, it provides insights into how institutions are responding to GenAI and its implications for academic honesty, providing potential best practices. Furthermore, the study situates its analysis within the broader context of higher education commodification, exploring how this trend might influence international students' interactions with GenAI. Despite its strengths, the study has some limitations. The analysis of 142 higher education institution policies may not fully represent global practices, potentially limiting the generalizability of the findings. Additionally, the study focuses solely on policy analysis and doesn't directly incorporate the perspectives of international students themselves. Gathering their input would provide a richer understanding of the challenges and opportunities they encounter. Finally, similar to Yusuf et al., 2024, the study lacks specificity regarding the GenAI tools relevant to international students, which hinders the development of practical recommendations.

The two studies offer differing perspectives on GenAI's impact on higher education. Yusuf et al. provide a comprehensive overview of student perceptions across diverse cultural contexts, while the other study investigates institutional responses and the particular challenges confronting international students. Synthesizing the findings, two key takeaways emerge: First, cultural context is crucial, as cultural values influence how students perceive and use AI, underscoring the need for culturally sensitive approaches to AI integration in education. Second, policy gaps exist, as academic integrity policies may not adequately address the challenges posed by AI, especially for international students. It is imperative that institutions adapt their policies to ensure fairness and academic integrity amid the increasing prevalence of AI-based technologies. International students may be particularly susceptible to the ethical and practical challenges associated with GenAI, necessitating tailored support and resources to address their unique needs.

Further research is required to elucidate the interplay between cultural contexts, institutional policies, and student experiences, with the goal of developing effective strategies for the responsible integration of GenAI in higher education. Gathering qualitative data from diverse student populations, including international students, would enhance understanding and inform the implementation of more efficacious intervention strategies. Additionally, a focus on specific GenAI tools and their functionalities would provide more practical guidance for educators and policymakers.

Daher and Hussein's (2024) research looks into higher education students' opinions of Generative AI tools for learning, focusing on four essential components: efficiency, interaction, affect, and intention (Daher and Hussein, 2024). Their mixed-methods approach, which includes a questionnaire with 153 responses and interviews with ten students, provides a detailed knowledge of student viewpoints. The key findings show that GenAI tools are typically viewed positively. Students expressed medium levels of perceived efficiency and interactivity with the tools, as well as a strong intention to use them for learning. Affect, or the emotional response to GenAI tools, was also recorded at a moderate degree. The study also investigates demographic aspects. Male students had considerably greater judgments of efficiency, affect, and intention than female students, but perceptions of interaction did not differ significantly between genders. Surprisingly, only the level of degree pursued altered the perception of interaction, with Ph.D. students reporting higher levels than B.A. Furthermore, prior technology and AI expertise were found to be favorably connected with perceptions of efficiency, interactivity, and impact. While the study provides useful information, some limitations must be acknowledged. While the sample size is appropriate for the questionnaire, it is very small for the interviews, which may restrict the generalizability of qualitative results. The study's concentration on a single university may limit the conclusions' wider application. Future study could evaluate these perspectives in a variety of institutional and cultural contexts, as well as the long-term influence of GenAI tools on educational results.

Previouse studies explores university students' perceptions and experiences with generative AI

tools in educational settings and cover a range of topics related to AI in education, from specific GenAI tools to broader AI applications. They employ various methodologies, including surveys, systematic reviews, and policy analyses (Abdaljaleel et al., 2024; Almaraz-López et al., 2023; Aravantinos et al., 2024; Bosch et al., 2023; Chan and Hu, 2023; Chan and Zhou, 2023c; Lavidas et al., 2024; Parissi et al., 2023) The findings indicate that students generally have positive attitudes towards GenAI, recognizing its potential for personalized learning, writing assistance, and research support. However, concerns about accuracy, privacy, and ethical implications persist (Abdaljaleel et al., 2024; Chan and Hu, 2023). Influential factors such as ease of use, social influence, and perceived usefulness significantly impact students' attitudes. While these studies provide valuable insights into various aspects of AI adoption, they often lack a comparative cross-cultural perspective comparison that allows a deeper understanding of how cultural factors might influence perceptions and usage of GenAI, which is crucial for developing effective and culturally sensitive strategies for AI integration in higher education

Empirical research on potential gender differences in attitudes toward technology use has been active for several decades, reflecting the long-standing concern about the gender gap in the technology workforce. However, inconsistent findings across individual studies make it difficult to draw firm conclusions on this issue (Daher and Hussein, 2024; Gesser-Edelsburg et al., 2024). Gender differences in students' attitudes toward the use of GenAI tools are rarely reported. While one study found that gender did not have a direct impact on attitudes toward emerging technologies (Alghamdi et al., 2022; Baidoo-Anu and Ansah, 2023; Pellas, 2023) other findings have suggested a moderate effect (Xia et al., 2023; Zhou and Sanfilippo, 2023). Therefore, the question of whether attitudes toward technology use differ significantly based on gender remains unclear, warranting further research (Strzelecki, 2023).

Research on university students' attitudes toward GenAI tools across disciplines is inconclusive. While some studies indicate differences (Alzahrani, 2023; Kelly et al., 2023b; Smith and Storrs, 2023) others report no differences (Chan and Hu, 2023). Students in science and engineering appear to have greater awareness, experience, and confidence in using GenAI compared to healthcare students. However, research is limited, and further exploration of disciplinary differences is needed (Chan and Hu, 2023; Kelly et al., 2023b). A study at an Australian institution revealed most students lacked knowledge, expertise, and confidence in using these technologies (Kelly et al., 2023b). Findings varied by discipline and student subgroups, including international and mature students. Yet, some students felt comfortable with tools they had not used before .

Research suggests university students perceive GenAI as a useful and enjoyable learning resource that improves functionality and comprehension. Perceived value strongly predicts their intention to use it, though concerns about accuracy, privacy, and ethics are also expressed.

Students use tools like Grammarly and Criterion for formative writing due to their instant feedback on grammar, spelling, and punctuation (Rejeki, 2023; Shadiev and Feng, 2024). QuillBot is used for paraphrasing and summarizing (Rejeki, 2023). An experimental study found Grammarly students viewed the feedback as clear and helpful, despite no writing development differences (Shadiev and Feng, 2024). Those unfamiliar may struggle to understand Grammarly's feedback (Fan, 2023).Studies show AI tools like Plot Generator and chatbots enhance language acquisition and communication in the target language by aiding grammar and brainstorming (Chigwada and Pasipamire, 2024; Liu et al., 2024). Gayed et al. found students perceived a GenAI tool based on GPT-2 as user-friendly and effective for improving English (Gayed et al., 2022). Raman et al. investigated students' intentions to use ChatGPT in Indian higher education (Raman et al., 2023). Students believe AI can be useful in academic administration and teaching, but not for admissions, testing, or placements. ChatGPT adoption was highly influenced by innovation, compatibility, and user-friendliness. Gender differences emerged, with males preferring compatibility, usability, and observability, and females preferring usability, compatibility, relative advantage and trialability. A study on ChatGPT acceptance found social influence, performance expectancy, and effort expectancy significantly impact behavioral intentions (Strzelecki and ElArabawy, 2024). Gender and study level moderated relationships, but results were inconclusive. Research conducted at Vietnamese University on the benefits of ChatGPT among 230 students revealed that they considered it to save time, provide information in various areas, offer personalized tutoring and feedback, and illuminate ideas in writing (Ngo, 2023). However, one of the main concerns indicated by students is their inability to assess the quality and reliability of sources, accurately cite sources, and use idioms and synonyms correctly.

Materials and Methods

The ontological stance of the researcher is rooted in objectivism, which posits that reality, in this context artificial intelligence (AI), exists independently of the actors involved, specifically the students. The epistemological position adopted by the researcher is positivism. Positivists maintain that objective scientific facts can only be gathered through empirical methods. Consequently, the research strategy employed by positivists is grounded in quantitative research methods. Within this framework, research findings are regarded as objective and generalizable. As a scientific approach that emphasizes structure, quantification, generalization, and testable hypotheses, the deductive approach is predominantly aligned with positivist research philosophy. The research strategy of the investigator is exploratory, as exploratory research seeks to investigate or clarify the understanding of a particular question, issue, or phenomenon, namely AI in this study.

This exploratory research had two objectives. The first objective was to determine the practices of students regarding the use of artificial intelligence (AI), specifically ChatGPT, and AI-based tools. The second objective was to ascertain the attitudes of students toward AI. A quantitative research strategy and a survey were chosen as the research tools.

By employing statistical methods, quantitative approaches not only facilitate the numerical description of phenomena but also assist in identifying relationships between two or more variables, which is the intent of the researcher in this study. Surveys are particularly suitable for inquiries regarding attitudes, and scales are widely utilized in questionnaires within the social sciences.

The research was conducted at universities in two non-English speaking European countries, Serbia and Austria, from December 2023 to February 2024 in Serbia and from January to February 2024 in Austria. The initial sample was intentionally selected from individuals who studied in Serbia or Austria using purposive sampling techniques. In the context of purposive sampling, participants are selected based on specific characteristics predetermined by the researcher, which in this instance are students, as their perspectives on artificial intelligence constitute the focal point of the study. However, the method for obtaining scores within that sample was random. This randomness aids in mitigating the influence of both known and unknown factors through the random selection of cases. Ideally, such randomization techniques afford each individual within the population an equal opportunity to be included in the sample, and, more critically, facilitate the application of inferential statistical methods during the analysis of the results.

The survey was anonymous, and participation in the student survey was voluntary. The responses were collected electronically through a questionnaire created using Google Forms. The online questionnaire was completed by 240 respondents, three of whom were not students. Those three respondents were excluded as invalid. The sample of Serbian students comprised 202 participants, significantly larger than the sample of Austrian students, which consisted of 35 participants. The sampling process in Austria was administered by the institution, limiting the researchers' ability to influence the number of respondents. Consequently, the research process extended over three months, during which the number of students in both groups, categorized by country of study, did not reach a satisfactory level for conducting statistical tests based on a priori power analysis results. Based on the central limit theorem, statisticians have established that a sample size of 30 or more typically yields a distribution of means that closely approximates a normal distribution. Consequently, a recommendation of a minimum sample size of 30 for statistical analyses serves as a valuable practical guideline for the least number of cases in each category within the overall sample, as the authors achieved in this research. All participants provided their consent to participate in the research and to use the obtained results for academic purposes in writing a scientific paper.

The survey was created in three languages: Serbian for Serbia, German for Austria, and English for the purpose of writing this paper. The questionnaire consisted of 30 questions, five of which were demographic questions, while one was an open-ended question for participants' comments. In terms of measurement, the closed-ended questions in the survey were categorized as scale types, specifically ordinal and nominal. The questionnaire included two new scales created specifically for this research, namely, the AI tools, which is composed of 13 questions, and the attitudes toward AI, which consists of 7 questions. The Likert scale, recognized as the most commonly utilized type of scale in research, was also selected for this study. Participants' attitudes and opinions were assessed on a scale ranging from 1 to 5, where 1 indicated complete disagreement and 5 indicated complete agreement. Descriptive measures

and parametric statistical techniques were employed, including the power test, independent samples t test (Student's, Welch's, and Yuan's), Bayesian independent samples t test, one-way analysis of variance (ANOVA), Bayesian ANOVA, two-way between-groups ANOVA, and correlation (Pearson product–moment correlation coefficient).

Parametric tests are generally regarded as more robust than non-parametric tests, and their use is recommended in social research. An a-posteriori power analysis was conducted to ascertain the true effect size, thereby confirming the sensitivity of the tests. For hypothesis testing in this quantitative study, t-tests were employed for two variables, while ANOVA was utilized for three variables. In light of the selection of parametric tests, both the traditional Student's t-test and Welch's t-test were applied for variables with unequal variances, along with Yuan's test or robust t-test for variables where there was a risk of Type II error based on the power analysis. Finally, to examine the impact of two independent variables in combination on a dependent variable, a two-way between-groups ANOVA was employed. Reliability analysis and factor analyses (principal component analysis and principal axis factoring) were conducted to test the scales. The data analysis was conducted using IBM SPSS Statistics 25 (for descriptive statistics, t-tests, and two ANOVAs), JASP 0.18.3 (for power analysis and factor analysis), and jamovi 2.3.28 (for Bayesian tests and robust t-tests).

Results

Responses were obtained from 337 valid participants (N=337), of whom 202 (85.23%) were from Serbia and 35 (14.77%) were from Austria. In terms of gender, the majority (158 or 67%) were female, 77 or 33% were male, and two students chose not to disclose their gender. The highest number of students belonged to the business studies field (40.93%), followed by students in the technical sciences (31.65%) and social sciences (14.35%). The remaining students accounted for less than 10% of the sample, including natural sciences (6.33%), medicine (5.06%), arts (1.27%), and one student in humanities (0.42%). For the purpose of the ANOVA tests, these seven groups of students were divided into three groups, namely, 97 students in business studies, 75 students in technical sciences, and 65 students in other fields of study. In terms of academic year, the highest number of students were in their first year (93), followed by fourth-year students (71), third-year students (27) and second-year students (21) following suit. There were 20 master's students in the sample and five doctoral students. These students were also grouped into three groups for the purpose of ANOVA: the first group consisted of students in the first two years of undergraduate studies (48.10%), the second group consisted of students in the second two years of undergraduate studies (41.35%), and the third group consisted of graduate students (10.55%).

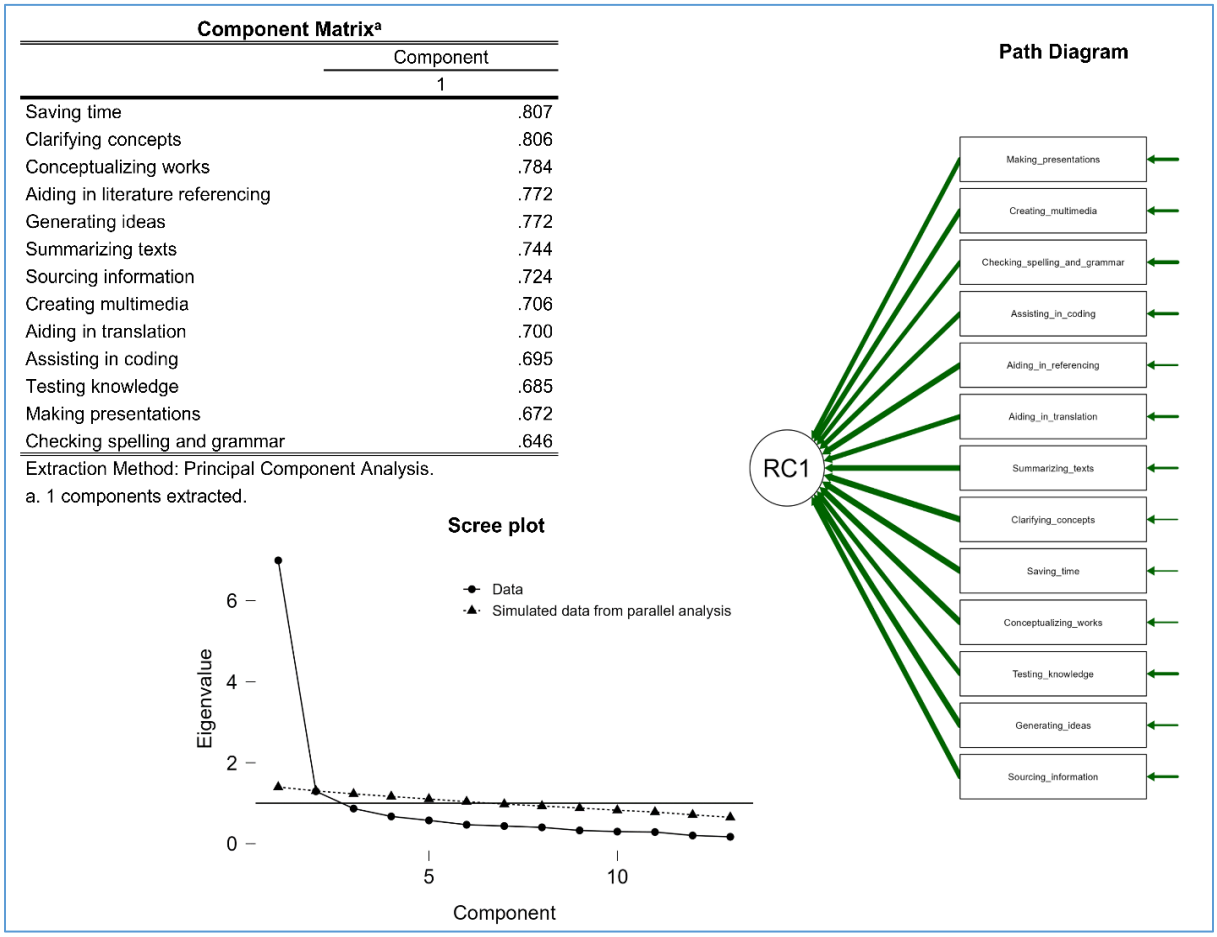
To determine which existing AI tools students utilize in their work, we developed a scale called "AI Tools", which consists of 13 variables, and calculated the mean values (Table 1). Subsequently, we assessed the reliability of the scale. The resulting Cronbach's alpha coefficient was .927. Consequently, we can assert that the internal consistency of our "AI Tools" scale, comprising 13 items, is truly exceptional, as values above 0.8 are preferred.

To assess the honesty of the respondents, particularly whether they provided automatic responses to Likert-type questions in these self-administered surveys, Harman's single-factor test was conducted. We performed a principal axis factor analysis with one fixed factor and obtained a result of 48.20%, indicating that a single factor accounts for 48.20% of the variance in the data, which falls below the threshold of 50%. This implies that there is no issue of common method bias.

Table 1. *Results of the AI tools scale, in descending means*

	N	Mean	Std. Deviation
Saving time	237	3.30	1.581
Sourcing information	237	2.98	1.493
Clarifying concepts	237	2.90	1.469
Summarizing texts	237	2.87	1.530
Generating ideas	237	2.81	1.394
Aiding in translation	237	2.64	1.561
Conceptualizing works	237	2.57	1.387
Average grade	237	2.54	1.051
Testing knowledge	237	2.46	1.439
Assisting in coding	237	2.23	1.459
Aiding in literature referencing	237	2.22	1.415
Checking spelling and grammar	237	2.16	1.364
Making presentations	237	2.04	1.374
Creating multimedia	237	1.82	1.170
Valid n (listwise)	237		

Figure 1. Factor Analysis of the AI tools scale



The 13 items of the Attitude toward AI Scale were subjected to further analysis through principal component analysis (PCA). We conducted a factor analysis and determined that our scale is suitable for analysis, as indicated by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, which yielded

a value of .911, surpassing the recommended threshold of .6. Additionally, Bartlett's test of sphericity yielded statistically significant results ($p < .001$). The component matrix highlights the factor loadings for the tasks associated with AI usage. All items loaded strongly onto a single component (RC1), representing the practical benefits of AI tools. Tasks with the highest loadings include "Saving time" (loading = 0.807), "Clarifying concepts" (loading = 0.806), and "Conceptualizing works" (loading = 0.784). Lower, but still significant, loadings include tasks such as "Making presentations" (loading = 0.672) and "Checking spelling and grammar" (loading = 0.646). The scree plot confirms the retention of one component, with the first component demonstrating a significantly higher eigenvalue compared to subsequent components. Through principal component analysis and examination of the screeplot (Figure 1), we identified the presence of one component with an eigenvalue of 6.99, explaining 53.80% of the variance. The path diagram illustrates the single-factor solution, with all observed variables loading onto the latent construct (RC1). The Oblimin rotated solution demonstrated the presence of a simple structure, with all variables strongly loading onto a single component, as depicted in Figure 1. The diagram visually emphasizes the broad utility of AI tools across a wide range of academic tasks. Given that this scale encompasses a comprehensive list of AI tools, the unidimensionality of the scale was not unexpected. The findings highlight the broad acknowledgment of artificial intelligence's significance among students in enhancing and optimizing both cognitive and practical processes.

To determine attitudes toward AI for the purpose of inferential statistical tests, we developed the "Attitude toward AI" scale. Originally, this scale consisted of 7 variables, 3 of which were negative and were reversed for further testing (Table 2). The calculated Cronbach's alpha coefficient was .780. Hence, we can infer that the internal consistency of our original scale is satisfactory, as values above .7 are deemed acceptable. Nevertheless, one item in our scale (AI should be strictly limited and controlled Transformed) exhibited a negative correlation during testing. Upon its exclusion from the scale, the Cronbach's alpha coefficient for the remaining six items increased to a more favorable .795, with no negative correlation observed during testing. The revised scale (Table 3) served as the foundation for all subsequent tests. Principal axis factoring analysis revealed that there was no common method bias in our new Attitudes toward AI scale data, as 47.65% of the variance on a single factor was below the threshold of 50%.

Table 2. *The results of the first Attitudes toward AI Scale, in descending means*

	N	Mean	Std. Deviation
AI represents a remarkable technological advancement	237	3.86	1.200
The emergence of AI tools is a positive thing	237	3.35	1.207
I am glad that AI has been invented	237	3.17	1.307
Average grade	237	3.14	0.852
I believe that AI is a danger to the human race Transformed	237	3.12	1.296
AI represents an opportunity for the development of human society	237	3.05	1.325
I am afraid of further AI development Transformed	237	2.99	1.397
AI should be strictly limited and controlled Transformed	237	2.40	1.342
Valid N (listwise)	237		

Table 3. *Results of the new and improved Attitudes toward AI Scale, in descending means*

	N	Mean	Std. Deviation
AI represents a remarkable technological advancement	237	3.86	1.200
The emergence of AI tools is a positive thing	237	3.35	1.207
Average grade	237	3.26	0.907
I am glad that AI has been invented	237	3.17	1.307
I believe that AI is a danger to the human race Transformed	237	3.12	1.296
AI represents an opportunity for the development of human society	237	3.05	1.325
I am afraid of further AI development Transformed	237	2.99	1.397
Valid N (listwise)	237		

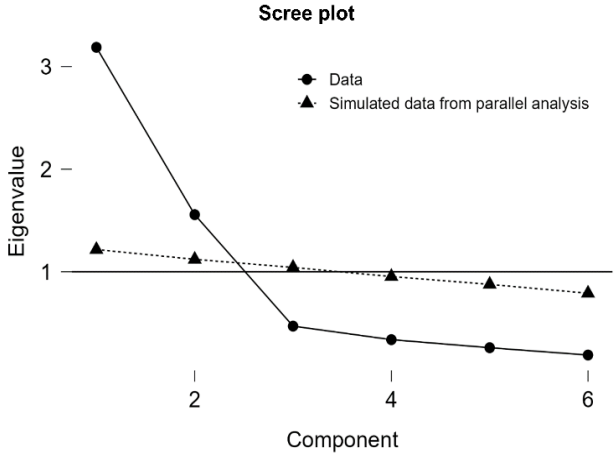
Our novel AI Attitudes Scale could be further simplified through factor analysis. The scale was deemed appropriate for analysis due to the KMO measure of sampling adequacy at .763, exceeding the recommended value of .6. Additionally, Bartlett's test demonstrated statistical significance at $p < .001$. The component matrix reveals the factor loadings for the items, indicating strong correlations between specific items and their respective components. The first component (RC1) is characterized by positive perceptions of AI, including statements such as "The emergence of AI tools is a positive thing" (loading = 0.908) and "I am glad that AI has been invented" (loading = 0.905). The second component (RC2) reflects concerns about AI, as evidenced by high loadings for items such as "I am afraid of further AI development" (loading = 0.844) and "I believe that AI is a danger to the human race" (loading = 0.841). Principal component analysis revealed the presence of two components with eigenvalues exceeding 1 (Figure 2). The scree plot illustrates the eigenvalues of the components, with a sharp decline after the second component. The two components were rotated using an oblimin rotation procedure. The rotated solution, as shown in Figure 2, yielded two interpretable factors that can be interpreted as positive attitudes toward AI (RC 1) and negative attitudes toward AI (RC 2). The two-component solution explained a total of 79.08% of the variance, with Factor 1 contributing 53.13% and Factor 2 contributing 25.95%. All seven items demonstrated clear loadings on either one of the factors, with all values surpassing 0.3. Notably, a very weak positive correlation (p=.183) was observed between these two components. The results suggest a clear dichotomy in participants' perceptions of AI, with RC1 capturing positive attitudes and opportunities related to AI, and RC2 reflecting apprehension and fear of its potential consequences. This dual perspective highlights the complexity of students' attitudes towards AI and underscores the importance of addressing both opportunities and risks in discourse surrounding AI development.

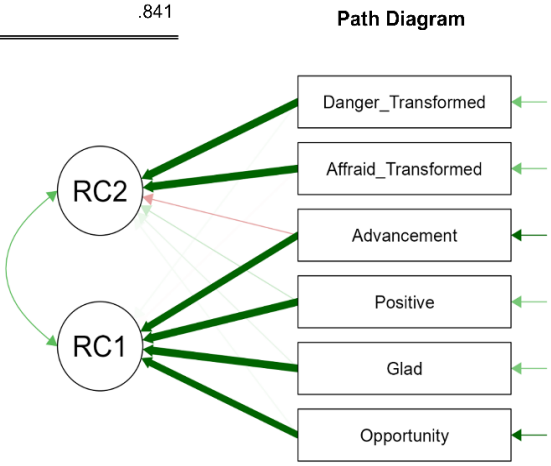
Figure 2. Factor Analysis of the Attitudes toward AI Scale

Component Matrix[a]

	Component	
	1	2
The emergence of AI tools is a positive thing	.908	
I am glad that AI has been invented	.905	
AI represents an opportunity for the development of human society	.819	
AI represents a remarkable technological advancement	.790	
I am afraid of further AI development Transformed		.844
I believe that AI is a danger to the human race Transformed		.841

Extraction Method: Principal Component Analysis.
a. 2 components extracted.





The initial step was to examine the strength and direction of the correlation of the linear relationship between our interval-level variables, which will serve as dependent variables in further tests, namely, (1) Attitudes toward AI Scale, (2) Rating of the usefulness of the ChatGPT question, and (3) Consideration

of using ChatGPT as cheating in an academic setting. The Shapiro-Wilk test for multivariate normality was not statistically significant ($p = .246$), leading to the selection of a more robust parametric test, the Pearson product–moment correlation coefficient (r). Two out of the three correlations were statistically significant. There was a significant, moderate positive relationship between the Usefulness of ChatGPT and Attitudes toward AI ($r = .514$, $n = 229$, $p < .001$). Additionally, a statistically significant correlation was found between Cheating and the Usefulness of ChatGPT ($r = -.309$, $n = 229$, $p < .001$) of a lower magnitude than the previous one but still present, with the strength of this negative relationship being low. There was a negligible, negative and nonsignificant correlation between the Cheating and Usefulness variables of the ChatGPT ($r = -.103$, $n = 229$, $p = .113$). Overall, the results suggest that if a student highly values the usefulness of ChatGPT, he or she will also have a more positive attitude toward AI, while he or she will hold a more negative attitude toward AI if he or she perceives the use of ChatGPT as an unethical academic practice in terms of being conducive to cheating. Nevertheless, the strength of these relationships is not strong.

For the purpose of parametric techniques, it is necessary to verify the assumptions on which these tests are based. The P value of the Shapiro-Wilk test for all variables was statistically significant, indicating that the assumption of normality was violated. To overcome this bias, we will conduct group testing with the bootstrapping option. All bootstrap results were derived from 1000 samples. We will test the homogeneity of variances and statistical power separately for each group, and if necessary, we will conduct more robust testing. The dependent measured variables that will undergo testing are (1) Attitudes toward AI Scale, (2) How do you rate the usefulness of the ChatGPT question, and (3) Do you consider using ChatGPT to be cheating in an academic setting?

An independent-samples t test was conducted to test the assumption that students ($n = 132$) who use ChatGPT as a learning aid ($M = 3.56$, $SD = 0.819$) have more positive attitudes toward AI than do students ($n = 105$) who do not use it ($M = 2.88$, $SD = 0.873$). A design with group sample sizes of 132 and 105 can detect effect sizes with a very high probability of at least 1 - β = .968 ; Levene's test was not significant. The t test was significant, $t(235) = 6.154$, $p = .001$. The effect size of this difference (.679, *BCa* 95% *CI* [.46, .89]) was large $d = .805$. The associated Bayes factor, $BF_{10} = 2.969 \times 10^{+6}$, suggested that the data were almost 3 million times more probable under the alternative hypothesis than under the null hypothesis. These findings suggest that students who use ChatGPT as a learning aid hold significantly more positive attitudes toward AI compared to their peers who do not.

These two groups of students were also subjected to an independent-samples t test to compare their ratings of the usefulness of ChatGPT. Levene's test showed significance ($p < .05$), indicating a violation of the assumption of equal variance, leading to the use of Welch's t test. As anticipated, ChatGPT users rated the usefulness of ChatGPT to be greater ($M = 3.87$, $SD = 0.903$) than nonusers ($M = 2.52$, $SD = 1.249$). This difference, 1.347, *BCa* 95% *CI* [1.05, 1.62], was significant, $t(183.319) = 9.291$, $p = .001$, and represented an effect of $d = 1.259$. The results of the Bayesian independent samples t test suggested that the chances of the null hypothesis occurring were nearly impossible $BF_{10} = 4.027 \times 10^{+15}$. Additionally, students who do not use ChatGPT ($M = 2.39$, $SD = 1.240$) were more convinced that using this service constitutes cheating in an academic environment, unlike ChatGPT users ($M = 3.02$, $SD = 1.394$). The test was significant, $t(235) = -3.693$, $p = .001$, with equal variances in both groups. The magnitude of the mean difference, -.633, *BCa* 95% *CI* [-.98, -.29], was above medium ($d = -.633$). A Bayes factor of 79 ($BF_{10} = 78.733$) corresponds to strong evidence favoring the alternative hypothesis. The results indicate that students who use ChatGPT perceive it as significantly more useful than those who do not. In contrast, non-users were more inclined to perceive ChatGPT use as academic dishonesty compared to users.

The subsequent step involved comparing the participants from different countries, specifically students from Serbia ($n = 202$) and students from Austria ($n = 35$). With sample sizes of 202 and 35, respectively, this research design can detect effect sizes with a probability 1 - β = .776. This indicates that there is a 77.60% chance of correctly rejecting a false null hypothesis if there is indeed a true effect, which falls slightly below the recommended level of 80%. To overcome this bias and obtain reliable results, a robust variant of the t test known as Yuan's t test will be conducted. These tests also address the issue of unequal variances. A robust independent samples t test was conducted to compare the attitudes toward AI between Serbian students ($M = 3.20$, $SD = 0.908$) and Austrian students ($M = 3.60$, $SD = 0.835$). The difference between the two groups was found to be significant $Yt(25.7) = 2.09$, 95% *CI* [-.807, -.006], $p = .047$. The effect size falls between small and medium, $\xi = .345$. The calculated Bayes factor is BF_{10} =

3.16. Given the alternative and null hypotheses, a Bayes factor of 3 corresponds to a belief of 75 percent in the statement that the alternative hypothesis is true. This finding corresponds to positive evidence in favor of the alternative hypothesis. The same groups of students were subjected to Yuen's test to compare their ratings of the usefulness of the ChatGPT. However, the test did not yield significant results *Yt*(54) = .83, 95% *CI* [-.535, .222], *p* = .410. Furthermore, no significant association was found between these two groups of students from different countries regarding whether the use of ChatGPT constitutes cheating at the university *Yt*(32.3) = .078, 95% *CI* [-.603, -.558], *p* = .938.

The significant difference in attitudes toward AI between Serbian and Austrian students suggests that cultural or contextual factors may influence perceptions of AI. The non-significant results for ratings of ChatGPT's usefulness suggest that students from both Serbia and Austria share similar perceptions of its utility. Similarly, the non-significant difference in perceptions of ChatGPT use as academic cheating indicates that both Serbian and Austrian students hold comparable views on this ethical issue. These findings highlight subtle but important differences in attitudes toward AI between students from different countries, emphasizing the need to consider cultural and contextual factors in studies of AI perceptions. However, shared perceptions regarding the usefulness and ethical implications of ChatGPT suggest that some views transcend national boundaries, reflecting the universal nature of students' experiences with AI in education. The lower statistical power (1 - β = .776) in this analysis slightly reduces the ability to detect true effects. Moreover, the small sample size for Austrian students ($n = 35$) limits the generalizability of the findings for this group. Future research could address these limitations by including larger and more balanced samples from different countries.

Finally, it is possible to test independent variables by student gender. These groups are not equal, but they are relatively large, with 77 male students and almost double that of 158 female students. Power analysis detected a probability of at least 1 - β = .948 to detect a true effect in independent samples t tests. Of the three tests conducted, two were found to be significant, and the assumptions of homogeneity of variances were not violated. The test regarding cheating through ChatGPT did not show statistical significance *t*(233) = 1.088, *BCa* 95% *CI* [-.169, .569], *p* = .284, *d* = .15. However, on average, male students ($M = 3.51$, $SD = 0.931$) had more positive attitudes toward AI than female students ($M = 3.14$, $SD = 0.877$). This difference, .373, *BCa* 95% *CI* [.096, .629], was found to be significant, *t(233)* =-3.693, *p* = .005, and represented an effect of *d* = .416. A Bayes factor close to ten ($BF_{10} = 9.698$) corresponds to positive evidence in favor of the alternative hypothesis. Moreover, a statistically significant difference was also found between the observed groups and their attitudes toward the usefulness of the ChatGPT *t(233)* =2.106, *p* = .035. This difference in means (.368, *BCa* 95% *CI* [.032, .698]) indicated a small effect *d* = .293; the Bayes factor $BF_{10} = 1.20$ was barely worth mentioning. There was no significant difference between male and female students' perceptions of whether using ChatGPT constitutes cheating. The significant difference in attitudes toward AI indicates that male students generally hold more favorable views than their female counterparts. Although male students rated ChatGPT as slightly more useful than female students, the small effect size and the weak Bayes factor suggest that this difference is of limited practical significance. These results suggest that while gender may influence general attitudes toward AI, its impact on ethical concerns and specific perceptions of usefulness is less pronounced.

We performed several parametric ANOVAs to examine the potential significant differences among the means in our sample of students in different study years. The students were grouped into three categories for the purpose of ANOVA: the first group consisted of students in the first two years of undergraduate studies ($n = 114$), the second group included students in the second two years of undergraduate studies ($n = 98$), and the last group comprised graduate students ($n = 25$). Our results indicated no statistically significant findings across all tests, specifically in relation to their perceptions of the utility of ChatGPT (*F(2,234)* = 1.090, *p* = .338), beliefs about the use of ChatGPT as cheating (*F(2,234)* = .350, *p* = .705), and attitudes toward AI (*F(2,234)* = 1.406, *p* = .247). The absence of significant differences suggests that students across different stages of their academic journey perceive the utility of ChatGPT in a similar way. Likewise, students' beliefs about the ethical implications of using ChatGPT appear to be consistent across study years. The lack of significant differences in attitudes toward AI suggests that students' general perceptions of AI remain stable regardless of their academic progress. These findings highlight a notable consistency in perceptions and attitudes toward ChatGPT and AI across different academic levels.

We also conducted tests to examine the differences among students from different fields of study.

For the purpose of ANOVA, all students were divided into three groups: business students (n = 97), technical students (n = 75) and students from other disciplines (n = 65). The results showed that there was no significant effect in these three groups on the variable "the usefulness of ChatGPT" (F(2,234) = 2.555, p = .080) or on the variable "the perception of ChatGPT as cheating" (F(2,234) = .202, p = .817). However, the ANOVA test revealed a significant difference among business students (M = 3.05, SD = 0.899), technical students (M = 3.42, SD = 0.842), and students from other disciplines (M = 3.37, SD = 0.947) in terms of their attitudes toward AI (F(2,234) = 4.336, p = .014, η^2 = .036). Post hoc tests using the Tukey HSD test indicated that a difference at the p < .5 level exists between a subset of the business sciences students and a subset of the technical sciences students. According to Cohen's criteria, the effect size falls between small and medium. The associated Bayes factor, BF_{10} = 2.340, provides weak evidence in favor of the alternative hypothesis. The lack of significant differences suggests that students from various fields of study share similar perceptions regarding the usefulness of ChatGPT. The non-significant results for perceptions of ChatGPT as cheating indicate that ethical concerns about its use are broadly similar across disciplines. The significant difference in attitudes toward AI among the groups points to discipline-specific variations. Specifically, technical students exhibited more positive attitudes compared to business students. These results suggest that while perceptions of ChatGPT's usefulness and its ethical implications are consistent across disciplines, attitudes toward AI vary, particularly between business and technical students.

Finally, we aimed to further test the established statistical relationship between students grouped based on their field of study and their attitudes toward AI by conducting a two-way between-group ANOVA with the introduction of an additional dichotomous factor into the analysis, namely, (1) country of study and (2) gender of the student, as we found a significant statistical association between these variables and attitudes toward AI in t tests. The interaction effect between the country of study and the field of study was not statistically significant, F(1,236) = .156, p = .694. However, the results of a 3 × 2 ANOVA examining the effects of gender and field of study on attitudes toward AI were statistically significant. The means and standard deviations for attitudes toward AI enhancement based on gender and the field of study are presented in Table 5. The ANOVA results (Table 6) indicated a significant main effect for attitudes toward AI, F(7,236) = 3.946, p < .001, *partial* η^2 = .108, a significant effect for gender, F(2,236) = 6.360, p < .002, *partial* η^2 = .053, a significant effect for the three groups of students divided based on their scientific orientation, F(2,236) = 7.715, p < .001, *partial* η^2 = .063, and a significant interaction between gender and field of study, F(3,236) = 2.971, p < .033, *partial* η^2 = .037, which was the most important finding of this test. Post hoc tests using the Tukey HSD test again indicated a difference at the p < .5 level only between a subset of the business sciences students and a subset of the technical sciences students; no difference was established for the subset of other sciences students. These findings highlight the complex interplay between gender and field of study in shaping attitudes toward AI. The significant interaction suggests that educational strategies promoting AI literacy and adoption should account for both academic discipline and gender. Moreover, the lack of interaction with the country of study implies that these results may generalize across different cultural or institutional settings. The significant interaction between gender and field of study is particularly noteworthy. This finding implies that the influence of academic discipline on attitudes toward AI is not uniform across genders. For example, the disparity in attitudes between business and technical students may be more pronounced for one gender than the other.

Table 4. *The means and standard deviations of the factors*

Dependent Variable: Attitudes_towards_AI_NEW

What is your gender?	Three groups of field of study	Mean	Std. Deviation	N
1 Male	1 Business Sciences	3.0269	.93105	31
	2 Technical Sciences	3.7586	.80374	29
	3 Other Sciences	3.9608	.76041	17
	Total	3.5087	.93067	77
2 Female	1 Business Sciences	3.0631	.89000	66
	2 Technical Sciences	3.2000	.80920	45
	3 Other Sciences	3.1773	.92952	47
	Total	3.1361	.87665	158
Total	1 Business Sciences	3.0515	.89861	97
	2 Technical Sciences	3.4200	.84156	75
	3 Other Sciences	3.3718	.94730	65
	Total	3.2560	.90737	237

Table 5. *Two-way ANOVA's Tests of Between-Subjects Effects*

Dependent Variable: Attitudes_toward_AI_NEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	20.916a	7	2.988	3.946	.000	.108
Intercept	219.013	1	219.013	289.259	.000	.558
Gender	9.631	2	4.816	6.360	.002	.053
Field_Grouped	11.683	2	5.842	7.715	.001	.063
Gender * Field_ Grouped	6.748	3	2.249	2.971	.033	.037
Error	173.388	229	.757			
Total	2706.833	237				
Corrected Total	194.304	236				

a. R Squared = ,108 (Adjusted R Squared = ,080)

The results of the two-way ANOVA tests and the t test confirming a statistically significant difference in attitudes toward AI between male and female students lead us to assume that male students in technical sciences hold a more positive attitude toward AI, which in turn leads to positive changes in the application of ChatGPT and new AI technologies. To confirm this assumption, we used the SPLIT command to divide the dataset by gender and repeated the ANOVA test for the effect of study direction and attitudes toward AI separately for female and male students. There was no significant difference in attitudes toward AI among female students only $F(2,155) = .397$, $p < .673$. On the other hand, there was a statistically significant difference at the $p < .001$ level in attitudes toward AI among three groups of male students with different study disciplines $F(2,74) = 8.658$, $p < .001$. Despite reaching statistical significance, the actual difference in mean scores between the groups was quite small. The effect size, calculated using eta squared, was $\eta^2 = .019$. Post hoc comparisons using the Tukey HSD test revealed that the mean score for business students ($n = 31$, $M = 3.03$, $SD = 0.931$) was significantly different from that for students in the technical sciences ($n = 29$, $M = 3.76$, $SD = 0.804$). The third group of students combined with students from all other science disciplines ($n = 17$, $M = 3.96$, $SD = 0.760$) did not differ significantly from the first two groups of students. Finally, a Bayes factor $BF_{10} = 74.813$ corresponds to strong evidence in favor of the alternative hypothesis. These findings provide critical insights into how gender and academic discipline intersect to shape attitudes toward AI. For male students, the field of study plays a notable role, with those in technical disciplines displaying the most positive attitudes. This emphasizes the importance of tailoring AI-related initiatives to leverage the positive predispositions of technical sciences students

while fostering more favorable attitudes among business students. For female students, uniform attitudes across disciplines suggest that other factors (e.g., educational experiences or societal influences) may be more relevant in shaping perceptions of AI.

Discussions

In the observed sample, students demonstrated a high level of use of mobile devices, as all of them used them for academic purposes. However, less than half of them, 44%, do not utilize ChatGPT as a tool. These results are not surprising, considering that mobile devices were predicted to have the second-fastest growth by the end of 2023 (Cisco, 2020). However, from a Serbian perspective, it is important to note that research conducted only four years ago (Stojanović and Domazet, 2020) indicated a very low level of mobile learning usage. Therefore, this recent improvement is significant. Considering the wide usage of ChatGPT, (Duarte, 2024) reported that less than half of the students, 44% of whom used ChatGPT as a tool. There are many reasons supporting this result, ranging from uncertainty about the accuracy, privacy, or transparency of the GenAI tools themselves (Abdaljaleel et al., 2024; Chan and Zhou, 2023c). This means that to help not only students but also all stakeholders better understand and use AI tools in an ethical and responsible way, policies and guidelines should be put in place (McDonald et al., 2024; Miao and Holmes, 2023; Perera and Lankathilake, 2023).

This finding aligns with the average score obtained from the AI tools scale, which is 2.54. There is a slightly above-average use of these tools for academic purposes. This finding implies that students do not fully utilize these tools for academic purposes. As GenAI tools are typically used without supervision or guidance, students may need assistance from their teacher to ensure that they are used correctly and to avoid the risk of misuse (Selim, 2024; Wale and Kassahun, 2024). Some students may use these tools without reflection or scepticism, which can lead to unintentional or intentional plagiarism. In addition, some students may choose not to use writing tools due to scepticism or a lack of effective learning strategies, particularly those who are repeating the course (Burkhard, 2022; Prentice and Kinden, 2018).

According to the results in Table 1, in which AI tools used by students are sorted according to the mean, the variable Saving time achieved the strongest rating of 3.30, which is the only mean above 3.0 on the AI Tools scale. In contrast, the weakest rating of 1.82 and the only rating below 2.0 made the variable Creating multimedia. Above-average ratings, in the range of 2.5-3.0, achieved six variables, i.e., Sourcing information of 2.98, Clarifying concepts of 2.90, Summarizing texts of 2.87, Generating ideas of 2.81, Aiding in translation of 2.64, and Conceptualizing works of 2.57. Finally, the below-average ratings, in the range of 2.0-2.5, scored five variables, i.e., testing knowledge of 2.46, assisting in coding of 2.23, assisting in literature referencing of 2.22, checking spelling and grammar of 2.16, and making presentations of 2.04. These results are supported by previous work indicating that students use AI tools for sourcing information, clarifying concepts, summarizing texts, generating ideas and aiding in translation (Bosch et al., 2023). However, the observed sample showed that tasks such as literature referencing, making presentations, and checking spelling and grammar were used less frequently. It is not surprising that tools for checking grammar and spelling are used less often, as students already use AI tools for translation. Additionally, testing knowledge is field specific, and it is rare to find material that corresponds to class materials and would be helpful for students. However, it is surprising that they reported low usage of literature referencing, which is obligatory in academic work.

The attitudes toward AI scale consisted of seven positive and negative attitudes toward AI. Through reliability testing, the scale was reduced to six items (Table 3), achieving an alpha level of .795 and an average mean score of 3.26. Factor analysis revealed two factors, four positive attitudes toward AI and two negative attitudes toward AI, in line with the initial design of the scale. Component 1 factors, which include positive attitudes, are, in descending order, the following: the belief that the emergence of AI tools is a positive thing (M=3.35), which had the strongest correlation of .908 in Component 1; the belief that AI has been invented (M=3.17), which had the second strongest correlation of .905; that AI represents an opportunity for the development of human society (M=3.05), which achieved a correlation of .819; and that AI represents a remarkable technological advancement (M=3.86), which had the weakest but still a high correlation of .790 in Component 1. Component 2 factors, which include negative attitudes, are, in descending order, fear of further AI development (M=2.99), which had the strongest correlation of .844 in Component 2, and that AI is a danger to the human race (M=3.12), with a correlation of .841. This result is

not surprising considering the novelty of ChatGPT. Watters and Lemanski reviewed the early literature on ChatGPT and discovered a "predominance of negative sentiment across disciplines" that raised concerns about employment opportunities and ethical considerations (Watters and Lemanski, 2023). However, a recent study has shown that people in general have a positive attitude toward the potential of GenAI tools to increase their efficiency and reduce the workload of bureaucratic systems in the future (Bright et al., 2024).

The usefulness of ChatGPT received an above-average and relatively high rating of 3.27. The result is not surprising if we believe that various studies have indicated its usefulness (Abdaljaleel et al., 2024; Bosch et al., 2023; Chan and Hu, 2023). The average rating was 2.67 for the question "Do you consider using ChatGPT to be cheating in an academic setting?" indicates that students do not have a unanimous opinion regarding the use of AI as an academic violation. Correlational analysis revealed that students who highly rated the usefulness of ChatGPT also tended to have more positive attitudes toward AI. However, the more students perceive the use of ChatGPT to be suitable for cheating, the more negative their attitude toward AI becomes. Through parametric t tests, it was determined that students who use ChatGPT have a positive attitude toward AI. Additionally, ChatGPT users rated its usefulness more highly than nonusers did. This finding is expected, as it is reasonable to assume that students who utilize AI would value its capabilities. Conversely, students who do not use ChatGPTs hold stronger beliefs that its usage constitutes cheating in an academic environment. These findings are consistent with previous research showing that students who had never used ChatGPT were more likely to regard it as cheating, whereas those who had previously used ChatGPT were more likely to believe that it is occasionally considered plagiarism. (Bosch et al., 2023). In relation to the country of study, no significant difference was found between students from Serbia and students from Austria regarding the usefulness of ChatGPT and whether the use of ChatGPT constitutes cheating at the university. However, a significant statistical association was found between students' country and their attitude toward AI, indicating that Austrian students have more positive attitudes toward AI than their Serbian counterparts. However, in further analysis, this difference gradually diminishes in favor of the field of study pursued by the students, likely because the majority of Austrian students in the observed sample were enrolled in the technical sciences. No gender differences were found in the test on cheating using ChatGPT, while a weak statistical association was established regarding the usefulness of ChatGPT, and a moderate statistical association was found regarding attitudes toward AI. The study revealed that ChatGPT users had more positive attitudes toward AI than did those who did not use ChatGPT.

ANOVA did not reveal any significant statistical associations among the means of students of different study years across all tests, specifically in relation to their perceptions of the utility of ChatGPT, their beliefs about the use of ChatGPT as cheating, or their attitudes toward AI. Very few studies have investigated students' perceptions within different years of study. One of the few studies showed that first-year students commonly use AI tools for referencing, plagiarism checks, and grammar, in contrast to their older colleagues (Bosch et al., 2023). In two out of three ANOVA tests, no significant associations were found among the means of students from different disciplines and the dependent variable utility of ChatGPT, beliefs about the use of ChatGPT as cheating. However, the ANOVA test revealed a difference among the three groups of students from different disciplines and their attitudes toward AI variables; specifically, a difference existed between a subset of business sciences students and a subset of technical sciences students. A number of studies have indicated that students' attitudes and use of AI tools in various disciplines may vary (Alzahrani, 2023; Chan and Hu, 2023; Kelly et al., 2023b; Smith and Storrs, 2023). The study programmes of technical and engineering disciplines may require the use of such tools, which could be a reason for their high usage. (von Garrel and Mayer, 2023). This could include a possible affinity for technology among students in these areas and/or, considering the gender-specific differences in usage, a greater proportion of male students in these study areas (von Garrel and Mayer, 2023). As we found significant differences in gender and country of study using t tests, we included gender and country of study as additional factors in the analysis of the established statistical relationships between students grouped based on their field of study and attitudes toward AI. The interaction effect between the country of study and the field of study was not statistically significant, but the interaction effect between gender and the field of study achieved statistical significance. The results indicated that male students in the technical sciences hold a positive attitude toward the implementation of new AI technology. The result was confirmed through a new series of ANOVA tests.

There was a statistically significant difference in attitudes toward AI among the three male student

groups with different disciplines, at a significance level of p<.001. Post hoc tests revealed a statistically significant difference in mean scores between technical sciences students and business sciences students. Since the technical sciences students reported higher mean scores, we concluded that the research results are supported. However, it is important to note that the actual difference in mean scores between the groups was relatively small. This small effect size was not surprising, as gender and field of study are two of many factors that can influence positive attitudes toward AI (Alzahrani, 2023; Chan and Hu, 2023; Chan and Zhou, 2023c).

This research has also revealed that male students in the technical sciences are the drivers of positive changes in the implementation of new AI technology and tools, as unequivocally indicated by the results. These are the findings, and the interpretation of these findings, given the exploratory nature of the study and the popularity of the topic, lies with each individual. Those who fear AI may see a danger in a separate group of AI popularizers, but we view them as catalysts for the development of positive attitudes toward AI.

Technical education plays a crucial role in fostering a supportive and motivating environment for AI adoption. Several factors contribute to this trend: Technical education often involves direct interaction with advanced technologies, including AI, which can cultivate a supportive and motivating environment for AI adoption. Students in these fields are frequently exposed to cutting-edge tools and software, helping them develop familiarity and comfort with AI technologies (Al-Momani and Ramayah, 2024). Courses often emphasize problem-solving, innovation, and the practical application of AI, reinforcing positive attitudes towards these technologies. The curriculum in technical sciences typically includes extensive coursework in AI, machine learning, and related fields (Abbasi et al., 2024). This exposure helps students understand the capabilities and potential applications of AI, making them more likely to appreciate and adopt these technologies. Hands-on projects and research opportunities allow students to experiment with AI tools, further enhancing their engagement and enthusiasm. Students in technical fields are aware of the growing demand for AI skills in the job market. This awareness can motivate them to develop a positive attitude towards AI, as proficiency in these technologies can significantly enhance their career prospects (Opiyo, 2024). The prospect of lucrative and innovative job opportunities in AI-related fields acts as a strong incentive. The community and peer network within technical disciplines often value technological advancement and innovation. Positive attitudes towards AI can be reinforced through interactions with like-minded peers and mentors who advocate for the adoption and development of AI technologies (Sun and Pratt, 2024). This supportive network can cultivate an environment where AI is seen as a beneficial and exciting tool. While gender dynamics can vary, technical fields have historically seen higher enrollment of male students, which may influence the overall perception and attitudes towards AI (Park et al., 2023). Male students might experience less stereotypical bias and may feel more confident and motivated to engage with AI technologies due to a more inclusive environment in their technical education.

GenAI tools influence student learning and attitudes through personalized learning, enhanced critical thinking, facilitated knowledge construction, and promoted exploration and creativity (Bahroun et al., 2023; Ogunleye et al., 2024; Samala et al., 2024; Wu et al., 2024). However, addressing surface learning concerns is essential to ensure that these tools contribute to meaningful and comprehensive educational experiences. Incorporating case studies and examples illustrates the diverse applications and potential impact of GenAI tools in education, providing a richer context for understanding their influence on student learning and attitudes (Samala et al., 2024). Research on learning strategies emphasizes the importance of deep processing and active engagement with the material. Future research should investigate how GenAI tools can be designed and implemented to promote deep learning and avoid surface-level engagement. This includes exploring pedagogical approaches that encourage students to critically evaluate AI-generated output and use it as a starting point for deeper inquiry. Generative AI tools can significantly enhance student learning by tailoring educational experiences. These tools adapt to individual learning styles and paces, offering customized resources and feedback that improve comprehension of complex concepts (Imran and Almusharraf, 2024). For instance, adaptive learning platforms powered by GenAI provide personalized problem sets and immediate feedback, enabling students to identify and address their weaknesses while maintaining motivation through achievable goals (Samala et al., 2024). A study on the use of such a platform in a mathematics course demonstrated improved student performance and increased satisfaction with the learning process. This personalized approach exemplifies how GenAI can facilitate more effective and engaging learning experiences (Imran and Almusharraf, 2024). However,

research also cautions against over-reliance on automated systems without human interaction and guidance. Future research could explore the optimal balance between AI-driven personalization and teacher-led instruction. Generative AI tools can foster critical thinking by offering students diverse perspectives and challenging them to analyze and evaluate information (Ogunleye et al., 2024). By generating multiple viewpoints on a topic, these tools encourage students to consider and critique different arguments. For example, in a history class, students utilized a GenAI tool to generate various arguments for a debate on the causes of World War I. The tool presented perspectives from economic, political, and social angles, prompting students to evaluate the validity and coherence of each argument against historical evidence. This exercise broadened their understanding of the topic and honed their critical thinking skills (Ogunleye et al., 2024). Further research could investigate how different GenAI tools and pedagogical approaches can be used to effectively foster critical thinking skills in various disciplines. Generative AI tools can facilitate knowledge construction by helping students link new information with existing knowledge. Through interactive engagement, these tools enable a deeper understanding of subjects. For instance, in a writing course, a GenAI tool assisted students in developing essays by providing suggestions for structure, coherence, and argumentation. This interactive process allowed students to refine their writing and develop a more nuanced understanding of their topics, effectively synthesizing new insights with prior learning (Bahroun et al., 2023; Wu et al., 2024). Generative AI tools can spark exploration and creativity by enabling students to experiment with diverse scenarios and ideas (Ogunleye et al., 2024). These tools can simulate various conditions and generate creative solutions, fostering innovation. In a creative writing class, for example, students used a GenAI tool to brainstorm story ideas and plot twists. The tool offered diverse suggestions based on initial prompts, inspiring students to explore unique narrative paths and experiment with new writing styles and genres, ultimately enhancing their creative capabilities. By providing students with new tools and possibilities, GenAI can encourage them to think outside the box and develop novel solutions. Further research could investigate how GenAI can be used to support different types of creative activities, such as writing, design, and problem-solving. While GenAI tools offer numerous advantages, they also raise concerns about the potential for surface learning (Wu et al., 2024). Students may be tempted to rely on these tools for quick answers without deeply engaging with the material. For instance, if students use a GenAI tool to summarize key arguments for a historical debate, the tool may provide concise summaries but omit crucial context and nuances. Relying solely on these AI-generated summaries could lead to a superficial understanding of the topic. Therefore, educators must integrate these tools thoughtfully, encouraging deep learning and critical engagement with the content rather than mere reliance on AI-generated outputs.

Students' perceptions of generative AI tools are strongly shaped by their prior experiences with these technologies. According to the study students who had positive encounters with GenAI tools rated them highly in terms of efficiency and interaction (Daher and Hussein, 2024). These students appreciated the quick and accurate responses provided by the tools, which aided their learning process. Conversely, students who faced negative experiences, often due to technical issues or inaccurate. The affective component, referring to students' emotional responses to GenAI tools, also plays a crucial role in shaping their perceptions (Roe et al., 2024). Students who felt supported and engaged by the tools reported higher levels of satisfaction and intention to use them in the future. This was highlighted in the same study, where male students and those with higher technology knowledge exhibited significantly higher perceptions of AI tools compared to their counterparts. Similarly, the intention to use GenAI tools was found to be higher among students who had positive affective responses. Another study emphasized that familiarity and willingness to engage with GenAI tools are crucial factors (Chan and Hu, 2023). Students who were more familiar with these technologies tended to perceive them positively and were more inclined to use them in their learning activities. The study also found that students recognized the potential benefits of GenAI tools, such as personalized learning support and assistance with writing and brainstorming. Despite the potential benefits, students also expressed concerns about the use of GenAI tools. These included doubts about the accuracy of the information provided, the risk of overreliance on the tools, and the potential impact on personal development and career prospects. Research on students' perspectives on Generative AI-assisted academic writing highlighted that students encountered AI-related, student-related, and task-related challenges during their use of GenAI tools for academic writing (Kim et al., 2024). These challenges could hinder students' acceptance and integration of these technologies into their learning practices.

Cultural norms play a significant role in shaping students' openness to adopting new technologies like AI. Serbian culture, rooted in strong family and community ties, fosters a collectivist orientation that prioritizes group harmony (Genkova et al., 2022). Conversely, Austrian culture exhibits a more individualistic ethos, emphasizing personal achievement and independence, influenced by the historical legacy of the Austro-Hungarian Empire (Makri and Schlegelmilch, 2017). The development of AI literacy also contributes to students' attitudes. Serbia faces challenges, including low digitalization levels and a shortage of qualified personnel, which may lead to more cautious attitudes towards AI among Serbian students (OACD, 2024). In contrast, Austria's implementation of a comprehensive national AI strategy, integrating AI across various sectors including education, likely fosters a more positive and receptive outlook towards AI among Austrian students (OECD, 2024a). Economic conditions can also influence student attitudes. As a developing economy, Serbia grapples with challenges like unemployment and brain drain, which may foster pragmatism and caution towards future prospects, including those related to AI (OECD, 2024b). Austria's robust and stable economy, coupled with high living standards, likely contributes to a more optimistic and ambitious outlook among Austrian students, potentially increasing their openness to AI's potential benefits (OECD, 2024a). Educational practices are another factor shaping student attitudes. Serbia's ongoing educational reforms aim to enhance quality and accessibility, but outdated curricula and limited resources may impact student motivation and attitudes towards education, including AI-related subjects (OACD, 2024). Austria's well-established education system, emphasizing quality and innovation, promotes critical thinking and a holistic learning approach, likely fostering positive student engagement and a more receptive attitude towards emerging technologies like AI (OECD, 2024a). The contrasting contexts of Serbia and Austria underscore the importance of considering these factors when developing and implementing AI-related educational initiatives. Further research exploring the nuanced interplay of these factors within each national context is warranted.

Generative AI (GenAI) integration in schools requires meticulous planning and consideration, addressing both policy and practice implications. Schools must revise assessment methods and update plagiarism policies to account for GenAI capabilities, with a focus on evaluating higher-order skills like critical thinking and creative problem-solving (Luo (Jess), 2024). Robust data privacy and security policies are essential to protect student information and ensure regulatory compliance (Luo (Jess), 2024). Ensuring all students have access to the necessary technology and resources to effectively use GenAI is crucial, which includes addressing digital literacy disparities (Bahroun et al., 2023). Continuous investment in teacher training and professional development is necessary for effective GenAI integration, including training on technical aspects, pedagogical approaches, ethical considerations, and fostering digital literacy among students (Bahroun et al., 2023; Luo (Jess), 2024). Policies should guide the adaptation of existing curricula and the creation of new learning experiences that leverage GenAI capabilities (Zhao et al., 2024). Integrating Generative AI into teaching and learning practices has significant practical implications. GenAI can personalize learning experiences and automate routine tasks, transforming the educational landscape. To effectively leverage these tools, teachers must adapt their approaches. Classroom management and student engagement also require new strategies when incorporating GenAI. Schools need to develop methods to manage these tools in the classroom and ensure active student engagement (Samala et al., 2024). Furthermore, GenAI can enhance collaboration and communication among students, teachers, and parents. Schools must establish effective strategies to utilize these tools for improved collaboration and communication (Bahroun et al., 2023). Leveraging GenAI, teachers should adapt assessment practices to provide personalized feedback and enable automated grading (Naseer et al., 2024). Additionally, establishing ongoing professional development systems is essential for teachers and administrators to stay updated with AI advancements (Bahroun et al., 2023).

Our study sheds light on students' attitudes toward AI technology and tools in two European countries and contributes to broader discussion on the use of these technologies in education. It is crucial to understand student perceptions in the context of GenAI technologies, as positive perceptions lead to a deep learning approach, while negative perceptions result in a surface approach (Parra-Díaz et al., 2024). To improve GenAI technologies, educators and policymakers should consider the perceptions of students. This will help to promote effective learning outcomes while addressing their needs and concerns. As there are only a small number of research studies on university students' attitudes toward AI tools (Bosch et al., 2023; Kelly et al., 2023b; Raman et al., 2023), particularly in European countries, this study has the potential to raise awareness among educators and learners toward a student-centered approach and the

importance of involving various stakeholders. Furthermore, the study revealed a significant difference in positive attitudes toward AI among students in various technical disciplines. Additionally, a significant difference in positive attitudes was noted among male students.

Conclusions

The attitudes of the students demonstrate the need to consider certain implications for the successful integration of GenAI into higher education. First, studies highlight that a positive attitude toward the use of AI technology for academic purposes is shaped by previous experience with these tools. To make informed decisions about the use of these technologies, institutions should provide educational resources and workshops to familiarize students with GenAI technology and its ethical and societal implications. Furthermore, institutions can develop strategies and interventions to promote positive attitudes toward AI, ultimately enhancing the learning experience for students. Second, the results of the study can be used to develop targeted interventions for different student groups. To foster AI adoption among specific groups of students, it is important to consider individual differences that may influence their perceptions of GenAI. Therefore, to promote the adoption of AI among specific groups of students, it is important to identify the factors that influence their adoption based on their respective disciplines, genders, years of study, and cultural contexts.

Additionally, the development of an AI attitudes scale represents a significant contribution to the field. Currently, there is a shortage of reliable and theoretically supported instruments for assessing students' attitudes toward GenAI, making it difficult to systematically understand the factors that influence their intention to use these technologies. The Attitude toward AI scale fills this void in the literature and provides a solid basis for future research and practice in this field. In addition, the applicability of the instrument to different educational contexts will allow researchers and practitioners to compare the factors that influence the adoption of GenAI among different populations, such as students and educators at different levels, in different countries, or in different academic disciplines. This may inform the development of context-specific interventions and policies to support the adoption of GenAI in higher education, providing valuable insights into the contextual factors that may shape perceptions of GenAI.

When interpreting the findings, it is important to consider the limitations of this study. The sample size was relatively small, which may limit the generalizability of the results to the broader population of students or countries. Additionally, due to the cross-sectional design of the study, it is not possible to examine how students' attitudes change over time as they are exposed to and gain experience with GenAI technologies. Future research should address these limitations by using larger and more diverse samples and employing longitudinal designs to track changes in students' attitudes toward generative AI over time. Furthermore, future research could investigate the influence of AI literacy on a particular cohort of students from diverse academic backgrounds, age groups and cultural contexts.

Based on the findings of this study, the authors recommend several strategies for educators, policymakers, and institutions aimed at fostering a balanced and inclusive approach to the integration of AI among university students. Given that male students, particularly in technical fields, exhibit more favorable attitudes towards AI, educational initiatives should capitalize on these positive inclinations by integrating advanced AI applications and promoting innovative thinking. For female students, where no notable differences across academic disciplines have been identified, the focus should be on developing inclusive and engaging AI-related materials to enhance interest and build confidence across all fields of study.

In light of the comparatively less favorable attitudes towards AI of business students, enhancements to the business curriculum should emphasize the practical applications of AI, such as in analytics, decision-making, and process automation, to clarify the technology's relevance and utility within their discipline. To further capitalize on the positive attitudes of technical students, educational institutions should offer advanced AI courses that highlight real-world applications, ethical implications, and the importance of interdisciplinary collaboration. Students from non-technical and business backgrounds should be encouraged to engage in collaborative AI projects with technical students. This initiative can help bridge the gap in attitudes and familiarity with AI technologies while fostering innovation across disciplines.

Conflict of interests

The authors declare no conflict of interest.

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Author Contributions

Conceptualization, S.A., T.S.T. and V.V.; methodology, S.A.; formal analysis, S.A. and V.V.; writing—original draft preparation, S.A. and T.S.T.; writing—review and editing, S.A. and T.S.T. All authors have read and agreed to the published version of the manuscript.

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Trust to the Mother Among Adolescents From Single-Parent Families and the Structure of Its Predictors

Yulia Mochalova[1*]

[1]Faculty of Psychology, Pedagogy and Defectology, Don State Technical University, Rostov-on-Don, Russian Federation
email: guliya@mail.ru

Abstract: The scientific and psychological validity of the a priori attitude of practicing psychologists and parents in solving the urgent problem of adolescent distrust has been verified that the trusting attitude of adolescents towards parents exists only in the form of opposition; trust or distrust based on a previously developed model for studying ambivalent trust. The aim of the research was to study the features of the classified ratios of trust/distrust to a mother in adolescents from single-parent families and the role of order in the structure of predictors of trust in a mother in these ratios. The study involved adolescent boys and girls, in the number of 177 people aged 15 years, raised in families where the only parent living with a teenager is the mother. The following methods were used: content analysis based on expert assessments; subjective scaling according to specified parameters; statistical technology for developing the construct classification of the trust/distrust ratio; approximation by hyperbolic rank parametric distribution; nonparametric statistics. It was found that 1) only 19% of the respondents have "absolute trust" and "absolute distrust", and the rest have different variants of ambivalent trust ($p<0.01$). 2) significant predictors of adolescents trust in the mother are: a) "trust in me"; b) honesty; c) reliability; d) fairness; e) commitment to fulfilling promises; f) an unappreciative attitude. 3) the average value of the β coefficient is higher in the "positive" variant of ambivalent trust, when adolescents from single-parent families have both trust and distrust of their mother, but trust significantly prevails over distrust.

Keywords: *trust, ambivalence, predictors of trust in the mother, adolescents.*

Introduction

One of the most pressing problems for the modern family in all its psychological and socio-psychological contexts is the problem of children's trust in their parents. If we consider the age aspect, then in adolescence, due to the increasing independence of children from their parents, this problem often becomes the most urgent, both from the perspective of parents and from the perspective of an adolescent (Danilova, 2018; Akbayeva et al., 2020; Clarke et al, 2020; Belousova A. et al., 2023, etc.).

Special attention should be paid to adolescents from single-parent families. The divorce of parents or the death of one of them can have a strong impact on the emotional sphere of children (Nikolaeva L.P. et al., 2019; Jung, 2024).

Analysis of the work of practicing psychologists dealing with this problem (Michalec et.al., 2024; Benjamin, 2024; Skripkina, 2000), showed that the phenomena of trust and distrust are considered only as a mutually exclusive opposition of two states of trust - distrust, and not as a single phenomenon in which there are not only complex relationships, mutual transitions, etc., between trust and distrust, but it is also experienced by the subject of trust in different ways and, at the same time, not always positively.

Parents, if they are trying to solve the problem of distrust on the part of a teenager, strategically "solve" it always only in this context - either he\she does not trust me, or he\she trusts me, without including any intermediate factors, although the role of the latter may be very significant.

Practicing psychologists and parents often identify the phenomena of trust and trustworthiness, which, of course, are interconnected, but far from being identical (Dorofeev V.A., Mochalova Yu.A. (2018)).

In studying the above–mentioned problem, it is necessary to proceed from the theoretical position

*Corresponding author: guliya@mail.ru

that trust and distrust can exist in the form of mutually exclusive opposition - either trust or distrust of an adolescent. In the works on the study of adolescents' trust in parents, this option is the theoretical basis of the research presented in them.

The "either... or.." option reflects the relationship of the sum between trust and distrust and the linearity of the space of their interaction, in which instantaneous inversions from trust to distrust are simply excluded, although as obvious experience shows, from adolescents' trust to distrust in parents there is sometimes only "one step". It can be assumed that there are states that we associate with the ambivalence of trust, which are the hidden basis of inversions.

In their work based on the logic of statistical generalizations on the trust-distrust ratio, Zybleva, 2017 identified nine zones of ambivalence of trust, classified at the level of a qualitative scale, potentially affecting the above-mentioned inversions in different ways. Two variants have a positive background in relation to the "psychological well-being" of the subject of trust (zone D and zone B in the diagram) and seven variants have a negative background - zones I – VII in the diagram. In addition, we have identified two more zones defined by two modes of trust (the first "trust" is denoted by the letter "D" - trust is the maximum possible, but there is no distrust, and the second - "distrust" is denoted by "N" - there is no trust, but distrust is the maximum possible).

In accordance with the above, the problem of adolescents' trust in parents can be studied from the position of parents in relation to an adolescent , as well as from the position of adolescents in relation to parents. These positions do not coincide in the vast majority of cases of this problem. Of course, when solving a problem, the best option is to integrate parents and adolescents, but the reality is that it is impossible to solve this problem and the only thing that needs to be recognized is that it is more important to "be" in the position of an adolescent when solving it.

In studying the above–mentioned problem, it is necessary to proceed from the fact that there are a huge number of predictors (different authors use different terms to denote them - causes, imperatives, conditions, factors, qualities, etc.) and they have a very different ontological status, and that when studying trust in parents, their empirical validity is very important.

An analysis of works in this area has shown that over the past 10 years there have been no works in which predictors of trust in parents would be the subjects of a separate study, although there are works in which such a task is set, but, for example, O.A. Zybleva identifies the phenomena of trust and trustfulness in the text (Danilova, 2018), which, although being related have different psychological nature.

In the works of Danilova Yu.Yu., predictors of trust in parents are a phenomenological background for the study of self-confidence (Krasnova, 2012). As for publicly available Internet sources, their contents have a literary status rather than have a well-developed empirical basis.

Trust in parents appears as a result of the action of several predictors. In a situation of multi-predictor trust in parents, two conditions - a single psychological organization of an adolescent and the presence of a functional relationship between predictors - can lead to the fact that they collectively form a structure characterized by a certain order in which the whole is not a product of the properties of its individual parts (predictors). Here it is worth paying special attention to what we will understand by the order in the structure of predictors of trust.

The fact is that when "adapting" the basic provisions of the theory of systems in different scientific disciplines, problems and confusion arise with the key definitions of this theory. This also applies to such basic concepts as "structure", "order", "structurality". In relation to psychology, very few researchers pay attention to the relative ontological autonomy of the content that they designate.

After analyzing the literature, we found that only O.V. Krasnova presents her criteria for using the concepts of "structure" and "structurality" in systemic research in psychology (Dorofeev, 2019).

When studying the order in the structure of the determinants of trust in the leader, V.A. Dorofeev (Arapov, Efimova, Schrader, 1975) believes that the basis may be the study of the balance between the functional significance of these determinants, the quantitative expression of which are the parameters of the hyperbolic H-distribution ranked by the parameter. The conclusion about the order in the structure of the system can be made based on the interpretation of the rank coefficient β, which characterizes the degree of steepness of the hyperbola: the higher the value of β, the more stable the structure is (Kudrin, 1993; Mochalova, 2016, etc.). With an increase in β, the values of which are limited by the upper limit, order and stability in the structure become higher, but at the same time adaptive capabilities decrease under conditions of change (Subbotin, 2011).

To study the order in the structure of predictors of adolescent trust in parents, it is very important to conduct a qualitative classification of these predictors. This is determined by the fact that classification is the basis for constructing the structure of any phenomenon (Vyatkin, 2009, etc.) and in the theory of discrete systems (a classified set is a variant of the discreteness of elements), one of the options for ordering the structure is to reduce the number of elements, since "..... the more parts the system is divided into, the more chaotic and less orderly its structure becomes " (Kim, Uichol, Park, Young-Shin, 2023, et al.).

Considering the above, we put forward the following hypotheses.

Hypothesis 1: Absolute adolescents' trust or distrust to the mother from single-parent families is no more common than various variants of ambivalent trust in her

Hypothesis 2: The peculiarities of the relationship between adolescents trust and distrust to the mother from single-parent families are manifested in the peculiarities of the order of the structure of predictors of trust in the mother.

Materials and Methods

The study involved girls and a boy from single-parent families, where the only parent living with the child is only the mother. Taking into account the fact that the ethnocultural characteristics of a teenager's family may manifest themselves in trust in the mother, we conducted measurements in grades 9 of the Rostov-on-Don MAEI (municipal autonomous educational institutions), taking into account the relative homogeneity of the subjects according to ethnic and religious criteria (Gurina, 2009). Since the acceptable average approximation error was assumed to be 15%, 177 adolescents from single-parent families aged 15 years participated in the main study with subsequent analysis of these results.

Different groups of methods were used: a) content analysis using expert assessments; b) sujective scaling according to specified quantitative parameters; c) technology for developing a statistical construct of qualitative classification of the ratio of trust and distrust; d) mathematical and statistical approximation of empirical data to find the parameters of a hyperbolic rank parametric distribution.

a) Content analysis using expert assessments was used to identify predictors of maternal trust in adolescents from single-parent families. The subjects were asked to write a short, non-standardized essay on the topic "What do you think your mother would have, that would be the basis for your trust in her." Instructions: "I will trust my mother if she.... (continue). Write down all the answers that come to your mind, because there are no right or wrong answers in this task. You can answer in monosyllables (one, two, three words) or in detail." Two psychology teachers at the university, one practical psychologist and one school psychologist acted as experts. During the expert assessment, the measure of consistency of their opinions was checked. Due to the fact that it was impossible to apply any numerical estimates to solve this problem, we found it reasonable to consider valid those options that all four experts have.

b) Subjective scaling according to the specified quantitative parameters was used in two organizational variants, taking into account the tasks that were solved on them. The first option was used to study the measure of adolescents' trust and distrust to the mother from single-parent families. Two unipolar scales (trust and distrust) were used. The choice of this method was due to the fact that it gave a relatively "direct" assessment of the studied variables, without "imposing" evaluation criteria on respondents. The number of gradations on the scale is from 0 (minimum) to 10 (maximum). The left pole of the scale (0 points) was characterized by a complete lack of trust/distrust, the right pole of the scale (10 points) was characterized by absolute trust/distrust. To increase the validity of empirical results, measurements on the scale of "trust" and "distrust" were carried out anonymously (the subjects were assigned numbers) and measurements of of trust and distrust were carried out at intervals of several days (4 days). The second option was used to study the quantitative relationship between predictors of adolescents trust to the mother from single-parent families. The research technique proposed by V.A. Dorofeev (Gurina, 2009) was used only in relation to our research situation. Due to the fact that a priori the interaction of predictors was considered additive (sum), the subjects were asked to distribute only 24 points (6×4=24) among 6 predictors, identified by experts during content analysis, in accordance with the opinion of the subjects about the significance of predictors of their trust in the mother in the aggregate of all six.

c) The development of a statistical construct for the qualitative classification of the ratio of trust and distrust was carried out using the following technology. 1) Creating a single scale by combining the results of trust and distrust into one sample, followed by joint normalization (standardization) in order to statisti-

cally substantiate trust and distrust (determine whether trust/distrust belongs to one or different samples) distributed according to Gauss's law. 2) Construction of a coordinate system with orthogonal axes based on trust and distrust and the origin of coordinates at the intersection of averages (value 0) and construction of confidence intervals. 3) Determination by individual jointly normalized values of trust and distrust in their ratio of the zone in which the subject is located.

d) Mathematical and statistical approximation of empirical data to find the parameters of the hyperbolic rank parametric distribution of the quantitative ratio between predictors of maternal trust in adolescents from single-parent families was carried out by the method proposed by R.V. Gurina (Dorofeev and Mochalova (2018)), which is based on the method of "straightened" hyperbolic dependence on a double logarithmic scale (ln) followed by linear approximation functions (the "Linear Regression" function in Microsoft Excel). Since the requirements for the validity of the final results of our study was required, due to the use of a regression model in finding the parameters of hyperbolic H-distributions of the significance of predictors of adolescents trust in the mother, to check the quality of the calculated models with the exception of the results of those subjects whose quality does not meet the necessary requirements, thus to solve this problem we used the average error approximation (s), which reflects the measure of discrepancy between empirical values and values calculated using the regression equation. Since there is no way to statistically estimate the tolerance of the average approximation error, and different statistical sources on regression analysis offer different options for the acceptable average approximation error (from 8% to 15%), we settled on the 15% option. Accordingly, those subjects with s>15% were excluded from further analysis.

Methods of statistical and mathematical analysis. The nonparametric binomial criterion m was used to statistically assess the significance of differences in the frequency of occurrence of an effect with its absence. A nonparametric χ^2 criterion was used to compare the empirical frequency distribution with the uniform theoretical one. The nonparametric N-Kruskal-Wallace criterion was used to determine the significance of differences in the β coefficient as a parameter of the hyperbolic H-distribution ranked by the parameter in adolescents from single-parent families in 11 zones of the ratio of trust and distrust to the mother

Results

1) Frequency distributions of classification zones of the ratio of adolescents trust and distrust to the mother.

In accordance with the classification scheme presented in the work of Kupreichenko, 2008, and the theoretical provisions presented in the theoretical part of the article and concerning additions to the zones of trust and distrust classified at the level of the qualitative scale, the entire sample was differentiated into 11 zones and, for the convenience of comparative analysis, specific significance in % of occurrence frequencies were calculated the subjects in each zone, which we present in Fig. 1 for clarity.

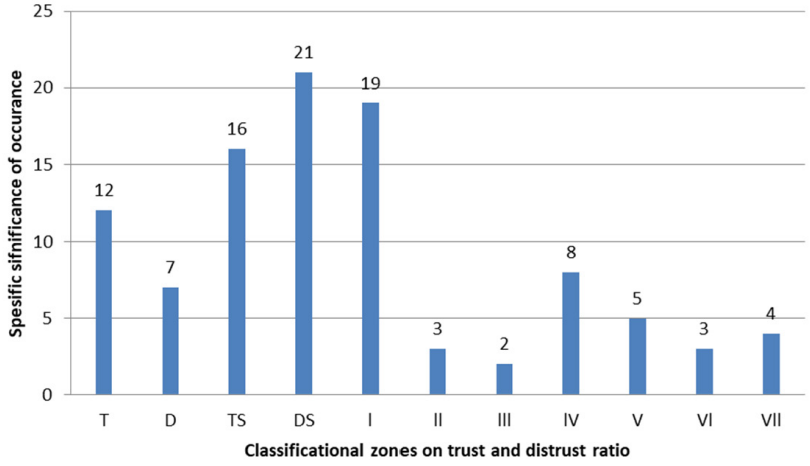

Figure 1. Diagram of the specific weights (in%) of the frequency of occurrence of adolescents in 11 zones of the ratio of trust and distrust of the mother

Note: "D" - absolute trust; "H" - absolute distrust; "DS" - trust statistically prevails; "TS"- distrust statistically prevails; I - trust/distrust within the confidence interval of average values; II - trust/distrust above the confidence interval; III - trust/distrust below the confidence interval IV- trust is higher, and distrust is within the confidence interval; V - trust is lower, and distrust is within the confidence interval; VI - distrust is lower, and trust is within the confidence interval; VII - distrust is higher, and trust is within the confidence interval

Two variants of the manifestation of trust in the mother, from which, as a rule, both practicing psychologists and parents "repel" in solving the problem of distrust of adolescents (the first "absolute trust" ("T") and the second "absolute distrust" ("D")), occur only in 32 (19%) of the 177 subjects, and the remaining 81% are teenagers who have ambivalent trust in their mother. Checking the statistical reliability of differences in the frequency of occurrence of adolescents with the variant "absolute trust" ("T") or "absolute distrust" ("D") with the frequency of occurrence of adolescents with ambivalent trust (included in one of the 9 zones) showed that these differences occur at $p<0.01$.

There is a relatively high percentage of occurrence in the sample of adolescents (37% in total) who have a "positive" variant of ambivalent trust (zone "T" and zone "D").

The most "negative" variant of ambivalent trust in the mother (zone "II"), when there is high trust and high distrust in adolescents in the ratio of trust and distrust, is relatively rare – only 5 out of 177 subjects, which is only 3%.

The most common "negative" variant of ambivalent trust in the mother is zone "IV", when there is absolute equality in the ratio of trust and distrust among adolescents and occurs in 14 out of 177 subjects, which was 8%.

To compare the empirical frequency distribution of the occurrence of subjects in different zones of the ratio of trust and distrust in the mother with a uniform theoretical one, a nonparametric $\chi 2$ criterion was used, which showed that there were no significant differences - $p \geq 0.05$.

2) The content of predictors of adolescents trust in the mother.

The results of a content analysis of the writings of teenagers on the topic "What does your mother have, as it seems to you, would be the basis for your trust in her" using expert assessments and taking into account the requirements for consistency of their opinions allowed us to identify 9 predictors of trust in the mother.

The first predictor was determined by the presence of trust on the part of the mother to the child (trust, which T.P. Skripkina called "Trust in me" (Skripkina, 2000)) and which in the writings was expressed in a generalized form as "I will trust my mother if she trusts me." The three predictors that experts identified were related to the mother's personality are 1) honesty; 2) reliability; 3) fairness. The five predictors identified by experts were determined by the behavioral losses of the mother – these are 1) commitment to fulfilling promises; 2) responsiveness to requests; 3) the fairness of accusations; 4) sincerity in communication; 5) unappreciative attitude. According to the frequency of occurrence in essays, the predictor "Mother's trust in me" is separately important, which occurs in one form or another in 63% of all adolescent writings. Further, there is no such obvious gap in the importance of any predictor of trust in the mother among adolescents (it occurs in one form or another from 17% to 24%).

One of the reasons, as it seems to us, is due to the fact that many predictors in a generalized form strongly correlate with each other. For example, the predictor that is associated with the mother's personality, reliability, correlates with the predictor that is associated with the behavioral losses of the mother - the obligation to fulfill promises. In this context, we asked experts to "consolidate" the classification model of predictors of maternal trust in adolescents. As a result, they reduced the model to 6 predictors. This is 1) "Mother's trust in me"; 2) honesty; 3) reliability; 4) fairness; 5) commitment to ful-filling promises; 6) an unappreciative attitude. These predictors were later used to test the second hypothesis of our study, although, if we comment, the predictor model reflects a certain average trend, which requires additional diagnostics in individual work with adolescents.

3) The order in the structure of predictors of adolescents trust in the mother.

For the convenience of analysis, the calculated average values and the standard deviation of the β coefficient for the rank distribution of predictors of adolescents trust in the mother in the 11 zones of the ratio of trust and distrust to her, we have summarized in Table 1.

Table 1.*The average values (Xsr.) and the standard deviation (σ) of the β coefficient for the rank distribution of predictors of trust in the mother in adolescents in the 11 zones of the ratio of trust and distrust to her*

Parameters	Classification zones according to the ratio of trust and distrust										
	T	**D**	**TS**	**DS**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**
$X_{cp.}$	0,998	0,412	0,544	1,033	0,654	0,221	0,241	0,255	0,298	0,311	0,299
σ	0,265	0,385	0,355	0,213	0,411	0,135	0,145	0,185	0,142	0,199	0,201

The average value of the β coefficient is higher (with a relatively low standard deviation), oddly enough, not with absolute trust of the mother (zone "T"), but with a "positive" variant of ambivalent trust, when trust in the mother in adolescents statistically significantly prevails over distrust of her (zone "D") – 1,033.

Determining the significance of differences in the indicators of the β coefficient as a parameter of the hyperbolic H-distribution ranked by the parameter in adolescents in 11 zones of the ratio of trust and distrust towards the mother using the nonparametric N-Kruskal-Wallace criterion showed that the differences presented in Table 1 have the character of a statistical pattern at $p \leq 0.05$.

Discussions

Confirmation of Hypothesis 1 and a relatively high percentage of occurrence in a sample of adolescents from single-parent families who have a "positive" variant of ambivalent trust (zone "T" and zone "D"), we interpret as the fact that such adolescents more often "do not want to absolutely trust or absolutely not to trust I the mother, since the situation failures will have to "repay something" to them, but with distrust a person loses only a part, and with trust he\she loses everything (Arapov, Efimova, Schrader, 1975).

If we consider the amount of the ratio between trust and distrust, the variability of the ratio is very high and the psychological context of working with adolescents in the variant of the ratio "7 and 3" may require a slightly different approach from the variant of the ratio "9 and 1".

As for the fact that the most "negative" variant of ambivalent trust in the mother (zone "II"), when in the ratio of trust/ distrust there is simultaneous high trust and high distrust in adolescents, which may be a consequence of schizoid personality traits of a teenager (in psychiatry, it is recognized that ambivalence is quite natural for people with schizophrenia (Bleyer, 1993), although rare, but they do occur, it should be noted, that psychological work with such adolescents in terms of increasing their trust in their mother should be specially organized in cooperation with medical specialists.

The fact that the most common "negative" variant of ambivalent trust in the mother is zone "IV", when there is absolute equality in the ratio of trust/distrust in adolescents, perhaps indicates that absolute equality in the ratio of trust and distrust of the mother in such adolescents does not have a true trust attitude towards mothers, on the contrary it is a mechanism of protection against inadequate, from the point of view of the teenager, attempts by the mother to penetrate into his\her inner world.

A higher average value of the β coefficient is not with absolute trust of the mother (zone "T"), but with a "positive" variant of ambivalent trust, when adolescents trust in the mother statistically significantly prevails over distrust of her (zone "D"), and an increase in the β coefficient is identified with an increase in the stability of the system structure (Kudrin, 2013; Kudrin, 2013, etc.). This is manifested in a decrease in spontaneity in the formation of new predictors of trust in matter and the disappearance of old ones, and a change in the balance between predictors, which means an increase in order in the structure. We can interpret this as the fact that with absolute adolescents trust in the mother (zone "T"), we are really dealing

not with trust in the mother, but with trust in her with the element of “shifting responsibility for solving our own problems onto her shoulders.” In this regard, the absolute trust in the mother of adolescents cannot be called a “positive phenomenon from all sides”.

Since it has been established at the level of statistical regularity that adolescents are more likely to have various types of ambivalent trust in their mother compared to options of either absolute trust or absolute distrust, it can be assumed that the conviction of practicing psychologists and parents that the trusting attitude of adolescents towards their mother exists only in the form of opposition or trust or distrust is not quite It is true and can lead to serious negative consequences when solving the problem of distrust of the mother. Thus, the high percentage of those who have a “positive” version of ambivalent trust indicates that quite a lot of teenagers “do not want” to absolutely trust or absolutely distrust their mother, since in a situation of failure they have to “repay something” and, at the same time, with distrust, a person loses only a part Though with trust, he\she loses everything.

Consequently, the observed behavioral patterns of “trust” in the mother may not reflect true trust in the mother, but act as a “means” of solving their conscious and unconscious tasks through a mechanism of protection from inadequate, from the point of view of , an adolescent attempts by the mother to penetrate into his\her inner world, or as a desire through trust to escape from their own responsibility.

The classification model of predictors of trust in the mother in adolescents, which includes 6 such predictors (1) “trust in me”; 2) honesty; 3) reliability; 4) fairness; 5) fairness of accusations; 6) unappreciative attitude), can be used in psychological work with adolescents, but it should always be taken into account, that the predictor model was obtained empirically and reflects a certain average trend, which will require additional diagnostics in individual work with adolescents.

The relationship of the order in the structure of predictors of trust in the mother with the classified zones of the ratio of trust/distrust in adolescents from single-parent families and the established role of the latter in trusting the mother indicates that practicing psychologists and parents should remember the need to “maintain” a balance in the importance of predictors of trust in the mother.

Conclusions

It has been established that the conviction of practicing psychologists and parents that the trusting attitude of adolescents towards their mother exists only in the form of opposition or trust or distrust is not entirely true and can lead to serious negative consequences when solving the problem of distrust of the mother. The features of the classified ratios of trust/distrust in the mother and the ordering of the structure of predictors of trust in the mother suggest that the observed behavioral patterns of “trust” in the mother may not reflect true trust in the mother, but act as a “means” of solving

Conflict of interests

The authors declare no conflict of interest.

Author Contributions

Conceptualization, M.Yu.; methodology, M.Yu; software, M.Yu; formal analysis, M.Yu; writing—original draft preparation, M.Yu; writing—review and editing, M.Yu.

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Beliefs and Experiences of Serbian Preschool Educators on Inclusive Education

Bojana Dimitrijević[1], *Jelena Starčević*[1]*

[1]Faculty of Education, University of Kragujevac, Jagodina, Serbia
e-mail: bojana.dimitrijevic@pefja.kg.ac.rs; jelena.starcevic@pefja.kg.ac.rs

Abstract: The purpose of this study is to examine a range of preschool educators' experiences and beliefs regarding inclusive education in public preschool institutions in Serbia. The research aimed to: a) determine the relationship between educators' self-assessed experience and competence, the availability of support systems, educators' beliefs about the parents of children with developmental difficulties, and their beliefs about inclusion; b) identify significant predictors of the educators' beliefs about the benefits of inclusion; c) explore whether nurses and preschool teachers differ in their experiences and beliefs. The sample consisted of 201 preschool educators: 145 preschool teachers and 56 nurses working with younger children. Principal Component Analysis with Oblimin rotation was employed, along with parallel analysis, which pointed to a four-factor structure: Teaching Experience and Competence, Availability of Expert Support, Negative Beliefs about Parents, and Inclusion Benefits. The results indicate that preschool educators report mildly positive experiences and beliefs about inclusive education, but they also hold a negative view of the parents of children with developmental difficulties. Negative beliefs about parents show the strongest (negative) correlation with beliefs in the benefits of inclusion and are the best predictor in the regression model, followed by self-assessed experience and competence and the participants' occupation (i.e., nurse or preschool teacher). Preschool teachers report that they have more experience and competence in working with children with developmental difficulties than nurses do, while other differences were not significant. The implications of the obtained results are discussed.

Keywords: *inclusive education; children with developmental difficulties; preschool teachers; nurses specialized in early education and child care; preschool educators' beliefs and attitudes; parents of children with developmental difficulties.*

Introduction

Inclusive education in Serbia was first introduced with the *Law on the Fundamentals of the Education System (2009)*, and this orientation has been retained in the current law (2023). This law stipulates that students and children who need additional support for any reason have the right to be educated in regular schools and preschools, with access to individualized instruction and individual education plans. Educational stance towards inclusive approach and democratic values is also reflected in the *Law on Preschool Education (2010)* and in the recent *Rulebook on the Fundamentals of Preschool Education and Care Programs* (2018). However, the laws also include the possibility of education in special education schools and their preschool equivalents in the Serbian context-developmental groups within preschool institutions.

Early inclusion is considered significant because it increases the likelihood that children with developmental delays and disabilities will be better prepared for school, face real-life circumstances, and be more readily accepted by peers exposed to diversity early on (Buysse and Bailey, 1993; Odom et al., 2011). The social and behavioural effects of inclusion in regular preschool education lead to positive outcomes, such as increased verbalization, improved peer interactions, and greater social participation (Buysse and Bailey, 1993; Odom et al., 2004; Kwon et al., 2011). Additionally, children who are included

*Corresponding author: jelena.starcevic@pefja.kg.ac.rs

in regular preschool settings have been observed to exhibit less object-directed behaviour, more peer-directed behaviour, use toys more appropriately, and require less teacher attention (Buysse and Bailey, 1993).

According to the findings of the *National Report on Inclusive Education in the Republic of Serbia for 2019-2021 (UNICEF, 2022)*, typically less than 30% of all children under three years old and up to 66% of all children between the ages of three and five and a half years attended preschool. The highest enrolment was in the mandatory preparatory preschool program, with up to 98% of six-year-old children participating. However, it is noted that the enrolment of children with developmental delays and disabilities, Roma children, and children from families with low socioeconomic status is even lower in comparison to their typical peers, placing these children at greater risk of discrimination (UNICEF, 2022). During the monitored period, the number of children in regular groups exceeded the number of children in developmental groups (ibid.), indicating that most children with developmental delays and disabilities who do enrol in preschool attend regular groups with typical peers and are educated by preschool teachers. This could possibly be partially assigned to the lack of developmental groups in some of the preschool institutions that are inclined to the idea of inclusive education.

This study examines a range of preschool educators' experiences and beliefs regarding inclusive education in public preschool institutions in Serbia: a) amount of experience they have in working with children with developmental difficulties, b) self-assessed competencies and knowledge for working with these children, c) availability of support from other experts, d) beliefs about parents of children with developmental difficulties and cooperation with these parents, and e) beliefs about benefits of inclusion. Of particular interest are the potential predictors of beliefs about the benefits of inclusive education. We will examine some predictors that have already been explored in the literature, as well as some that appear to be new, such as the specific occupation of preschool educators – whether they are nurses specialized in early education and child care, or preschool teachers working with older children. Given the lowest enrolment rate in preschool groups for the youngest children, from six month to three years of age (UNICEF, 2022), and considering the importance of optimal child care and early intervention especially during infancy and toddlerhood (Berk, 2017), we will further explore whether nurses differ in experiences and beliefs from preschool teachers*.

Beliefs of Preschool Educators Towards Inclusion

Various authors suggest that teachers' professional beliefs and attitudes are predominantly implicit, stable, and rooted in personal experience (Kagan, 1992; Kane et al., 2002). However, they are also influenced by prevailing societal stereotypes (e.g., Dimitrijević et al., 2017; Zachos, 2017). These beliefs are thought to contribute to the selection, interpretation, and evaluation of relevant information, thereby guiding teachers' actions (Fives and Buehl, 2012; Pajares, 1992; Richardson, 1996). It is therefore considered important to explore teachers' beliefs and attitudes, especially about vulnerable groups of students.

There are limited data about relationships between teachers' attitudes and beliefs about inclusion and their potential or actual behaviour. Some research results indicate that teachers' positive attitudes were strongly and positively associated with observed application of inclusive education practices (Sharma and Sokal, 2016), predicted teachers' declared readiness to include children with severe socio-emotional and behavioural problems (MacFarlane and Woolfson, 2013), and that student-teacher interaction as well as quality of teaching strategies and instruction were dependent of teachers' attitudes towards inclusion (Jordan et al., 1997).

The results of research on samples of in-service preschool educators (Bruns and Mogharreban, 2007; Chiner and Cardona, 2013; Dias and Cadime, 2016; Lee et al., 2015; Scanlon et al., 2022; Stančić and Stanisavljević Petrović, 2013; Štemberger and Kiswarday, 2018), preservice early education teachers (Yu and Cho, 2022), as well as numerous research studies and reviews of research on samples of primary and secondary school teachers (Avramidis et al., 2000; Avramidis and Kalyva, 2007; Avramidis and Norwich, 2002; Bowman, 1986; Đević, 2009; Forlin, 1995; Ward et al., 1994) indicate that attitudes toward inclusion generally range from neutral to positive. There are, however, factors that influence teachers' and preschool educators' beliefs and attitudes, such as the perceived severity of the difficulties (Avramidis et al., 2000; Avramidis and Kalyva, 2007; Avramidis and Norwich, 2002; Bowman, 1986; Chiner and Cardona, 2013;

* For the purposes of this paper, we use the term 'preschool educators' to refer collectively to nurses and preschool teachers.

Đević, 2009; Forlin, 1995; Ward et al., 1994), or the specific developmental domain in which the difficulties are most prominent. Intellectual or behavioural difficulties, for example, are often perceived as less appropriate for inclusion in regular classes (Avramidis and Norwich, 2002; Đević, 2009; Karić et al., 2014).

Results on preschool educator samples indicate that on average all three components of attitudes (cognitive, affective, and behavioural) are generally positive, suggesting good understanding of inclusion principles, a high readiness to adapt their work with children needing additional support, and a low level of discomfort working with these children (Štemberger and Kiswarday, 2018), or in some studies that behavioural aspects of attitudes are more positive in comparison to other components (Dias and Cadime, 2016; Scanlon et al., 2022). However, it was also found that while preschool educators have predominantly positive attitudes toward including children needing additional support in regular groups and assess their competence for inclusive education as high, they feel less competent regarding specific knowledge and skills, such as alternative communication techniques or characteristics of children with motor development disabilities (Bruns and Mogharreban, 2007).

In Serbia, a study found that 57.8% of preschool educators expressed a positive attitude toward inclusion in general, yet 60% were unwilling to accept a child with disabilities into their own preschool group (Stančić and Stanisavljević Petrović, 2013). This indicates that while educators support the concept of inclusion, they may not be fully willing to implement it in their own classrooms. The study also noted that respondents generally agree that social inclusion is a benefit of inclusive education (68.9%), but only 30.4% respondents believe it will significantly contribute to the development of the potentials of children needing additional support (Stančić and Stanisavljević Petrović, 2013).

Professional experience with diversity as a predictor of attitudes towards inclusion

In studies involving primary school teachers, having experience with students with developmental difficulties, engaging in inclusive education, or participating in projects promoting inclusivity have been linked to more positive attitudes towards these students (Avramidis et al., 2000; Avramidis and Kalyva, 2007; Karić et al., 2014; Đević, 2009). However, empirical findings regarding the relation between professional experience and attitudes towards inclusion are not unambiguous. For example, some research indicate that teachers who have had positive personal experiences demonstrating more positive attitudes (Rajović and Jovanović, 2010), while professional experience did not influence their beliefs (Rajović and Jovanović, 2010; Starčević et al., 2018). In Scottish research experience in teaching students with severe socio-emotional and behavioural difficulties predicted lower willingness to include these children into regular classes (MacFarlane and Woolfson, 2013).

Research studies on samples of preschool educators indicate similar inconsistencies regarding the influence of experience. In several studies professional experience was related to more positive attitudes and beliefs (Galović et al., 2014; Scanlon et al., 2022; Stančić and Stanisavljević Petrović, 2013). Specifically, educators who believed they had “some” or “a lot of experience” with inclusion held more positive behavioural readiness (i.e., were more willing to adapt their behaviour to facilitate inclusion) than those who stated that they had “no experience” or “little experience” (Scanlon et al., 2022). In research conducted in Serbia (Stančić and Stanisavljević Petrović, 2013), educators with prior experience working with children needing additional support statistically more often believe that including these children in regular groups contributes to the development of humanity and empathy in other children. However, when assessing the benefits of inclusion for the well-being of children requiring additional support, there are no statistically significant differences between experienced and inexperienced educators (ibid.). Galović and colleagues (2014) found a non-linear relationship between amount of experience and attitudes: educators with less than one year of experience in an inclusive context had more positive expectations than those with no experience, but no significant differences were observed compared to more experienced educators. Furthermore, study in Hong Kong showed that self-assessed professional experience with developmental difficulties in children did not predicted acceptance of children into regular preschool classes (Lee et al., 2015), while a Portuguese study found that experience working with children with developmental disabilities was a negative predictor of the behavioural component of preschool teachers’ attitudes (Dias and Cadime, 2016).

Such discrepancies between the results of studies suggest that certain variables may modify the relationship between professional experience and attitudes. The quality of experience is, unsurprisingly, one such variable: those who rated their experience as extremely positive had more favourable attitudes

towards inclusion and more positive expectations compared to those who rated their experience as negative (Galović et al., 2014).

Self-assessed competences and knowledge as a predictor of attitudes towards inclusion

The perception among teachers that they are incompetent and inadequately trained to work with students with developmental difficulties has been recognized as a barrier to the implementation of inclusive education both by the experts in this field (Macura-Milovanović et al., 2009), as well as by the teachers themselves (Avramidis and Kalyva, 2007). In a number of studies a variable of teachers' self-efficacy (how competent they perceive themselves to be) was a significant predictor of or correlated with their attitudes towards inclusion (Avramidis et al., 2000; Desombre et al., 2019; Saloviita, 2020; Savolainen et al., 2020; Starčević et al., 2018), although in some of the studies teachers' self-efficacy had only weak association with attitudes (Saloviita, 2020).

In research on samples of preschool educators, results were not unequivocal regarding whether self-assessed knowledge, skills, or self-efficacy are connected to their beliefs and attitudes. In a study by Slovenian authors, preschool educators and teachers who had attended training for working with children needing additional support generally had more positive beliefs about this group of children compared to those who had not (Štemberger and Kiswarday, 2018). In research conducted in Hong Kong on a sample of preschool educators, authors analysed whether knowledge, self-efficacy, and the prevalence of various government initiatives were predictors of acceptance of children with difficulties and resistance to inclusive education. The only significant predictor was self-efficacy (Lai-Mui-Lee et al., 2014).

On the other hand, some reports indicate that self-assessed knowledge, skills, and self-efficacy were not related to attitudes and beliefs of preschool educators. In a Spanish study with preschool educators and teachers in primary and secondary schools, self-assessed skills and knowledge did not influence attitudes towards inclusion (Chiner and Cardona, 2013). In already mentioned study in Hong Kong (Lee et al., 2015) self-accessed knowledge did not predicted acceptance of children into regular preschool classes. In a study with somewhat different research design, there were no significant differences among groups of preschool educators and teachers at all educational levels (including secondary school) that rated themselves as having no training, little training, or moderate to extensive training, concerning their perception of inclusion, inclusive practices, and outcomes of inclusion (Galović et al., 2014).

Availability of support as a predictor of attitudes towards inclusion

Although teachers tend to hold positive attitudes towards inclusion they also express the need for support from other experts, additional training, more time and less students in their classes (Avramidis et al., 2000). Research results on samples of preschool educators indicate similar tendencies (Chiner and Cardona, 2013; Odom et al., 2011; Stančić and Stanisavljević Petrović, 2013). In the study by Stančić and Stanisavljević Petrović (2013), preschool educators ranked support from professionals in other fields (psychologists, pedagogues, special education teachers) as the second most frequent form of assistance needed for implementing preschool inclusion (61.5%), right after reducing the number of children in the group. Odom and colleagues (2011) highlight that professional collaboration among all actors is one of the characteristics of high-quality inclusive preschool education and may be more significant factor influencing the effects of early inclusion than the characteristics and difficulties of children. Those educators who are willing to personally engage in inclusive preschool education consider the availability of support from other professionals to be more significant than those who are not willing to engage personally (Stančić and Stanisavljević Petrović, 2013).

The availability of support within the schools where they work has been shown to be a significant predictor of attitudes of teachers towards inclusion (Avramidis and Norwich, 2002). In a study by Spanish authors, which included preschool educators and primary and secondary school teachers, the perceived availability of support from special educators (but not from school psychologists) influenced attitudes towards inclusion: Educators who felt they had sufficient support had more positive attitudes toward inclusion compared to those who were uncertain or felt they did not receive enough support (Chiner and Cardona, 2013).

Teachers' perceptions of parents and collaboration with parents as predictors of beliefs towards inclusion

To our knowledge, no studies have yet examined the relationship between teachers' beliefs about the parents of children with developmental difficulties and their attitudes or beliefs about the inclusion of these children in preschool classes. Still, this is an important question that should be examined. It is known that parents of children with developmental difficulties are often perceived by teachers and preschool educators as denying the existence of their child's difficulties, which, according to teachers, complicates collaboration (Janjić et al., 2012). In research by Jeremić and colleagues (2022), preschool educators expressed beliefs that parents of children with developmental difficulties are rarely interested in improvement of their pedagogical competencies, are lacking interest in their children's participation in preschool activities, and are less interested in participation in preschool activities as spectators or participants. This is an even more undesirable when considering that 50.4% of educators view collaboration as a key factor for successful inclusion, following the belief that peer acceptance and educator expertise are significant factors (Stančić and Stanisavljević Petrović, 2013). Additionally, educators who view inclusion as an appropriate framework for preschool education support the belief that collaboration with parents is a key factor for the success of inclusion more strongly compared to those who do not support inclusion. Finally, 47.3% of educators believe that improving collaboration with parents is a necessary change for improving inclusive education and teaching (ibid.). In line with this, Vasiljević-Prodanović and colleagues (2023) found that preschool teachers perceive cooperation with parents of typical children as more successful than cooperation with parents of children with developmental difficulties regarding three aspects: school-based involvement, home-based involvement, and school-home conferencing. In contrast, a minority of studies, including one by Turkish authors, have found no differences in the perception of cooperation with parents of children with disabilities compared to parents of typically developing children (Sucuoğlu and Bakkaloğlu, 2016).

Teaching position and grade level as predictors of attitudes towards inclusion

Current research results, both in Serbia and elsewhere, do not provide insights into how different groups of preschool educators, such as nurses and preschool teachers, perceive early inclusion in mainstream groups. However, differences between other teaching positions have been subjected to empirical investigations. Research results indicate that the teaching position (class teachers or subject teachers, special or regular education), as well as the age of the children teachers work with and the grade level at which they teach (preschool, primary, or secondary education) are related to attitudes towards inclusion. Typically, educators that work with younger students at lower levels of education, had more positive attitudes towards inclusion (Chiner and Cardona, 2013; Garriott et al., 2003; Štemberger and Kiswarday, 2018), although there are studies that suggest otherwise (Gaines and Barnes, 2017). Specifically, some studies have found that preschool teachers have more positive attitudes towards inclusion compared to secondary school teachers, though no statistically significant differences were found when compared to primary school teachers (Chiner and Cardona, 2013). Preschool teachers perceive they have more time compared to secondary school teachers to teach all their students, while both preschool and secondary school teachers believe they have more material resources than primary school teachers (ibid.). A study by Slovenian authors found that preschool teachers show more positive beliefs about inclusion compared to primary school teachers, particularly in the cognitive dimension of attitudes, though no differences were observed in the affective and behavioural components (Štemberger and Kiswarday, 2018). The most positive attitudes in this study were found among preschool teachers with no experience working with children needing additional support who had received training in inclusive education (ibid.). However, in the study by Gaines and Barnes (2017), kindergarten and elementary school teachers, considered as a single group, exhibited more negative attitudes compared to secondary school teachers.

In research conducted in Serbia, differences among preschool teachers and other teacher groups were also noted. Specifically, concerning core beliefs and expected outcomes of inclusion, preschool teachers have less negative attitudes than secondary school teachers and more positive expectations of inclusion compared to primary school teachers (Galović et al., 2014).

The Present Study

This paper deals with the preschool educators' experiences and beliefs regarding inclusive education within public preschool institutions in Serbia. The research aimed to: a) determine the relationship between educators' self-assessed experience and competence in working with children with developmental difficulties, the availability of support system (i.e., other experts' support), educators' beliefs about the parents of children with developmental difficulties, and their beliefs about the inclusion, i.e., whether inclusion provides benefits for the children with developmental difficulties; b) identify significant predictors of the educators' beliefs about benefits of inclusion; c) explore whether nurses and preschool teachers differ in their experiences and beliefs regarding inclusion.

Materials and Methods

Participants and Procedure

This study was conducted on a convenience sample of 201 preschool educators at a time employed in public preschool institutions in Serbia: 145 preschool teachers (72.1%) working with children aged three to seven years and 56 nurses (27.9%) working with younger children. One hundred ninety-nine participants (99%) identified as female, one as male, and one participant chose not to respond. The average teaching experience of 15 years (M = 15.26, SD = 9.78) indicate that our sample, on average, have been working as long as the inclusive education have been developing in Serbia. Almost 90 percent of nurses, and none of the preschool teachers, have a secondary vocational education in nursing and early education. Only 10.7 percent of nurses hold a higher education degree, whereas all preschool teachers, as it is formally expected, have either a bachelor's or master's degree.

The questionnaire regarding inclusion of children with developmental difficulties was distributed electronically at the beginning of 2024. Participants were informed about the research through their professional association. Additionally, potential participants were notified via emails sent to the management of preschool institutions across various regions of Serbia. All participants were informed about the purpose of the study and were assured of anonymity upon consenting to participate.

Instrument

A questionnaire exploring different aspects of the experiences and beliefs of preschool educators regarding the early inclusion of children with seven types of difficulties (cognitive/intellectual domain, speech development and communication, fine motor skills, gross motor skills, perception and senses development, emotional development, and social development and interpersonal relations) was created for the purpose of this research. The questionnaire comprises 35 items with responses given on a 5-point Likert scale. The experience, competence, availability of expert support as well as perception of benefits of inclusion were explored via single item applied to seven domains of developmental difficulties: "How much experience do you have in working with children who have difficulties in the following developmental domain", "How much knowledge and skills do you have in working with children who have difficulties in the following developmental domain", "To what extent is the support from other experts – from your institution as well as external experts, available for you when it comes to working with children who have difficulties in the following developmental domain" and "Children who experience developmental difficulties in following domain benefit greatly from attending mainstream preschool education classes". Beliefs about parents and cooperation with them were explored via seven heterogeneous items (e.g. "Parents of children with difficulties do not want to acknowledge that their child has a problem").

Principal Component Analysis with Oblimin rotation was employed along with parallel analysis. Both pointed to the four-factor structure that explained total of 78.05% of data variance. Each of the items loads strongly on only one factor, and each factor is represented by a number of strongly loading items (with values between .98 and .68). The items concerning experience in teaching children with developmental difficulties were combined into one factor with the items concerning competence in teaching these children. Moderate to high intercorrelations between items from these two sets of data were established, in the range of $.55 \leq r \leq .74$. In the final, the four scales out of whole questionnaire were discerned and

labelled as Teaching Experience and Competence (14 items), Availability of Expert Support (seven items), Negative Beliefs about Parents (seven items) and Inclusion Benefits (seven items).

Data Analysis

SPSS 20.0 was used for data analysis.

Results

I Descriptive Statistics

Descriptive statistics for the four scales are presented in the Table 1. The range of achieved scores matches the theoretical range of scales' scores (from one to five). Kolmogorov-Smirnov tests indicate that the distributions of scales' scores deviate from the normal curve. Still, both skew and kurtosis values in all cases were lower than 1.0, i.e., within the acceptable range (George and Mallery, 2020). All mean scores are above the theoretical mean, the highest is on the scale Negative Beliefs about Parents and the lowest is on the scale Availability of Expert Support. An inspection of the distribution of scores on Inclusion Benefits revealed that 55.1% of preschool educators have an average score above 3 on items expressing benefits for children with developmental difficulties, indicating a positive view on the scale.

Table 1. Descriptive statistics for four scales

Scales	N	*M* (*SD*)	*Range*	Skew	Ku	K-S
Teaching Experience and Competence	200	3.45 (0.84)	1-5	-.78	.48	.14**
Availability of Expert Support	201	3.13 (1.06)	1-5	-.20	-.68	.17**
Negative Beliefs about Parents	201	3.68 (0.84)	1-5	-.68	.82	.07*
Inclusion Benefits	198	3.55 (0.99)	1-5	-.32	-.25	.16**

Note. K-S – Kolmogorov-Smirnov test; **p < .001, *p < .05

II Internal Consistency and Correlations of Measures

In Table 2, bivariate correlations of the four scales are presented. The Cronbach's alpha coefficients of the scales are appearing in parentheses along the diagonal of the table. Internal consistencies for the scales with one item applied to different domains of developmental difficulties are very high, while the internal consistency of the Negative Beliefs about Parents is good, considerably surpassing .80 (George and Mallery, 2020).

Table 2. Scale reliabilities and inter-correlations

Scales	TEC	AES	NBP	IB
Teaching Experience and Competence (TEC)	(.97)			
Availability of Expert Support (AES)	.10	(.99)		
Negative Beliefs about Parents (NBP)	-.03	**-.24****	(.87)	
Inclusion Benefits (IB)	.26**	.14	**-.35****	(.98)

** p < .01

Perception of inclusion as being beneficial for children with difficulties is moderately and negatively correlated with negative beliefs about parents of children with (unspecified) difficulties as well as positively correlated with (self-assessed) experience and competence in working with children with difficulties. Besides, a significant correlation is observed between negative beliefs about parents and the availability of support from other experts (with a negative sign).

III Predictors of the beliefs about inclusion benefits: Regression analysis

To identify significant predictors of the beliefs about benefits of inclusion of children with developmental difficulties in mainstream preschool classes, a standard multiple regression analysis was em-

ployed. Two scales/variables that significantly correlated with the Inclusion Benefits scale, as well as the participants' occupation, were entered into the regression equation. Initial analyses were performed to confirm that the assumptions of normality, linearity, multicollinearity, and homoscedasticity were not violated. The main findings are presented in Table 3. The model explains 21.5% of the variance in beliefs about benefits of inclusion, with the occupation uniquely explaining 3.2%, Teaching Experience and Competence uniquely explaining 8.5%, and Negative Beliefs about Parents uniquely explaining 12.0% of the variance. Adjusted R square, as an estimate of the true population value, points to the similar amount of explained variance, i.e., 20.3%.

Table 3. Regression analysis summary for predicting beliefs about inclusion benefits

Variables	*B*	*SE B*	β	*t*	*p*
Occupation	-2.92	1.04	-.19	-2.80	.006
Teaching Experience and Competence	.18	.04	.31	4.58	.000
Negative Beliefs about Parents	-.41	.08	-.35	-5.42	.000

IV Differences among subsamples with different occupation

In order to discover whether participants with different occupation – nurses with specialization in early education and preschool teachers – differ in respect to experience and competence, availability of support system, as well as their beliefs about the parents of children with difficulties, and beliefs about benefits of inclusion, t-tests for independent samples were conducted. The results have shown that there are statistically significant differences between participants from different subcategories only regarding the teaching experience and competence, with medium effect size (see Cohen, 1988). Preschool teachers perceive themselves as more experienced and competent in working with children with developmental difficulties in comparison to nurses. Although nurses have slightly more positive beliefs in inclusion benefits (M=25.70) than the preschool teachers do (M=24.54), the difference does not reach the level of significance. The differences are even smaller when it comes to availability of expert support and negative beliefs about parents.

Table 4. Differences between nurses and preschool teachers

Scales	n_1	Nurses		n_2	Preschool teachers		t (df)	p	d
		M_1*	SD_1		M_2*	SD_2			
TEC	55	41.91	13.48	145	50.77	10.18	-4.42 (78.471)	.000	0.74
AES	56	22.23	6.68	145	21.76	7.68	.41 (199)	.685	0.06
NBP	56	26.04	6.20	145	25.65	5.79	.42 (199)	.677	0.06
IB	56	25.70	7.81	142	24.54	6.53	.98 (86.902)	.330	0.16

Note. TEC – Teaching Experience and Competence; AES – Availability of Expert Support; NBP – Negative Beliefs about Parents; IB – Inclusion Benefits; * Mean of the composite score which resulted from summing the values of items.

Discussions

Fifteen years after the first law introduced inclusive education in Serbia, this study explores preschool educators' experiences and beliefs regarding inclusion in public preschool institutions. The study specifically addresses the predictors of beliefs about the benefits of inclusive education. The differences between the two groups of preschool educators – nurses with a specialization in early education and child care, and preschool teachers – were also examined.

Although experience and competence are usually considered as distinct variables in empirical research, the principal component analysis of the questionnaire data in this study suggest that these two variables can be integrated. Items concerning experience and items concerning competence were relatively highly correlated with each other, and in the process of extracting the main components, they were linked to one and the same component.

Descriptive statistics of main study variables revealed that preschool educators report mildly positive experiences and beliefs about inclusive education, as results of previous research on preschool educators samples mostly report (e.g. Bruns and Mogharreban, 2007; Chiner and Cardona, 2013; Dias and Cadime, 2016; Lee et al., 2015; Scanlon et al., 2022; Stančić and Stanisavljević Petrović, 2013; Štemberger and Kiswarday, 2018), but they also hold a negative view of the parents of children with developmental difficulties which is also in line with results of some research (Jeremić and colleagues (2022)). The percentage of educators expressing positive attitudes towards inclusive education (specifically, towards benefits of inclusion for children with the need for additional support) is slightly lower than the percentage determined 11 years ago (Stančić and Stanisavljević Petrović, 2013). The mean values for the Teaching Experience and Competence and Availability of Expert Support are on the positive side of the scale, but they remain relatively low, particularly concerning perception of availability of support from other experts. The very high internal consistency of the Availability of Expert Support scale indicates that insufficient support is reported for working with children across all domains of developmental difficulties (cognitive/intellectual domain, speech development and communication, fine motor skills, gross motor skills, perception and senses development, emotional development, and social development and interpersonal relations). Similarly, the teachers in research by Chiner and Cardona (2013) on average thought that support was insufficient and rated availability of supports even lower than participants in our research.

The correlations analyses indicate that preschool educators who tend to view parents negatively are more likely to believe that their children would not benefit from inclusion and that they, as teachers, receive less expert support. Beliefs in the benefits of inclusion are significantly connected to teaching experience and competence, contributing to the body of research that signals the same pattern in relation to experience (e.g., Galović et al., 2014; Scanlon et al., 2022; Stančić and Stanisavljević Petrović, 2013), as well as to studies that found significant connection between beliefs in inclusion benefits and self-assessed competence (e.g., Štemberger and Kiswarday, 2018; Lai-Mui-Lee et al., 2014).

This study revealed a new variable of significance for attitudes towards inclusive education: the (negative) perception of parents of children with developmental difficulties. Negative beliefs about parents show the strongest (negative) correlation with beliefs in the benefits of inclusion and are the best predictor in the regression model, explaining the highest percentage of variance in beliefs about inclusion benefits. This aligns with the finding that about half of educators consider collaboration with parents to be among the three most important factors for successful inclusion (Stančić and Stanisavljević Petrović, 2013). Given that the role of the perception of parents in relation to attitudes towards inclusive education has not been investigated, the results of this study highlight a somewhat neglected area in developing teachers' attitudes towards inclusive education. Improving cooperation with parents could involve the professional development of preschool staff, as well as fostering a supportive atmosphere and procedures within preschool institutions.

Following the perception of parents, the most important predictor of beliefs in inclusion benefits is self-assessed experience and competence in working with children with difficulties, a well-established factor in the literature (Galović et al., 2014; Scanlon et al., 2022; Stančić and Stanisavljević Petrović, 2013). Lastly, occupation of participants was also a significant predictor though it explains only the small percentage of the criterion variance but indicates that being a nurse is predictive of more positive beliefs about inclusion benefits for children with developmental difficulties.

Finally, this study aimed to examine whether nurses with specialization in early education and preschool teachers differ in their experiences and beliefs regarding inclusive education. As expected, given the enrolment rates at different levels of preschool education, preschool teachers more often report having experience and competence in working with children with developmental difficulties than nurses do. Regarding the other variables—availability of expert support, negative beliefs about parents, and beliefs in inclusion benefits—no significant differences were found.

The variable of particular interest was beliefs about the benefits of inclusion. It is known that those working with younger children and at lower educational levels generally hold more positive beliefs about inclusion compared to those working with older children (e.g. Chiner and Cardona, 2013; Garriott et al., 2003; Štemberger and Kiswarday, 2018). This may be attributed to the more holistic approach taken by lower-grade teachers, who focus more on the development of individual students rather than predominantly focusing on the subject matter (Avramidis and Norwich, 2002). However, research also indicates that educators who receive more training in the field of inclusive education and in addressing students'

needs for additional support tend to have more positive beliefs compared to those with less training (e.g. Scanlon et al., 2022). To become a nurse specialized in early education and child care, a completed secondary vocational medical school is required, while preschool teachers must obtain a higher education degree. It is possible that most participants with postsecondary degree have completed compulsory courses dealing with typical development as well as exceptional children development and education, and therefore feel more competent. These opposing influences—working with younger children at a lower educational level and having less formal education—may have contributed to the lack of statistically significant differences in beliefs about inclusion benefits between groups of nurses and preschool teachers.

Additionally, the insignificant differences in the (seemingly scarce) availability of expert support and the non-negligible presence of negative beliefs about parents suggest systemic shortcomings that affect both preschool teachers and nurses. Developing an effective support network of experts both within and outside institutions is recommended, but with caution to avoid further stigmatizing children with difficulties. The support network should aim to maximize these children's involvement in joint educational and social activities with their peers.

Conclusions

The study on preschool educators' experiences and beliefs regarding inclusive education revealed predominantly neutral to mildly positive attitudes, which is a somewhat disappointing result considering the efforts made to develop inclusive education over the past 15 years in Serbia. At the same time, the study highlights areas for improvement to advance inclusive education. In addition to building experience and competence in working with children with developmental disabilities, support for preschool educators in inclusive practices must also focus on strengthening their cooperation with parents of these children (and likely with parents in general). Future initiatives should also consider more appropriate approaches to organizing a support network of experts to facilitate inclusive education while simultaneously avoiding the risks of stigmatization and exclusion. Apart from the greater opportunities that preschool teachers have had to develop experience and competence, both preschool teachers and nurses express similar professional needs and beliefs about inclusive education, indicating a need for systematic interventions.

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Conflict of interests

The authors declare no conflict of interest.

Author Contributions

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The Impact of Individual and Organizational Characteristics on Work Ethics- Cross-Cultural Comparison

Tahir Masood Qureshi [1], *Marija Runic-Ristic* [2*], *Vilmos Tot* [3]

[1]School of Business and Quality Management, Hamdan Bin Mohammed Smart University, Dubai, UAE,
e-mail: t.masood@hbmsu.ac.ae
[2]School of Business and Quality Management, Hamdan Bin Mohammed Smart University, Dubai, UAE,
e-mail: MRistic@hbmsu.ac.ae
[3]Faculty of Business Economics, University Educons, Sremska Kamenica, Serbia,
e-mail: tot.vilmos@gmail.com

Abstract: This study aims to analyze the effect of individual (gender and education) and organizational (organizational sector) characteristics on work ethics in the United Kingdom, Serbia, and the United Arab Emirates. This research is centered around a survey conducted among managers, from the UK, the UAE, and Serbia. Their main task was to evaluate the aspects of the Multidimensional Work Ethic Profile (MWEP) short form. The MWEP was chosen for this study as it does not explicitly address work ethics with religion, making it a suitable tool for examining work ethics across three cultures with different religious practices. This study contributes to existing literature by exploring how organizational factors influence work ethics in three countries that share business interests and have cultural and economic ties. The findings indicate that these factors have an impact on work ethics in studied countries.

Keywords: *individual characteristics, MWEP, organizational characteristics, cross-cultural comparison, gender, education, human resources development, Serbia, UK, UAE.*

Introduction

Since work ethics represents an individual's system of values and norms, much research has been directed at its connection with national cultures. Numerous studies have analyzed the relationship between national culture and ethics (Chen et al., 2018; Perez, 2017; Sims and Gegez, 2004; Vitolla et al., 2021).

However, the majority of these studies either focused on Protestant Work Ethics (PWE) (Kalemci and Kalemci Tuzun, 2019; Zhang et al., 2021) or Islamic Work Ethics (Ali and Al-Kazemi, 2007; Khan et al., 2015; Mohammad et al., 2018). Recently, researchers have tried to stop analyzing work ethics in the context of religion and have paid more attention to the Multidimensional Work Ethic Profile (MWEP) (Miller et al., 2002). Therefore, recent cross-cultural studies have used the MWEP instrument (Li et al., 2020; Meriac et al., 2013; Miller et al., 2002).

Previous studies have also analyzed and emphasized the significant influence of work ethics on employees and organizational performance (Adeyeye et al., 2015; Runic-Ristic et al., 2024; Sapada et al., 2018). Moreover, the authors discovered that work ethics are related to a country's economic development. Work ethics are higher in developed countries than in less developed countries. According to Adeyeye et al. (2015), work ethics represent a crucial factor in organizational development and production, leading to an increase in national wealth and sustainable political stability (Adeyeye et al., 2015).

The present study analyzes the relationship between work ethics and individual and organizational

*Corresponding author: MRistic@hbmsu.ac.ae

characteristics by comparing three nations: the UK, the UAE, and Serbian, which differ in many ways (having different languages, religion, economic conditions, standard of living, legal, and educational systems, and finally, not having the same cultural values). In our study, we used sfMWEP (Meriac et al., 2013) instrument, which is the shorter version of MWEP and consists of seven work ethics dimensions. These seven dimensions are hard work, leisure, self-reliance, morality/ethics, the centrality of work, wasted time, and delay of gratification (Miller et al., 2002). We used the MWEP instrument in this study because the three cultures that we examined belong to different religions, and the advantage of this instrument is that it doesn't analyze the work ethics from the aspect of religion compared to other instruments (e.g., the Protestant Work Ethics Questionnaire (PWE) and the Islamic Work Ethic Instrument (IWE).

In this study, we analyzed the following hypothesis:

H1: There is an interaction effect between gender and nationality on work ethic dimensions among British, UAE and Serbian managers.

H2: There is a statistically significant relationship between the education and work ethic dimensions among British, UAE, and Serbian managers.

H3: There is an interaction effect between organizational sector and nationality on work ethic dimensions among British, UAE, and Serbian managers.

The UAE has a very close economic relationship with Serbia and the UK. British expats in the UAE represent one of the largest groups of expats, and there are strong trade ties between the two countries. At the same time, Serbia represents the UAE's most important economic partner in Southeast Europe. Therefore, it is essential to understand the influence of individual and organizational characteristics on work ethics in these three nations.

The paper is organized as follows. In the first section, we analyze the literature on the impact of individual and organizational characteristics on work ethics. In the second section, we present the methodology and results. At the end, we discuss the limitations of our study and further research.

Theoretical framework and literature review

Gender and work ethic

The position of women in the examined societies (British, UAE, and Serbian) differs in many ways, and there is a difference in gender parity among these three cultures.

The discovery of oil reserves in the UAE led to significant changes in society. It has transformed from a traditional society based on agriculture to a modern industrial society. These changes have also affected the role of Arab women in all spheres of life, particularly at work. Before modernism, women in the UAE were not active at work. However, with modernization, Emirati women have begun pursuing higher education and moving into the labor market. As a consequence of these changes, the UAE has had the highest increase in the female workforce among Arab countries over the last decade (ILO Data Explorer, 2023).

The position of women in Serbian organizations is better than that of Emirati women; however, it is worse than the position of women in Western Europe, particularly the UK (Stošić et al., 2015). Serbian society is mostly male-dominant and has been especially emphasized in the past decades. The wars during the 90s, sanctions imposed by the UN, exclusion from international trade, transition and privatization only increased the crises of man's role and withed the gap between men and women in organizations (Arandarenko et al., 2012). Increased misogyny is one of the characteristics of Serbian society during the transitional process, and the position of women in Serbian society is still marginalized. The proportion of employed women (41%) in Serbia is considerably lower than that of employed men (56%) (Statistical Office of the Republic of Serbia, Employment, 2024). Although Serbian women have better qualifications than men, they are less paid, do not participate in the decision-making process, and work more in wage-paid jobs. This is in contrast to Western economies, where average employed women are less qualified than average employed men, justifying the wage gap (Avlijaš et al., 2013).

Since the UK is a developed country, there is more parity between the female and male workforce. Approximately 72% of women are employed, compared to 80% of men (UK - Office for National Statistics, 2024). However, even in the UK, women are mostly present in low-paid jobs and less productive sectors (ESG and Education, 2024). There are still barriers for women to progress and build skills in the UK, and

the highest positions women occupy are mostly in public administration, tourism, education, and health. Therefore, British women were less willing to enroll in STEM education.

The influence of gender on work ethics has been one of the most analyzed demographic variables. However, the results of these studies have been inconsistent. Some authors have identified that gender has minimal or no impact on work ethics (Alsarhan et al., 2021; Barragan et al., 2018; Schminke et al., 2003). Others have found differences between genders in terms of work ethics, but there is also inconsistency in these results. Some studies have shown that women behave more ethically than men (Bageac et al., 2011; Furnham and Rajamanickam, 1992; Ghorpade et al., 2006) others have identified that men are more ethical than women (M. Fredricks et al., 2014; McInerney et al., 2010; Phau and Kea, 2007; Stam et al., 2013).

Authors who used the MWEP construct to analyze gender differences in work ethics have also reached inconsistent results. Meriac et al. (2010) identified no gender differences (Meriac et al., 2010), whereas Ryan and Tipu (2016) found some differences (Ryan and Tipu, 2016). According to their study, women consider the Centrality of Work, Hard Work, and Self-reliance to be more important than men, whereas Leisure and Wasted Time dimensions are higher for men.

Considering the inconsistency in previous findings, the following hypothesis is proposed

H1: There is an interaction effect between gender and nationality on work ethic dimensions among British, UAE and Serbian managers.

Education and work ethic

All three countries that we analyzed had different educational systems. According to the ranking of the U.S. News and World Report's Best Countries for Education list for 2022, the UK in 2nd place right after the USA, the UAE in 28th place, and Serbia in 68th place (The Best Countries in the World, 2022) their ranking is based on three factors: the level of development of the public education system, the quality of education, and whether respondents are willing to enroll in a university in that nation.

There are not so many studies that have analyzed the influence of education on work ethic as is the case with gender and age (Gierczyk and Harrison, 2019). The results of these studies are inconclusive. Some authors have found that educational level has no impact on work ethics (Keller et al., 2007; Lee and Tsang, 2013), while others have identified that an impact exists (Asio et al., 2019; Ghahremani and Ghourchian, 2012; Yousef, 2001).

The authors, who discovered the influence of education on work ethics, have also come across inconsistent results. Some research found that employees with higher educational levels are more ethical (Asio et al., 2019; Yousef, 2001), while others have revealed that employees with higher educational levels behave more unethically (Constandt and Willem, 2019; Kim and Miller, 2008; Malloy and Agarwal, 2003). However, none of the previous studies tried to discover whether work ethics change with the educational level of employees by using the MWEP construct.

Considering the inconsistency in previous findings, we propose the following hypothesis.

H2: There is a statistically significant relationship between the education and work ethic dimensions among British, UAE, and Serbian managers.

Organizational characteristics and work ethics

Organizational and industry characteristics (e.g., industry type, organizational size) can also have an impact on work ethics. However, in this study, we analyzed the effect of the organizational sector on work ethics among the three nations. Only a few prior studies have investigated the effect of organizational characteristics (such as organizational type, sector, and size) on work ethics (Ali and Al-Kazemi, 2007; Budhwar and Mellahi, 2016; Metle, 2002; Yousef, 2001), but none have used the MWEP. For instance, Yousef (2001) analyzed the influence of organizational type (manufacturing or service) and sector (government or private) on work ethics and found that employees working in service and government organizations support Islamic work ethics more than those working in private and manufacturing organizations Yousef (2001). The results of Yousef (2001) correspond to those of Ali and Al-Kazemi (2007), which indicated that UAE managers in the public sector had a higher work ethics than managers in the private sector(Ali and Al-Kazemi, 2007; Yousef, 2001). On the other hand, Metle (2002) found that Kuwaiti managers in the public sector behave more unethically than those in the private sector (Metle, 2002).

The majority of studies that have analyzed the influence of organizational factors, particularly the organizational sector, on work ethics (especially Islamic Work Ethic) have been conducted in the Arab region, and no studies have analyzed these factors in the West, particularly in Europe.

Considering the results of previous research, we propose the following hypothesis:

H3: There is an interaction effect between organizational sector and nationality on work ethic dimensions among British, UAE, and Serbian managers.

Materials and Methods

The respondents in our study were British, UAE, and Serbian managers. We researched companies in the UAE and Serbia. The sample consisted of 467 managers. Of these, 153 were Serbian, 157 were Emirati, and 157 were British. The Emirati managers and Serbian managers were analyzed in Serbia and the UAE. However, British managers were surveyed in public and private companies situated in the UAE. Demographic characteristics of the participants are presented in Table 1.

Table 1. *Demographic characteristics*

	Serbia	UAE	UK	Total
	%	%	%	%
Gender				
Male	60.8	74.5	42.0	59.1
Female	39.2	25.5	58.0	40.9
Education				
Primary - up to 5 years	0.0	0.6	0.0	0.2
High Schools - 10 years	1.3	1.3	0.0	0.9
Secondary Schools - 12 years	20.3	6.4	20.4	15.6
Undergraduate degree - 14 years	49.7	36.9	49.7	45.4
Graduate degree - 16 years	28.8	54.1	23.6	35.5
PhD degree	0.0	0.6	6.4	2.4
Organizational Sector				
Private sector	60.0	76.9	26.8	53.7
Public sector	40.0	23.1	73.2	46.3

The questionnaire consisted of two parts. In the first part, we identify the personal characteristics of the respondents such as nationality, gender, and education and characteristics of the organizations where participants worked (organizational sector:1= private, 2= public).

In the second part, we measured work ethics using the sfMWEP (Meriac et al., 2013) which is the shorter version of MWEP and consists of seven work ethics dimensions. These seven dimensions are hard work, leisure, self-reliance, morality/ethics, the centrality of work, wasted time, and delay of gratification (Miller et al., 2002).

Research Results

The theoretical model was first tested using Structural Equation Modelling. SEM was conducted on a sample of 467 respondents using a five-point Likert scale measuring work ethics with 28 items (Figure 1).

In our dataset, we did not have variables with missing values, three respondents were unengaged.

After conducting factor analysis, we removed four items (CentralityofWork1, CentralityofWork2, CentralityofWork3, and CentralityofWork4) because of strong factor cross-loadings. When we removed these four items, the KMO value indicated that sampling was adequate (KMO =0.906, Sig.= 0.000). All Communalities were above .607, and the six-factor model explained 71.261 of the variance. There were 0 (0,0%) non-redundant residuals with absolute values greater than 0.05. The discriminant validity showed that we had no strong cross-loadings. The Factor Correlation Matrix showed that all values are below .560

(Table 2)

Figure 1. Latent variables and rectangles measure variables

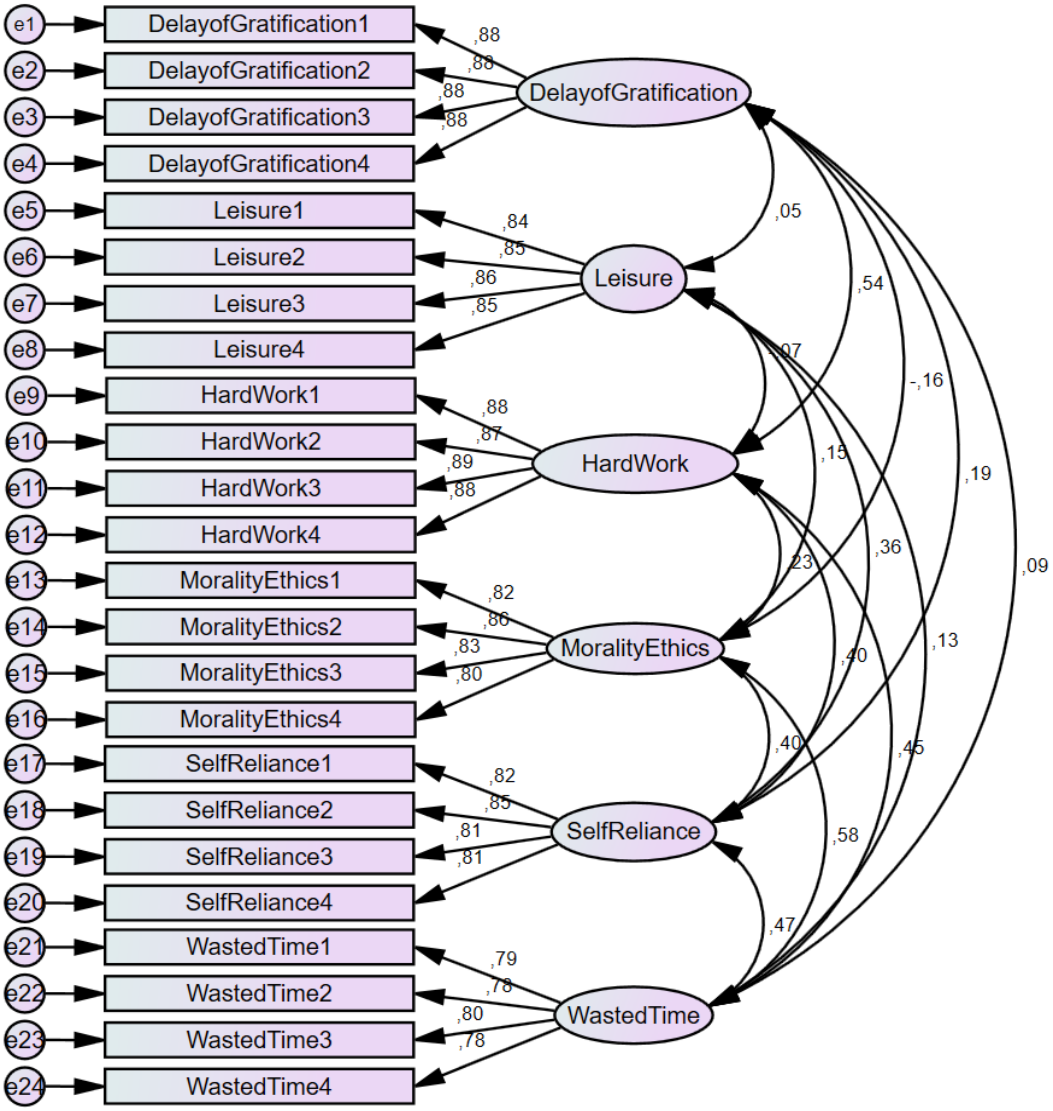

Table 2. *Factor Correlation Matrix*

Factor	1	2	3	4	5	6
1	1	0.052	0.519	-0.157	0.194	0.086
2	0.052	1	-0.072	0.149	0.348	0.127
3	0.519	-0.072	1	0.224	0.399	0.436
4	-0.157	0.149	0.224	1	0.39	0.56
5	0.194	0.348	0.399	0.39	1	0.458
6	0.086	0.127	0.436	0.56	0.458	1

Extraction Method: Maximum Likelihood
Rotation Method: Promax with Kaiser Normalization

All the Cronbach's alpha values exceeded 0.70 indicating that the model's reliability is confirmed.

The AVE for all factors was above 5, and the CR for each factor was above the minimum threshold of 0.70 (Table 4). Finally, it was shown that the hypothesized model represents a good fit to the data (RMSEA=,000 CFI=1,000 CMIN=220,919 DF=237) and, thus, there was no need to conduct post-hoc modifications. (Table 4)

Table 3. *The AVE*

	CR	AVE	MSV	Max R(H)	Self Reliance	Delayof Gratification	Leisure	Hard Work	Morality Ethics	Wasted Time
SelfReliance	0.893	0.676	0.221	0.894	0.822					
DelayofGratification	0.932	0.774	0.288	0.932	0.194	0.88				
Leisure	0.913	0.723	0.127	0.913	0.356	0.051	0.85			
HardWork	0.932	0.775	0.288	0.933	0.403	0.537	-0.068	0.881		
MoralityEthics	0.895	0.681	0.338	0.897	0.399	-0.156	0.151	0.229	0.825	
WastedTime	0.869	0.625	0.338	0.87	0.47	0.087	0.13	0.447	0.581	0.79

After confirming the reliability of the scale and the theoretical model, we started confirming the hypotheses.

Hypothesis 1

We used a two way ANOVA to examine how gender and national culture interact to influence work ethics. The respondents' preferences for work ethic dimensions were dependent variables, while national culture and gender served as the independent variables. The ANOVA setup was framed as a 3 × 2 factorial design (culture × gender). (Table 5)

Findings revealed that significant interaction exists between gender and all three national cultures on the Self-reliance, Hard work, and Delay of gratification dimensions (Table 4)

Table 4. *A significant interaction*

	F	p	partial η2
Self-reliance	6.559	0.002	0.028
Hard Work	7.375	0.001	0.031
Delay of Gratification	3.428	0.033	0.015

A pairwise comparison identified significant differences.

The findings have discovered that a significant interaction between gender and national culture on three work ethic dimensions among the three groups of managers exists, we can conclude that H1 is confirmed.

Table 5. *Means and standard deviation*

		Wasted Time		Self-Reliance		Morality Ethics		Hard Work		Leisure		Delay of Gratification	
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Culture X Gender													
UK	Male	3.98	.46	3.64*	.62	4.23	.31	3.94*	.72	3.08	.56	2.72*	.78
	Female	4.06	.38	3.91*	.61	4.24	.32	3.31*	1.04	3.19	.73	2.37*	.85
Serbia	Male	3.62	.47	3.71*	.53	3.37	.37	3.77*	.48	3.36	.60	3.44*	.58
	Female	3.71	.55	3.50*	.62	3.34	.31	3.69*	.49	3.11	.67	3.49*	.52
UAE	Male	3.80	.64	3.71*	.62	3.60	.71	4.07*	.79	2.94	.70	3.37*	.61
	Female	3.74	.65	3.64*	.52	3.83	.61	4.06*	.71	2.96	.68	3.22*	.61
Culture X Organizational Sector													
UK	Private sector	4.07*	.49	3.78	.59	4.26	.30	3.67	.89	3.14	.67	2.45	.72
	Public sector	4.00*	.38	3.80	.64	4.21	.32	3.52	1.00	3.14	.65	2.56	.88
	Businessman/woman	4.74*	.00	4.65	.00	4.59	.00	4.30	.00	4.15	.00	2.85	.00
	Others	4.41*	.28	4.00	.55	4.59	.02	4.06	.20	2.91	1.06	1.82	.15

		Wasted Time		Self-Reliance		Morality Ethics		Hard Work		Leisure		Delay of Gratification	
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Serbia	Private sector	3.56*	.53	3.51	.60	3.36	.39	3.66	.51	3.15	.68	3.44	.56
	Public sector	3.74*	.48	3.72	.55	3.37	.31	3.84	.43	3.33	.57	3.51	.54
	Businessman/woman	3.89*	.33	3.91	.43	3.33	.24	3.74	.40	3.59	.55	3.41	.55
	Others	3.65*	.35	4.00	.17	3.17	.09	3.58	.99	3.90	.01	3.51	1.02
UAE	Private sector	3.86*	.64	3.76	.56	3.71	.65	4.14	.74	2.89	.69	3.32	.57
	Public sector	3.72*	.69	3.58	.65	3.66	.77	3.98	.82	3.04	.72	3.52	.56
	Businessman/woman	3.70*	.44	3.53	.48	3.15	.47	3.84	.55	3.25	.33	3.33	.30
	Others	3.50*	.60	3.52	.69	3.49	.78	3.87	.88	3.05	.79	3.04	.87

Notes: * p<.05

Hypothesis 2

Pearson's product-moment correlation was used to assess the relationship between work ethic dimensions and educational level for each of the three nationalities.

Analyses indicated that the relationship was linear. Both variables were normally distributed with no outliers.

A correlation was discovered for the UAE and British samples, whereas there was no correlation between educational level and work ethics for the Serbian sample. (Table 6)

Table 6. *Pearson's product-moment correlation*

Correlations				
		UK	UAE	Serbia
Wasted Time Score	Pearson Correlation	.137	.259**	-.028
	Sig. (2-tailed)	.086	.001	.734
	N	157	157	149
Self Reliance Score	Pearson Correlation	.027	.191*	-.036
	Sig. (2-tailed)	.741	.017	.659
	N	157	157	149
Morality/Ethics Score	Pearson Correlation	.079	.058	.112
	Sig. (2-tailed)	.324	.471	.174
	N	157	157	149
Hard Work Score	Pearson Correlation	.270**	.143	-.045
	Sig. (2-tailed)	.001	.073	.587
	N	157	157	149
Leisure Score	Pearson Correlation	-.100	-.148	-.047
	Sig. (2-tailed)	.212	.064	.569
	N	157	157	149
Delay of Gratification Score	Pearson Correlation	.168*	.035	-.081
	Sig. (2-tailed)	.035	.661	.329
	N	157	157	149

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Considering our results, we can say that H2 is partially confirmed because there is no correlation between education and work ethic dimensions for the Serbian sample.

Hypothesis 3

A two way ANOVA was conducted to analyze if there is an impact on work dimensions based on the combination of organizational sector and nationality. Respondents' preference for each work ethic dimension was a dependent variable, and the culture and organization sectors were independent variables. The ANOVA setup was framed as a 3 × 2 factorial design (culture × organizational sector). The results can be seen in Table 5.

The results revealed that there was a statistically significant interaction among all three national cultures and the organization sector on the Wasted Time ($F(6,455) = 2.287$, $p = .035$, partial $\eta 2 = .029$). A pairwise comparison identified significant differences.

The results indicate that a significant interaction effect between the organizational sector and nationality on work ethic dimensions among the three groups of managers exists. Therefore, it can be said that H3 is accepted.

Discussion

The findings confirm most, but not all, of our hypotheses. These results support H1 and H3, and partially support H2.

Testing the first hypothesis of the study indicates that both gender and culture influence work ethics. To date, studies about the connection between work ethics and gender have been inconsistent. Studies that used the MWEP scale have identified inconsistent results. Our results show that males from Britain and the UAE consider the Wasted Time dimension more important than Serbian males. British male managers are expected to place greater importance on time management and that they do not spend much time nurturing social contacts at work because they belong to a low-context and individualistic culture. Moreover, they belong to a masculine culture in which employees are more competitive, people are more ambitious, and material success is highly appreciated. Since "time is money," they try not to waste time at work. However, since the UAE belongs to a high-context and collectivistic culture, we do not expect UAE male managers to value the Wasted Time dimension. They should be more oriented towards fostering personal relationships at work, which is usually time-consuming. Perhaps such a result can be ascribed to the fact that the UAE scores 50 on the masculinity dimension, which means that it is neither a Masculine nor Feminine culture (Hofstede, 2001). Thus, UAE male managers from our sample express more characteristics of masculine culture. The results could have been different if we had analyzed another profession that was not as competitive as the management profession.

The fact that the Self-reliance dimension is significantly higher for British females than for Serbian females indicates that British female managers are more oriented towards achievement and self-fulfillment than their Serbian female counterparts are. The lack of need for achievement among Serbian females can be a consequence of the fact that they work in a transitional economy characterized by a deteriorating economic situation and lack of employment opportunities, especially for women (Linz and Luke Chu, 2013). Therefore, women in Serbian society rarely have the opportunity to choose jobs that would fulfill them and where they would be able to express a need for accomplishment.

We expected that both British females and males would value more the Morality than the other two groups of both males and females. They come from an individualistic and highly developed country and do not consider bribery and preferential employment of relatives and friends to be acceptable business practices. On the other hand, bribery and preferential employment of relatives and friends are still codes of business conduct in the other two countries, especially in Serbia. In general, nepotism is a common way of doing business in collectivistic cultures, such as Serbia and the UAE. In general, in Arab organizations "wasta" phenomenon (connections help one to become successful) is deeply rooted.

The results of our research demonstrate that British females consider the Hard Work dimension to be less important than the other two groups of females. On the other hand, UAE females expressed a significantly higher mean score for this dimension than Serbian females. British females, who come from an economically developed Western country, have more opportunities for promotion than females from an underdeveloped economy in the East, such as the Serbian economy. Moreover, British females have better opportunities than UAE females who live in societies where female roles are still constrained to traditional roles. When Serbian and UAE female managers encounter a "glass ceiling." which inhibits their

success, they might believe that they are going to overcome these barriers by expressing hard work. This is especially the case with UAE female managers, who still live mostly in a male-dominant and traditional society. Traditionally, Arab women were expected to be confined and devoted to their families (Read, 2003). Although the UAE has had the highest increase in the female workforce among Arab countries over the last decade, less than 50% of UAE females participate in the total UAE workforce (ILO Data Explorer, 2023). Therefore, it is expected that UAE females express a higher mean for the Hard Work dimension compared to the other two groups of females.

Testing of the second hypothesis of the study partially identified that there is a relationship between educational level and work ethics among members of different nationalities. A relationship was discovered for the UAE and British samples, while there was no relationship between educational level and work ethics for the Serbian sample.

Thus far, the results of previous studies that have analyzed the influence of education on work ethics have also been inconclusive. The results of our study are also inconsistent if we consider that we have not identified any impact of education on work ethics in the Serbian sample. On the other hand, UAE managers who are more educated value the Leisure and Self-reliance dimensions more than less-educated UAE managers, while British managers with a higher level of education consider the Hard Work and Delay of Gratification dimensions to be more important than their less-educated counterparts.

Testing the third hypothesis revealed that the organizational sector and culture affect managers' work ethics. Both British and Emirati managers who work in the private sector have statistically higher means for the Wasted Time dimension than Serbian managers do. Serbian managers who work in the private sector have a lower mean for this dimension, which is probably the result of the fact that they work in an economy in transition where the effort and excellence of employees are still not appreciated and rewarded enough. Currently, the unemployment rate in Serbia is high, leading to a decrease in the living standards of citizens and an increase in the poverty rate (Gallyamova, 2015). Therefore, employers in the private sector in Serbia mostly do not treat employees as valuable assets that cannot be easily replaced, and they do not find it necessary to reward high performance. They believe that they can easily find new employees in the labor market. This attitude decreases employees' motivation and willingness to be more efficient and productive. Although there are no significant differences between these two sectors within each culture, managers in the private sector for all three groups have higher means for the Wasted Time dimension than do managers in the public sector. For managers who work in the private sector, it is more important to be more efficient and productive than for managers from the public sector because their salaries and incentives are usually aligned with their work performance. In the public sector, compensation is more balanced and less aligned with individual performance (Heinrich and Marschke, 2010; Speklé and Verbeeten, 2014). Moreover, in the public sector, there is less chance that one will lose their jobs if they underperform, whereas this is not the case in the private sector.

Managers from the UAE who work in the private sector express a statistically higher mean for the Self-reliance dimension than Serbian managers. We have also identified that UAE managers in the private sector value this dimension more than those in the public sector, while the situation in Serbia is the opposite. UAE managers in the private sector seek more independence and have a higher need for accomplishment than their Serbian counterparts, because their work and contributions are more appreciated by superiors. They have more opportunities for promotion, and their ideas and innovation are highly appreciated, but this is not the case in most private companies in Serbia. These results are supported by Schwartz and Bardi's (1997) findings, which report that if the reward is equal for most employees, it hinders their willingness to make more effort and strive to achieve more at work (Schwartz and Bardi, 1997).

Another interesting finding that we have not expected is that British managers employed in the public sector show a significantly lower mean for the Hard work dimension compared to their Serbian counterparts. In Serbia, as in most transitional economies, employment in the public sector is usually acquired through political and personal connections, and most often, it is not a matter of individual qualifications. Therefore, we believe that Serbian managers from our sample who work in the public sector will express a significantly lower mean for Hard work ethics compared to the other two groups of respondents who work in the public sector.

Conclusion

Although it is clear that cultural background influences employees' work ethics, organizations with a diversified workforce also need to pay attention to the gender and educational level of employees. Higher scores for hard work ethics among Serbian and Emirati females indicate that they should be given more career opportunities and more autonomy at their workplace. The higher support for female work engagement in these cultures might increase Self-reliance on work ethics among the female workforce.

Interestingly, Emirati managers who work in the private sector displayed a statistically higher mean for Self-reliance and Hard work dimensions. This is a very interesting result because UAE nationals mostly work in the public sector, where they can easily obtain a high-paid job and receive higher benefits (Berengaut, and Muniz, 2005; Forstenlechner et al., 2012). Research indicates that UAE nationals who work in the private sector have a higher need for accomplishments and achievements. Perhaps by working in the private sector, they have become aware that one needs to try hard to move up the career ladder. Since differences between the work ethic of Emirati managers in the private and public sectors are identified, it can be suggested that Emirati youth should be encouraged to be present in the private sector. In doing so, perhaps Emirati managers will also start valuing other ethical dimensions.

The results show that Serbian managers working in the private sector express a lower mean for Wasted time, Self-reliance, and Hard work dimensions, which can provide valuable insights for international companies operating in this region. Serbian managers in the private sector are usually underpaid and high performers are not rewarded and appreciated. International companies that employ the Serbian workforce should pay special attention to rewarding high performance to encourage Serbian managers to nurture more of these ethical dimensions.

We believe that our study has several limitations. The first limitation refers to the instrument. By using a comparative approach, we examined differences in work ethic among analyzed nationalities. Since we analyzed cultural dimensions from the aspect of nationality, we did not pay attention to individual differences within cultures. Even the criticisms of Hofstede's concepts point out that we should consider individual differences among members of one culture (Kirkman, Lowe, and Gibson, 2006). For future research, we would recommend that cultural dimensions should be measured at the individual level.

The second limitation refers to the sample. The British sample was not equivalent to the UAE and Serbian sample. The British sample consists of British expatriates who were UAE residents, and previous studies have shown that the behavior of expatriates can be changed by the influence of the new country (Boonsathorn, 2007). Thus, if the sample consists of expatriates, future research should include the number of years expatriates have lived in the host country as the significant variable of the study.

The third limitation regards the number of respondents in our research. We believe that it is not large enough to generalize the findings. For future research, we would recommend that it should include more respondents.

We have contributed to the current literature using the MWEP scale to analyze the link between work ethics and individual and organizational characteristics. So far, only two studies have analyzed the link between gender and work ethics using the MWEP scale, and none have analyzed the influence of education and organizational characteristics on work ethics using the MWEP scale.

We extend the current literature by analyzing the connection between work ethics and individual and organizational characteristics among three nations that share business interests. Previous studies have been conducted on the population of students or employees in a particular sector. Our respondents had full-time employment and were from different sectors and companies. Furthermore, none of the previous studies have analyzed three countries that are both culturally and economically different and that share business interests.

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Conflict of interests

The authors declare no conflict of interest.

Author Contributions

Conceptualization, T.M.Q., M.R.R. and V.T.; methodology, T.M.Q. and M.R.R.; software, V.T.; formal analysis, M.R.R., and V.T.; writing—original draft preparation, T.M.Q. and M.R.R.; writing—review and editing, M.Q. and M.R.R; Analysis, discussion and conclusion, T.M.Q., M.R.R. and V.T. All authors have read and agreed to the published version of the manuscript

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The Influence of E-Sports on Economy Education and Cultural Communication

Dejan Dašić[1*], *Biljana Vitković*[2], *Marija Ilievska Kostadinović*[3]

[1]Information Technology School, Belgrade, e-mail: dejan.dasic@its.edu.rs
[2]Faculty of Sport, University Union "Nikola Tesla", Belgrade, e-mail: biljana.vitkovic@fzs.edu.rs
[3]Faculty of Law, Security and Management "Constantine the Great", University Union "Nikola Tesla", Belgrade, e-mail: marija.ilievska@konstantinveliki.edu.rs

Abstract: The growing popularity of eSports has attracted significant attention due to its potential influence beyond the realm of entertainment. This paper investigates the effects of eSports on the economy, education, and cultural communication. By exploring how eSports platforms and events provide avenues for generating profit, facilitating learning, and fostering cultural exchange, the study seeks to reveal the diverse impacts of digital gaming on both business and education, as well as its role in global communication This study employs a descriptive-qualitative methodology, examines case studies to evaluate the industry's economic prospects, educational advantages, and the cross-cultural connections promoted by eSports. The results demonstrate that eSports is a versatile platform that not only improves digital literacy and collaboration skills but also acts as a conduit for cultural understanding in an increasingly interconnected world. Furthermore, economic revenues from e-sports continue to grow annually. Grasping these dynamics is essential for educators, policymakers, and stakeholders aiming to harness digital gaming for economic, educational and cultural progress.

Keywords: *eSports, Education, Cultural communication, Digital literacy, Serbia.*

Introduction

In recent years, the rise of e-sports has captivated global attention, not only as a burgeoning industry but also as a cultural and educational phenomenon. At the beginning of this century, the eSports industry was still not a significant player, although it already existed as a niche within video and computer gaming. Its economic aspect and interest in this regard only began to grow with the emergence of the internet and its infrastructure. Today, eSports holds great significance, particularly among the younger generation. Professional players from around the world compete against each other in numerous tournaments, both online and offline, and are enthusiastically followed by millions of fans. (Block and Haack, 2021) E-sports, defined as competitive video gaming facilitated by electronic systems, has rapidly evolved from a niche interest to a mainstream cultural activity with significant implications for education and cultural communication. This paper explores the multifaceted influence of eSports on these domains, aiming to uncover how this digital subculture shapes educational practices and enhances cultural exchanges in contemporary society. Esports is a complex social phenomenon, but it is often regarded solely as a business or economic industry. (Jonasson and Thiborg, 2010). Major corporations such as Microsoft, Samsung, and Red Bull have garnered considerable attention by contributing to the professionalization and global participation in esports (Pizzo, et al., 2018). Some authors confirm that eSports athlete (or e'athlete as an abbreviation) is a suitable term that encapsulates individuals who compete in any esports to achieve an in-game ranking or who compete in a formalized competition (Bubna, et al., 2023).

The integration of Sports into educational settings has sparked discussions on its potential benefits and challenges. Advocates argue that eSports can foster critical thinking, teamwork, and strategic

*Corresponding author: dejan.dasic@its.edu.rs

decision-making skills among participants, mirroring the cognitive demands of traditional sports. Moreover, its appeal among youth populations presents an opportunity to engage students in learning through mediums they find inherently motivating. Conversely, critics raise concerns about the sedentary nature of gaming and its potential to detract from physical activity and traditional forms of education.

Culturally, eSports serves as a global platform for communication and interaction, transcending geographical boundaries and cultural differences. Through live-streamed tournaments, online communities, and fan engagement, e-sports cultivates a shared language of competition and camaraderie among diverse audiences worldwide. This cultural exchange not only promotes understanding and tolerance but also challenges conventional notions of sports and entertainment. e-sports seem not only to be about playing computer games, but can also serve as a means of satisfying the need to belong (Martončik, 2015) .

One of the main catalysts for the rapid expansion of eSports in recent years has been live streaming, particularly through platforms such as Twitch.tv and YouTube. Since its launch in 2011, Twitch has transformed the gaming industry, making it easier for content creators to broadcast their gameplay live. Before Twitch, real-time gaming broadcasts were both costly and complicated. Twitch simplified this process, making live streaming more accessible and widespread.The digital nature of eSports has proven to be a valuable competitive alternative, especially during times of crisis, offering distinct advantages over traditional sports. One area worth exploring is the distinction between amateurs and professionals in the eSports realm. Unlike many traditional sports, competitive video gaming does not consider age as a limiting factor. The structure of eSports competitions can be compared to the pro-am setup found in various sports tournaments. The participation of amateurs alongside professionals allows younger players to transition to a professional level at an earlier age. (Kane, and Spradley, 2017). To fully harness the potential of eSports, global engagement in the development of policies and regulations governing this ever-evolving sector is essential. This engagement requires close collaboration between governments, international organizations, the industry, and the eSports community to develop consistent and unified guidelines that will direct the sustainable growth of the sector (Ceruso, 2024). Esports has even penetrated higher education as an intercollegiate sport, with two university sports departments officially recognizing eSports as a sports team and providing scholarships for eSports athletes. This connection between eSports and collegiate sports raises the question of whether eSports should be considered a sport by the broader community. (Jenny, et al., 2017).

Methodology

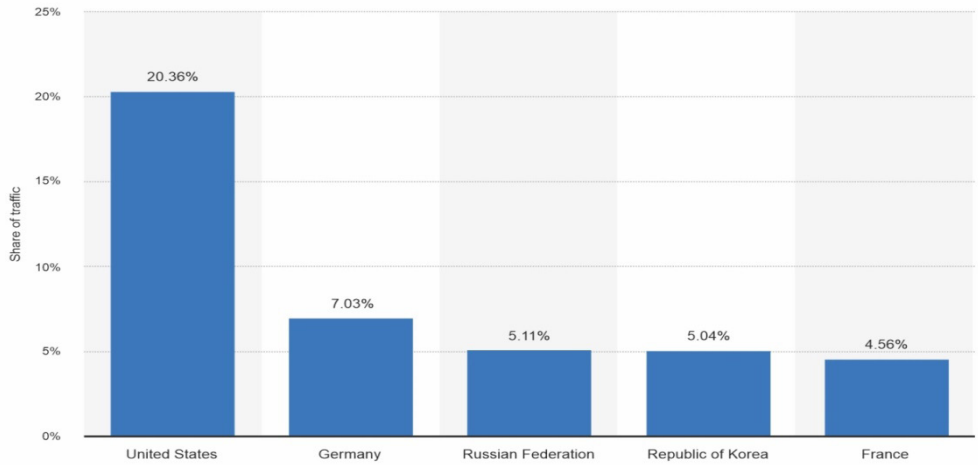
The academic exploration of eSports remains relatively limited, with available data on the subject being sparse. This study employs a descriptive-qualitative methodology. Initially, we investigate the primary financial elements of the eSports industry, including its global revenue, popularity, and level of recognition. We analyze the critical growth drivers that have shaped the eSports sector and are expected to influence its future trajectory. Subsequently, we evaluate the impact of eSports on education and its role in connecting young people globally. Lastly, we review the history, evolution, and current status of eSports in Serbia.

The influence of eSports on economy

The conflation of gaming and eSports is common in the local market, making it essential to differentiate between these two concepts. eSports is only a part of the gaming industry, while gaming encompasses all games that can be played on computers, tablets, gaming consoles (such as Sony PlayStation, Xbox...), or phones. eSports is a competitive sports discipline where the typical setup involves 10 computers divided into two groups (commonly referred to as 5 vs. 5), with two teams competing according to specific game rules. In summary, modern scholars appear to share a common framework for defining eSports. With subtle distinctions, they generally view eSports through two key criteria: technological specificity (involving computers, cyberspace, and electronics) and competitive excellence (encompassing athleticism, professionalism, and sport). These criteria are closely linked to video game culture, positioning eSports as an extension of gaming itself (Karhulahti, 2017).

Like any other industry, the eSports sector also requires marketing approaches (Dašić and Jeličić, 2016). To enable audiences to follow competitions happening worldwide, live broadcasts are often streamed on platforms such as YouTube and, more recently, Facebook. One of the most prominent platforms is Twitch, although other platforms may also be popular depending on the target market (see Figure 1). In addition to participating in competitive games, many players frequently play games for themselves and, by streaming these games, gain fans and followers, thereby generating revenue.

Figure 1. Regional distribution of desktop to Twitch as of December 2023 by country

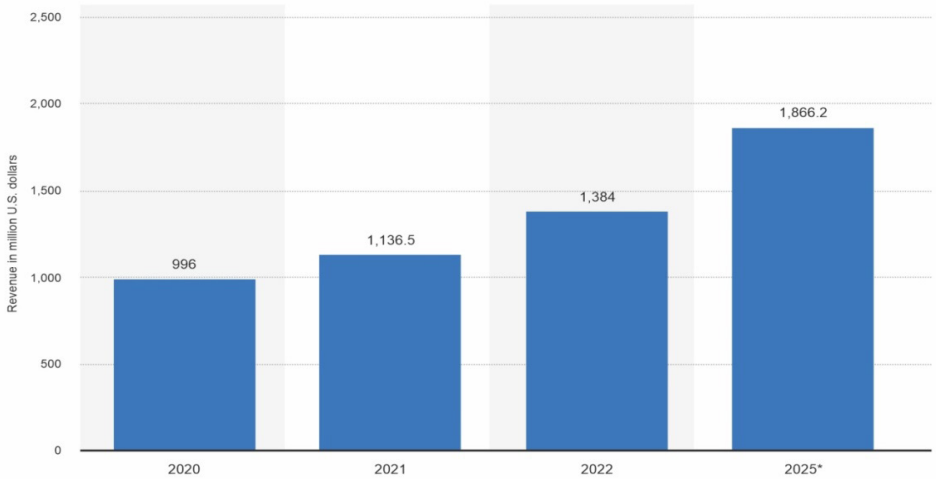


Source: https://www.statista.com/statistics/511558/twitch-traffic-by-country/

EU statistics reveal extensive participation in video games, with one in two EU citizens engaging in gaming in some way. In 2022, the industry produced €179 billion in revenue, with a notable share from mobile games. Europe hosts 5,000 video game companies that provide jobs for more than 74,000 individuals. Moreover, video game technologies and skills are applied in various other fields, including film production, training, healthcare, and defense, highlighting their broad utility and influence. According to recent forecasts 60 percent of Americans play video games daily, 41 percent of players use personal computers and first-person shooters are the most popular multiplayer games (Khromov, et al,. 2019).

Gaming industry today represents the fastest-growing sector in the world, having surged by 10% from 2016 to 2017. Leading the market are China ($46.4B), the USA ($44.0B), Japan ($19.1B), South Korea ($7.4B), and Germany ($6.5B), among others (Newzoo, 2023). As for eSports, as shown in Figure 2, this segment of the gaming industry is also experiencing rapid growth. Esports is a rapidly growing industry that attracts a high number of players and has a high economic value (Thiel and John, 2018).

Figure 2. Esports market revenue worldwide from 2020 to 2025 (in million U.S. dollars)



Source: https://www.statista.com/topics/3121/esports-market/

In recent years, eSports have gained traction as a significant social phenomenon, with support from networks like BBC, OSN, SporTV, and Super Channel, alongside online streaming platforms such as Twitch (owned by Amazon) and YouTube (owned by Google). This type of content is particularly popular among millennials, especially young men. In 2019, the gaming video content (GVC) audience grew by 5%, reaching 944 million viewers. Despite a smaller audience, Twitch outperformed YouTube in revenue generation, earning $1.54 billion compared to YouTube's $1.46 billion, thanks to stronger monetization strategies. Streaming platforms play a role beyond simple distribution, as they allow streamers to achieve economic sustainability using the monetization tools available through these platforms. Sponsors are crucial to eSports, providing financial support and promotion. Companies such as Dell and Monster Energy sponsor teams and events, while game developers like Riot Games and Activision are essential for creating and maintaining games. (Cacho-Elizondo, Álvarez and Garcia, 2020).

Both qualitative and quantitative data reveal that brands, including sponsors and sports clubs, are increasingly engaging with eSports to connect with a new, younger, and predominantly male demographic (Vuković, Dašić, Vuković, 2024). The data highlight how eSports is not only growing in prominence but also how streaming is becoming a crucial economic sector within this space. eSports players are leveraging streaming to generate revenue through various channels such as tournament winnings, fan donations, and sponsorships. This shift underscores the expanding economic impact of both eSports and streaming, as they provide new opportunities for financial gain and audience engagement. (Wohn and Freeman, 2020; Bertschy, Muhlbacher, and Desbordes, 2020; Riatti and Thiel, 2022).

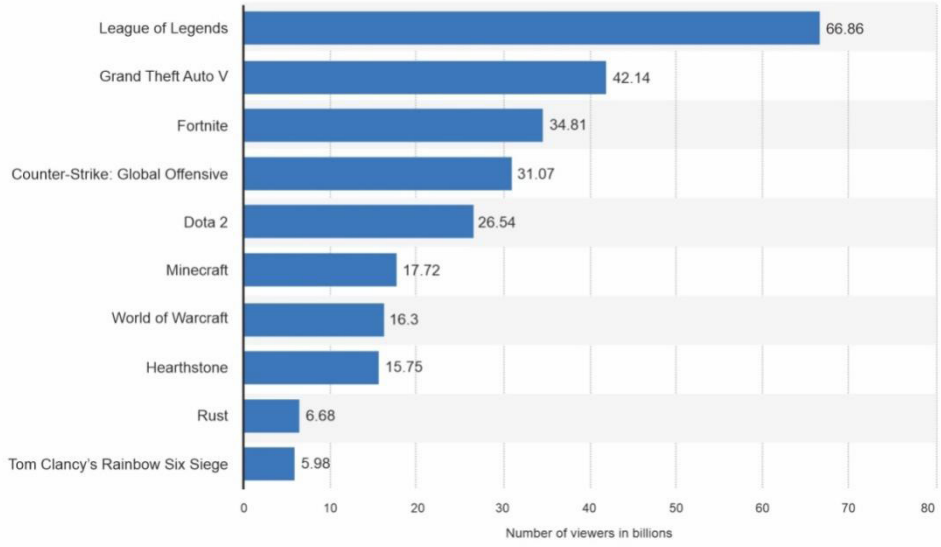
Esports is increasingly incorporating features from other markets, with rising compensation for top players driven by advancements in communication technologies and online streaming. This has resulted in a substantial increase in the prize pools available at tournaments. Game developers have realized they can monetize tournament-related expenses directly through ticket sales and broadcasting rights, and indirectly by promoting additional in-game purchases. To draw in audiences, tournament organizers aim to attract elite players with ever-larger prize pools. Although prize funds for professional gamers differ depending on the game and tournament location, most have surged from minimal amounts a decade ago to over $100 million in prizes today. (Ward and Harmon, 2019).

Several authors (Haji Rasouli and Kumarasuriyar, 2016; Scholz, 2019; Nyström et al., 2022) suggest that as esports continue to grow, sustainability will become increasingly relevant for all stakeholders, even though some participants in the ecosystem often pay insufficient attention to it. It is crucial to explore the sustainability of esports from new perspectives, including economic, ecological, and social dimensions.

The influence of eSports on education end cultural communication

The explosive rise in eSports popularity has significantly increased the volume of academic research focused on organized, competitive gaming. This field has rapidly evolved from non-existence to a recognized area of study within disciplines such as business, sports science, cognitive science, computer science, law, media studies, and sociology. (Reitman, et al., 2020). The integration of eSports into the education of young people has long been recognized as a significant factor in their overall development. The North American region dominated the eSports market, accounting for approximately 29% of global revenues in 2022. Games like League of Legends (LoL), Dota 2, and Fortnite (see Figure 3) have emerged as major catalysts for the growth of eSports, drawing in large and enthusiastic fanbases. Awareness of eSports is expanding rapidly, with nearly two billion people having heard of it at this point. Concurrently, the demand for eSports events is increasing at an impressive double-digit rate each year, reflecting the sector's rising popularity and engagement. (Newzoo, 2023).

Figure 3. Most popular games on Twitch worldwide as of December 2023, by all time views (in billions)



Source: Twitch most popular games by all time viewers 2023.

In the digital age, eSports has emerged as a global phenomenon with profound implications for cultural communication. Esports, or competitive video gaming, has evolved beyond entertainment to become a significant platform for cross-cultural interaction and exchange (Barjaktarović, 2023). Esports facilitates unprecedented levels of cultural exchange through its widespread digital presence and international tournaments. The competitive nature of e-sports attracts diverse audiences from various cultural backgrounds, creating a shared space where individuals can interact and engage with each other's cultures. Online platforms such as streaming services and social media play a crucial role in this interaction, enabling real-time communication and collaboration among players and fans across the globe (Vuković, Urošević, and Dašić, 2023). In the field of education, eSports facilitates the development of cognitive and social skills, such as critical thinking, problem-solving, teamwork, and communication. These skills can be applied across various academic and professional contexts. (Dambrosio, 2024)

One of the key aspects of eSports' influence on cultural communication is its ability to transcend geographical and linguistic barriers (Dašić, 2023). Games often feature universal themes and narratives that resonate with a global audience, while in-game interactions and community forums allow for the exchange of cultural perspectives and experiences. This digital interaction fosters a sense of global community and mutual understanding among participants.

Additionally, eSports tournaments and events often become cultural spectacles, attracting attention from media outlets and audiences worldwide. These events not only showcase competitive gaming but also highlight cultural elements such as regional gaming styles, fan traditions, and cross-cultural collaborations. By celebrating these diverse cultural expressions, eSports contributes to a broader appreciation of global cultural diversity.

However, the influence of eSports on cultural communication is not without challenges. Issues such as digital divide, cultural misrepresentation, and the potential for cultural homogenization can impact the quality and nature of intercultural exchanges. It is essential to address these challenges to ensure that e-sports remains a positive force for cultural communication and understanding. The rapid expansion of eSports, marked by increasing numbers of participants, viewers, and economic impact, renders it an area that researchers, public officials, and policymakers must pay attention to (Ristić, Živković, and Jemović, 2023). Furthermore, eSports holds the potential to connect with societal groups that have been challenging to engage in the past (Polman et al., 2018).

Gaming and eSports in Serbia

Based on relevant statistical data, it is evident that Serbia plays a prominent role in the regional gaming and e-sports scene (Dašić and Ratković, 2018). Serbia was among the pioneering countries in the region to initiate the organization of both local and regional tournaments, positioning itself as a key

player in this developing industry. Despite this early involvement, the country has yet to make a significant leap forward within the sector. This lack of substantial progress can be attributed to several factors, including a limited understanding of the gaming and e-sports industry as a whole, fragmented efforts by individual enthusiasts, and the underutilization of essential marketing tools and strategies. Gaming and e-sports represent a rapidly growing industry with their own unique communication channels, requiring a well-coordinated approach to fully capitalize on the opportunities they present. Without a deeper comprehension of these specialized channels and a more unified, strategic approach to marketing, Serbia risks falling behind in what is now a highly competitive global industry.

E-Frag was the pioneering organization to introduce eSports in Serbia, marking the beginning of competitive gaming in the region. The early tournaments were mostly local, but they gradually expanded to encompass the surrounding areas. After successfully organizing a number of events, E-Frag decided to take a bold step by hosting the first European Championship in Counter-Strike in Belgrade. This landmark tournament took place in mid-December 2013, attracting 30 European countries, each competing for a chance to reach the semifinals. Four teams had the honor of being hosted in Belgrade, staying at the Kristal Hotel, where the event itself was held. At that time, the prize pool was a modest €3,000. However, the landscape has since evolved, and today the prize pool for such tournaments has grown substantially. A minimum of €100,000 is now required for prize money, not to mention the additional costs involved in organizing an event of this scale (Ratković and Dašić, 2018).

The sports and gaming industry in Serbia has seen significant growth in recent years. According to the Serbian Games Association (SGA) report, 2023 brought a 17% increase in revenue for the top 15 companies in this field. The overall value of the industry has grown considerably, and employment in this sector has also experienced strong growth, with a nearly 98% increase in the number of employees over the past year. Players in Serbia are attracted by both the local and international success of companies developing video games. In 2022, the industry reached a record number of new games in development, with around 100 games currently in progress. Additionally, the top 15 companies generated 10% more revenue than the previous year. Serbia is becoming an increasingly attractive destination for gaming start-ups, thanks in part to support and initiatives such as talent development programs and game development initiatives.

It is estimated that over 4,500 people are employed in the video game sector. The number of employees has increased by an impressive 98% compared to last year, largely due to the relocation of professionals from abroad, particularly from Russia, Ukraine, and Belarus. The roles are diverse, and 60% of our respondents have announced plans to expand their teams. Women make up one-third of the workforce, placing Serbia among the leaders in Europe in terms of having such an inclusive gaming industry. In 2024 alone, 475 new positions are expected to open. The top fifteen gaming companies in Serbia generated €175 million in revenue, marking an increase from the previous year (Figure 4).

Figure 4. Trends in the Serbian Gaming Industry 2017-2023

Year	Employees	Companies + teams + studios	Estimated total revenue in million EUR	Games published
2023	^ 3419	^ 150	^ 175	v 30
2022	^ 1744	^ 140	^ 150	^ 51
2021	^ 1548	^ 130	^ 125	v 35
2020	^ 1431	^ 120	^ 120	v 41
2019	^ 1325	^ 100	^ 80–120	v 46
2018	^ 1281	^ 60	^ 80	^ 70
2017	– n/a	– 30	– n/a	– 89

Source: Serbian gaming industry report 2024.

In a relatively short time, Serbia's gaming ecosystem has undergone remarkable transformation. A growing number of teams are not only focused on game development but also on offering services and

creating tools that are becoming integral to the industry. Companies, studios, and teams differ in size, location, and the variety of projects they engage in. We are seeing an increasing presence of global industry leaders entering the market through acquisitions and investments in local startups. The number of job opportunities across diverse professions is on the rise, and notable progress is also being made in the field of education (Dašić, et al., 2024).

Despite the organizational challenges faced in hosting European and global tournaments, the passion for eSports continues to sustain its popularity in Serbia. A significant factor in this success has been the large number of tournaments organized by players and fans, which were streamed online and quickly attracted substantial viewership and media coverage. Early on, companies with close ties to the gaming industry—such as video game developers, software and hardware producers, and manufacturers of gaming consoles, keyboards, mice, headsets, and other peripherals—became sponsors, playing a key role in the development of e-sports. As these companies expanded their involvement, they began sponsoring players and teams, helping to further bridge the gap between e-sports and traditional sports competitions. While streaming platforms usually sponsor major tournaments and organizations, other prominent brands supporting eSports include Intel, Kingston, Monster, Coca-Cola, Cooler Master, HyperX, and many others (Ratković and Dašić, 2018).

Equipment manufacturers have also contributed to the popularization of e-sports through their consistent presence at such events and by sponsoring players to better promote their products. Their involvement allows them to more accurately understand this emerging market, enabling them to market their products and brands to millions of consumers and secure significantly higher profits (Dašić, Kostadinović, and Kim, 2023).

With the rapid expansion of the e-sports market and the ability to track return on investment, this sector has become increasingly appealing to investors, sponsors, and advertisers. One of the key advantages is the relative ease of market segmentation, as the well-defined characteristics of the mini-communities within specific games allow for precise targeting. Research indicates that both players and audiences tend to fall within the 16 to 47 age range, with a predominantly male demographic (61%-39%). These individuals generally possess higher purchasing power, are exposed to stress, and demonstrate a strong competitive nature.Professional e-sports players often incorporate physical exercise into their routines to stay fit, reflecting the growing professionalism within the industry. Many of these players come from traditional sports backgrounds, transitioning to eSports after injuries sidelined them, in search of new competitive outlets. This unique blend of characteristics makes the eSports market particularly attractive for sponsors and advertisers, as it allows for focused positioning strategies that can effectively engage this dynamic audience. Simultaneously, the measurable growth of the industry continues to draw in investors seeking profitable opportunities in an expanding field (Ratković and Pećić, 2024).

Esports in Serbia has significant potential and should be leveraged as a promotional tool, but it is essential to apply marketing principles tailored to this environment. Additionally, marketing efforts need to focus on raising awareness about the importance of this industry. E-sports should be popularized with an understanding of the value and revenue it can generate.

Conclusion

Esports has a significant impact on education and cultural communication among young people. In the realm of education, e-sports fosters the development of cognitive and social skills such as critical thinking, problem-solving, teamwork, and communication. These skills can be applied across various academic and professional contexts. In terms of cultural communication, e-sports plays a key role in building community among youth. Participants develop connections with people around the world through digital platforms, forming virtual teams and communities that encourage collaboration and understanding of cultural differences. These activities also promote values like teamwork and sportsmanship, which positively influence personal and social development. From an economic perspective, eSports is unique due to its commercially developed, distributed, and maintained gaming artifacts. Unlike many established and recognized sports, e-sports operates on gaming systems designed as commercial products by profit-driven companies.

Despite these positive aspects, there are also negative considerations. Research (Holden, Kaburakis, Rodenberg, 2018) has shown limited awareness and seemingly little preparedness to address

health-related challenges. For instance, a survey conducted in Australia by Bond University and the Interactive Games and Entertainment Association revealed: (i) 98% of households with children have video games; (ii) 68% of the population plays video games; and (iii) the average daily time spent playing video games is 88 minutes. Given the potentially harmful combination of e-sports with stimulants and inactivity, it is crucial to encourage more exercise and physical activity programs for e-sports enthusiasts. Another study (DiFrancisco-Donoghue et al., 2021) found a misconception that regular exercise can negate the negative health effects of prolonged sitting. The physical demands on eSports competitors are three times greater than those on office workers and vary depending on the e-sports games, platforms (computers, consoles, mobile devices), and performance levels (McGee et al., 2021). Finally, the rapid growth in revenue, viewership, player numbers, and exposure has led to issues such as cheating. "Boosting" is a form of cheating where highly skilled players access accounts of weaker players to increase the account's rank in exchange for monetary compensation (Conroy et al., 2021). Future research might need to focus on how to mitigate the negative effects, considering that the growth of the gaming industry is an unstoppable process.

Conflict of interests

The authors declare no conflict of interest.

Author Contributions

Conceptualization: D.D.; methodology: D.D.; resources: B.V. and M.I.K., supervision: D.D., and B.V.; writing—original draft preparation: D.D, and B.V.; writing—review and editing: D.D. All authors have read and agreed to the published version of the manuscript.

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Designing Digital Multimodal Resources for the Kindergarten: From Intuition to Awareness

Nikolay Tsankov[1*] , *Milena Levunlieva*[2]

[1]Faculty of Education, Trakia University, Stara Zagora, Bulgaria
e-mail: nikolay.tsankov@trakia-uni.bg
[2]Faculty of Pedagogy, South-West University, Blagoevgrad, Bulgaria
e-mail: levunlieva@swu.bg

Abstract: The study adapts McNeill and Robin's (2012) evaluation system for digital story design to identify pre-service kindergarten teachers' perceptions of its process and product aspect. Conducted within the course Pedagogy of Construction and Technology, the empirical study involves self-, peer, and expert evaluation of custom-designed multimodal educational digital ensembles. Significant differences across these evaluation axes emerge in the indicators clarity and cohesion, the capacity of the resource to render symbolic/metaphorical meanings, and students' consideration of the audience's age-related capabilities. Unlike students, experts manifest a more pronounced criticism, because their evaluation draws on their experience and perception of the applicability of the resources. To contextualize the three axes of evaluation, focus group discussions were conducted exploring students' intentions related to goal setting, preparation, the author's presence, and the multimodal modes of expression. A lack of specialized technological knowledge was established for effective use of multimedia software. Inconsistencies in students' perception of the storyboarding process were also identified, along with an orientation to the audience's motivation rather than to their age-related characteristics. These findings highlight the need for a systematic design of university courses in educational multimodal digital design for Education majors.

Keywords: *evaluation of multimodal digital resources for educational purposes, meaning-making as design, multimodal digital ensemble, pre-service kindergarten teachers' training.*

Introduction

While the theory of education since the New London Group has relied increasingly heavily on the synergic incorporation of modalities other than the verbal and the cognitive ones in the process of educational interaction, its practice is still catching up.

Digital coursebooks and guides, when they are available for schools or kindergartens, are being used as convenient means of illustrating the instructional content rather than as a unity of meaningfully organized multi-modal assemblies meant to fulfil a specific cognitive or social goal. And while the core curricula of students of media and communication, journalism, and public relations do include Multimodal composition as a required course (Ball, 2012), education majors still have to rely mostly on intuition in the expedient use and development of digital didactic resources incorporating non-hierarchically organized modes of expression and operation. The present study is an attempt to evaluate the instruments, knowledge, and skills pre-service kindergarten teachers apply in preparing such resources. It adapts the three-stage evaluation framework introduced by McNeil and Robin (2012) to explore the students' points of departure in the design process; the leading factors defining its nature (target audience, available technological solutions or the expected educational goal) and the extent to which they use digital applications in a goal-oriented conscious manner to design these resources. The assessment process, which includes self-reflection (survey questionnaire and focus discussion), peer evaluation and expert

*Corresponding author: nikolay.tsankov@trakia-uni.bg

evaluation, is intended to trace the strong and weak points in students' design process and analyse the level of correspondence between the task set to the designers and the digital multi-modal assemblies they produced as a didactic instrument for pre-school children in order to help them design and construct a specific object as part of their work in the thematic area Construction and Technology.

Theoretical Rationale

The consistent association of teaching literacy with the teaching of multi-modal and digital literacies ever since New London Group's groundbreaking work on literacy pedagogy requires continuous revisiting of national educational panels and poses specific curriculum design requirements on under-graduate, graduate, and post-graduate programs in Education. Pre-service teachers need systematic and dynamically oriented knowledge not only on how to appreciate and assess the multi-modal nature of learning, but also how to design and use multi-modal didactic instruments effectively with students at all educational and age levels.

In the context of "culturally and linguistically diverse and increasingly globalized societies", The New London Group define two interdependent and mutually defining goals of literacy learning: (i) providing instruments to use and perceive effectively the ever changing "language of work, power and community" and (ii) forming, stimulating and fine-honing students' "critical engagement to design their social futures and achieve … fulfilling employment" (Cazden, Cope, Fairclough, Gee, Kalantzis, Kress, Luke, Luke, Michaels and Nakata, 1996:60).

Such goals result in a conception of meaning making as design that identifies meaning both as a process and as a product – a fundamental premise that allows educators to consider any semiotic activity, activating the tactile, audio, visual, gestural, spatial, spoken, and written modalities (Kalantzis and Cope, 2012) in a non-hierarchical manner (Bezemer and Kress, 2015; Magnusson and Godhe, 2019), as "an active and dynamic process, and not something governed by static rules" (Cazden et al., 1996:60). It also incorporates all modalities in the learning process transforming literacy learning into acquisition and active application of multiliteracies in a continuous process of designing and reconceptualizing resources and meanings.

This conception of literacy pedagogy also implies that education majors, including those specializing in pre-school education, should possess the skills and capacities to design, create, and assess multimodal compositions as part of children's preparation for school. It also suggests that literacy practices should ramify into the organization and implementation of small projects, experiential learning, effective use of materials to construct everyday objects, etc. All these activities are part of the Construction and Technology thematic area in kindergartens, which makes it especially suited as a medium and environment for meaning-centred multiliteracy learning.

In an exploration on "how digital competence is conceptualized in recent revisions in the curriculum for Swedish compulsory school", Godhe, Magnusson and Hashemi (2020:74) identify four recurrent themes incorporating (i) the use of digital tools and media; (ii) programming; (iii) critical awareness and (iv) responsibility. However, they argue that the most pervasive theme emergent in all subject areas is "the tool-oriented use of digital tools and media" (Godhe et al., 2020:74) – a tendency they find alarmingly limited in view of the international frameworks of digital and multi-modal competence and in the context of the increasingly multi-modal nature of communication nowadays.

The alert raised by Godhe et al. (2020) suggests that the operationalization of literacy as "literacy in multiple forms in a context of cultural diversity and of ubiquitous technology and multimedia in communication" (Paniagua and Istance, 2018:129) also requires a transformation of instructional content and curricula in university Education programs – a transformation guided by the concept of teachers and learners as active designers of their knowledge, learning environment, and ultimately, their social futures.

These conclusions further consolidate the argument that "multiliteracy and critical literacy are not just related but inherent in all literacy engagement" (Silvers, Shorey and Crafton, 2010:379) – a conception which confirms the fundamental association between social engagement and literacy as a meaning making ability. Kalantzis and Cope (2008:203) define five questions to guide teachers when designing multimodal activities and resources for literacy learning: (i) what is the referential value of meanings (representational); (ii) how do meanings apply to one another (organizational); (iii) what is the relation between meanings and the persons they involve; (iv) what is the relative status of meanings within the larger

world of meaning (contextual); (iv) whose interests are the meanings intended to support (ideological). Designed to respond to these five zones of semantic and operative density, and based on a "multiplicity of forms", multimodal resources and analysis "lead to critical reflection and connection with everyday experiences" (Kalantzis and Cope, 2008:134).

In a reality where multimodality is the natural form of communication, new digital platforms and information tools are erasing the boundary between designers of meaning and their audiences, which is why young people are naturally inclined to analyse and produce multimodal texts (Anderson, 2003).

Within the framework of teacher education, this means that special considerations need to be made for pre-service teacher training to be oriented towards the diverse and numerous ways of applying, designing and planning the goal-oriented, effective and adequate use of digital multimodal assemblies in pedagogical interaction. Jewitt (2009: 12) proves that multimodality exceeds the realm of theory and applies to a myriad of applications, regarded concurrently as "theory, perspective, field of research or methodological instrument." Vasudevan, Schultz and Bateman emphasize the benefits of building literacy skills and providing conditions for engaged meaningful learning (Vasudevan et al., 2010). Becker and Blell (2018:129) argue that students' awareness of the authenticity of their target audience favours an enhanced understanding of new concepts and their application. Johnson and Smagorinski (2013) foreground the idea that the design of multimodal ensembles in language education increases contextual understanding and, alerting students to their target audience, captures the pragmatic function of language and improves social interaction. In an exploration of multimodal instruction in science education Demirbag and Gunel (2014) conclude that it enhances the quality of causal and critical thinking and the degree to which students master the instructional content.

Despite all these findings, evidence is accruing of sustained lack of access to high quality teaching to support 21 c. skills, which necessitates that teachers' knowledge should be contextualized not only as pedagogy and content, but also in terms of technology (Mishra and Koehler, 2006) and supported by a profound understanding of the multimodal nature of digital texts and environments (Gregori-Signes, 2014; Kress, 2010) to provide conditions for future teachers to become skilled designers and composers of multimodal digital texts.

Building on this argument, Cappello (2019) demonstrates that a focus on a visual curriculum, including digital multimodal compositions, makes it possible for education majors to express their identities. Delving further into the essence of multimodal storytelling, Mills and Unsworth (2017:612) argue that "in visual narratives, characters are developed through emotional expressiveness, which is indicated largely through nuanced and authentic representations of body language, such as stance, gestures, facial expressions, and movement" (Mills and Unsworth, 2017:612).

Exploring the effects of "immersing teacher candidates in a multimodal composing experience", Shinas and Wen (2022:7) put forward compelling evidence of:

- intentionality of design choices;
- prominent expression of designers' sociocultural identities in both the multimodal composition process and in the post-assignment reflections of students;
- developing awareness of teacher candidates of the benefits digital storytelling can bring to the literacy classroom in terms of creative skills and self expression;
- a changed perception of technology integration in education and in personal growth (Shinas and Wen, 2022:8).

Table 1. *Structural semantic, and functional components of the multimodal composition (based on Cazden et al. (1996), Halliday and Matthiessen (2004) and Halliday and Matthiessen (2004))*

<table>
<tr><td colspan="3">PRODUCT ASPECT of the multimodal composition as part of the multimodal communication continuum Creative realization</td></tr>
<tr><td colspan="2" rowspan="2">PROCESS ASPECT: Form (of expression) and Content (modes of meaning)</td><td>FUNCTIONAL ASPECT: Conceptual core</td></tr>
<tr><td rowspan="2">Pragmatic/Interpersonal (language as action or the audiences' relationship with the author of the message and what it is intended to do)</td></tr>
<tr><td>Representational (what the meanings refer to)</td><td rowspan="3">Visual mode of meaning
Language mode of meaning
Audio mode of meaning
Spatial mode of meaning
Gestural mode of meaning</td></tr>
<tr><td>Expressive (how the author/ designer and the meanings apply to each other)</td><td>Ideational (language as reflection - the audiences' experience of the outer world/the message reflected in its potential to activate response (social, emotional, creative, cognitive, empirical, etc.)</td></tr>
<tr><td>Contextual (where do these meanings stand in relation to the larger world of meaning)</td><td>Textual (enabling and organizing the ideational and interpersonal functions through the potential for synergy of meaning, knowledge and active experience</td></tr>
</table>

Tracing back the historical development of the multimodal composition, G. Palmery demonstrates that the scope and content covered by the umbrella term multimodal text is not an evolutionary new idea (Palmeri, 2012). The operationalization of its structure and components for the purposes of assessment, however, are a later development. Ball (2012:70), editor of Kairos: A Journal of Rhetoric, Technology, and Pedagogy, whose mission is "to offer scholars a place to transfer their knowledge of linear, print-based, academic writing into multimedia-based scholarship that enacts the author's argument", summarizes the assessment criteria for scholarly multimedia (webtexts) introduced for the needs of the Institute for Multimedia Literacy (IML) honours program in Digital Writing Studies based on (Kuhn, 2008) and revisited by Kuhn, Johnson and Lopez (2010).

Elaborating on Kuhn's criteria, she defines 6 rather than the original 4 components of multimodal texts: (i)conceptual core, (ii) form and content, (iii) creative realization, (iv) research component; (v) audience; and (vi) timelines. Table 1 visualizes our concept of the multimodal composition as a unity of form, content and function in which our adaptation of the assessment criteria suggested by Ball (2012) and McNeil and Robin (2012) is grounded.

Methodology

The empirical study was conducted with a sample of 32 under-graduate students of Pre-school and primary school pedagogy. As part of their course in Pedagogy of construction and technology activities. The course is oriented towards the design of methodological solutions for pedagogical interaction in the kindergarten which form and develop specific technological knowledge, skills, and attitudes closely related to children's preparation for school. Within the frame of the area of Construction and technologies education it focuses on work with figures and visuals, understanding and solving problems, carrying out small projects, as well as on knowledge transfer and application of technological operations. The educational and psychological rationale behind the activities within this area includes providing conditions for self-realization through games, building children's confidence in their capabilities, and stimulating their motivation.

The following assignment was given to the Pre-school education majors: Design a situated pedagogical interaction in the educational area "Construction and technologies" which allows for a constructionist and/or technological analysis in the condition of multimodal presentation of a construction and/or technological process. The project should combine a variety of modes of representation (visual – photos, illustrations, video, colours, symbols; audio – music; speech – speed, rhythm, meaningful pauses; speech; writing, space – movement, gestures, facial expressions).

The research is pre-eminently aimed at establishing the points of convergence and divergence in the assessment, self-assessment and expert assessment stage of the projects. It is based on McNeil and Robin and McNeil (2012) who propose an evaluation framework for digital storytelling that has three axes focusing on: the design process, the development process, and the completed product. Each of these is composed of: self- evaluation by the creator(s), peer-evaluation by other students, and educational evaluation by the teacher. We have adapted the criteria and indicators in the evaluation rubric to account for

the fact that the evaluation is provided by pre-school teachers expert in the field of digital storytelling, who did not witness the design process and were only familiar with its result. Therefore, the evaluation in our adapted framework (Table 2) is focused on the product itself, rather than on the its design or development phases.

Table 2. *Integrated evaluation framework for contextual assessment of multimodal designs*

Criteria	Expert/peer/self-evaluation Indicators	Focus group discussion questions
1. The aim is clearly stated and is in accord with: (Why?)	1.1. the audience's capacities 1.2. the multimodal medium of the communication act; 1.3. the speed (rhythm, voice punctuation) of the story	1. Describe your digital story 2. How would you describe its aim?
2. Multimodal content of the story (What?)	2.1. The content creates an atmosphere that corresponds to the educational goal(s); 2.2. The modes of expression employed have the capacity to convey symbolic/metaphorical meaning and/or attitudes/intentions 2.3. The modes of expression employed have the capacity to convey logical/referential meanings only	2. Describe the preparation stage of the design in view of its (i) setting; (ii) script; and (iii) objects and instrument used to demonstrate the instructions. How did you choose these objects? Did you use available ones or did you buy new ones, specifically for this purpose? How did you choose the mode of designing your digital resource in terms of software, hardware, device?
3. Multimodal signature (personal presence) of the author (How 1)	3.1. the author creates an atmosphere that corresponds to its aim and content; 3.2. the author's role in the communicative act is clearly and unequivocally established; 3.3. the author's mood and attitude to the target audience (the potential participants in the communicative act) is easy to identify.	3. During the preparation stage did you have specific expectations about your potential audience? Did these expectations affect your preparation? How?
4. Multimodal means of expression (How 2)	4.1. cohesiveness of the story 4.2. cohesion of the message 4.3. clarity of the message	4. Which are the elements of your video which may elicit a strong emotional response from the children? Which are the elements of your video that may elicit a strong cognitive response?

A self-assessment card was designed on the basis of the criteria and indicators pointed out on Table 1 and a cross examination was conducted of the data coming from three instruments: self-evaluation, peer evaluation and expert evaluation by teachers.

The expert evaluation method collects data stemming from the knowledge and experience of experts in the field of pre-school education (six experts with over 10 years of experience and with professional interests specifically oriented towards the design and adaptation of digital resources). These data are instrumental in analysing the degree to which students' multimodal ensembles meet the criteria and indicators listed above.

The study employs the Delfy method to elicit independent expert evaluations and prognoses and the results are analysed by deducing the average of expert assessments in relation to each indicator. The method of heuristic prognostication is also applied to provide experts' perspective on the potential of the multimodal ensembles for improvement and for reaching an adequate quality to be introduced to educational practice.

The focus group discussion method was employed to elicit information through focused questions by forming two groups of 12 students. The constructed semi-structured interview included the following subject areas as starting points: (1) descriptive goal-setting in the digital multimodal ensemble; (2) design, scripting, and composition of the digital multimodal ensemble; (3) technological solutions chosen for the

digital multimodal ensemble; and (4) cognitive, social, and emotional methodological construction of the digital multimodal ensemble. In addition to eliciting information through focused questions, the discussions with the focus groups served as an additional point of departure for our analysis and provided us with the opportunity to formulate our hypothesis.

Results

The results of the self-evaluation, peer evaluation and expert evaluation of the multimodal digital ensembles are presented in Table 3 and only those will be commented which demonstrate the required level of statistical significance and differences.

Within the study, a statistically significant difference was found between the students' self-evaluation (M = 8.25) regarding "the consideration of the target audience capcities" the expert evaluation (M = 6.35) of the same indicator. The results of Mann-Whitney U test showed that there was a statistically significant difference between the experts' evaluation and the students' self-evaluation Asymp. Sig. (2-tailed) was 0.012, indicating that p = 0.012<0. 05, which is evidence of a statistically significant difference in the values and leads to the conclusion that there is a difference between the two groups (the students and the experts) in terms of what educational value the multimodal ensembles created by the students bring to the audience in view of their age-related capacities.

Table 3. *Average evaluation results*

Indicator	Average self-evaluation (*M*)	Average peer evaluation (*M*)	Average expert evaluation (*M*)
Allowances are made for the target audiences (age-related) capacities	8.25	7.95	6.35
Adequacy of the multimodal (visual, verbal, audio) medium to the defined goal	8.00	7.35	7.00
Speed of the multimodal ensemble (rhythm and voice punctuation	7.25	8.95	8.00
The content creates and atmosphere corresponding to the educational goal	9.05	9.00	7.85
The modes of representation use can convey symbolic/metaphorical and/or attitudes/intentions	7.00	7.25	5.00
The modes of representation use can convey referential/logical meanings only	8.25	8.15	7.05
The author sets a tone and atmosphere that correspond to the goal and the content of the ensemble	9.00	8.75	7.25
The role of the author in the communicative act is clearly stated	9.55	9.35	9.00
The attitude of the author to the other participants in the communicative act (the audience) is clear and visible	9.35	9.15	8.95
Cohesiveness of the ensemble	8.00	7.95	6.85
Cohesion of the ensemble	7.55	7.00	5.25
Clarity of the message	6.95	9.85	5.00

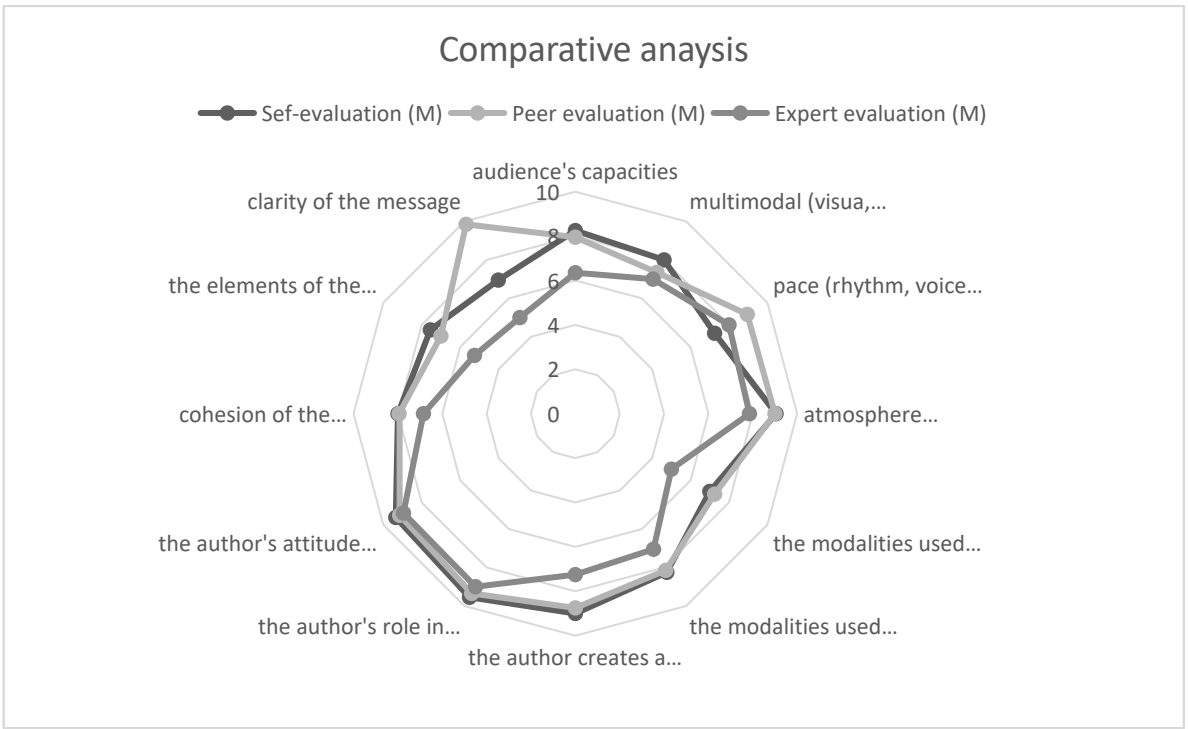
Statistically significant differences between the self-assessment and the expert assessment were also found with respect to the indicators "the modalities used (visual, verbal, sound) can convey symbolic/metaphorical meanings and/or attitude/intention", where Asymp. Sig. (2-tailed) is 0.003 on the Mann-Whitney U test, "message/narrative integrity" where Asymp. Sig. (2-tailed) is 0.011 on the Mann-Whitney U test, and "message logical coherence", where Asymp. Sig. (2-tailed) is 0.001 on the Mann-Whitney U test. In all three cases, it is evident that p < 0.05, which is evidence of a statistically significant difference in values and allows the conclusion that there is a difference between the two groups (of authors/students and experts) in terms of the indicators in the evaluation/self-evaluation of the multimodal ensembles created by the students.

Overall, a comparative examination (Figure 1) of the students' self-assessment, peer evaluation and expert evaluation highlights the experts' more manifested criticism arguably based on their experi-

ence and the search for practical dimensions of the application of the multimodal digital ensemble. The most sensitive divergence in the values occur in relation to: (i) the clarity of the message; (ii) the cohesion of the message; (iii) the capacity for the modes of representation used (visual, verbal, aural) to convey symbolic/metaphorical meanings and/or attitude/intent; and (iv) the author's consideration of the audience's (age-related) capacities.

Arguably, these differences could be easily attributed to the experts' professional experience. As in-service teachers they inevitably assess the multimodal ensemble from the perspective of its application in kindergartens and its potential results. However, it is worth noting that the indicators cohesion and cohesiveness actually characterize any text in terms of its perception and generation and thus apply to any message, irrespective of whether it is preeminently verbal or includes other modalities. In this case cohesiveness characterizes the text in terms of its completeness – whether or not all the elements are present that make it comprehensible in favourable communicative conditions. The cohesion indicator, in its turn, applies to the congruence among the separate meaningful element and their representations (here they include the visual, audio, spatial, verbal, ets. modes) on the one hand, and the course of the multimodal ensemble, on the other, which develops in space and time as a story. As designers of these stories the students have the prerogative to be familiar with the process of meaning-making and its immediate context – an opportunity the experts are denuded of. In their assessment, they substitute this actual context of activating and re-designing the available resources for a heuristic prognosis of the potential communicative situations and social practices where this product can be used. In this sense, their assessment emphasizes and foregrounds the multimodal ensemble preeminently as a resource, but not as a process. The students, on their part are mostly oriented towards the decisions and choices made during the design process.

Figure 1. Comparative analysis: self-evaluation, peer evaluation, expert evaluation results



It is precisely this difference of focus inherent in the roles of the evaluator and the author/designer as part of the meaning-making process that also accounts for the discrepancies in the section concerning whether or not the multimodal ensembles make considerations for the abilities and special characteristics of the target audience. Along with their assessment of the multimodal medium of the communicative act, to the experts this indicator is of crucial importance in assessing then goal component of the multimodal resource as a didactic instrument. To the students on the other hand, whose target audience is the child in the kindergarten but only as part of the project assigned to them by their lecturer, this indicator also reflects their perception of the resource as a solution to a task given.

The awareness of this double addressing of the multimodal ensemble also lies at the basis of our persuasion that our quantitative data should be analysed only using the information received during the focus-group discussions as a key or password for their interpretation.

Discussions

Our interpretation of these results is rooted in the perception that any exploration of how we communicate through a variety of modalities should take as its starting point how language, gesture, image, space and sound are used in situated activities: "Meaning-making is always relative to social practices. What is a relevant way of perceiving an image cannot be decided upon unless one considers the practice of which it is a part. All representations have meaning potential, but what aspects of these potentials are exploited is a situated affair" (Ivarsson, Linderoth and Saljo, 2009:210).

Since our focus is on the evaluation and perception of the multimodal ensembles as a data mining opportunity for designing Digital storytelling courses for education majors, we take as our point of departure the changing social and communicative roles of the participants in the three distinct, yet interrelated, assessment processes: peer evaluation, expert evaluation, and self-evaluation, which was conducted in two complementary stages - through semi-structured interviews and questionnaires.

Our data is analysed and explored through the lens of the information we received from our focus group discussions with students about (i) the design process and the script in view of students' goals, (ii) the preparation process in terms of timing, technological solutions, software, hardware, materials used, etc.; (iii) designers' expectations and considerations of the target audience; (iv) elements of the ensemble specifically aimed at emotional and cognitive response.

The recurrent themes during the interviews gave us the base-line for our investigation into the other data coming from the evaluation rubrics. We coded the transcriptions using a process of independent coding to increase reliability.

Several important areas of designers' perception of their product emerge from students' answers. In terms of its goal aspect what they find crucial is the instructional content as its main determinant and its accordance with the expected outcomes for the audience. Students also consider vital the clarity of the description of the process presented in the video in terms of two main factors: its separate stages and the quality of the video as a demonstration of the steps the audience is to take in constructing an object. Students also believe that the goal aspect of their product is also informed by the right combination of different modes of representation, such as (i) the amalgamation of speech, demonstration/gesture, posture, and visibility; (ii) the right combination of sound elements (balance, rhythm); (iii) the visibility of the objects and the suitable tools used to demonstrate the construction process; (iv) the synchronization between sound pauses and their duration in relation to importance/difficulty level of the element being highlighted; (v) the correct movement in space; (vi) the correct and concise articulation of instructions so as to demonstrate the sequence of operations by combining explanation and display. Additionally, pre-service kindergarten teachers include the allowances made for the audience's age-related capacities as part of the content aspect of the video such as rendering the essence of the message in a way that the children would pay attention and understand what was important. However, this consideration does not actually address the goal aspect of the resource designed. Another component of the goal aspect of the multimodal ensemble seems to be students' resources and technical considerations, which include using a teacher's book to follow a precise sequence of technological operations to create the story; using a phone to record the video and improving its quality so that the result is more holistic; estimating the correct distance between the camera and the staging. No reference to specific software products for creation of digital content was made during the discussions.

As to students' perception of the preparation process and its most important highlights, these include content and script, form, and the presumed stages of the digital story. In terms of content students find it important to tie their concept of what the children already know and have experience of to the subject matter and the script, to include a personal story in the narrative to impress the children and increase their focus; and to make a meaningful transition from the sensory to the emotional and the cognitive within the multimodal narrative. Their perception of the formal aspect of the ensemble involves matching the timelines of the separate components; combining a variety of multimodal modes (speaking, movement, gesture, display) into an overall composition; contrasting the colours in the materials/objects used to

make every element as visible as possible; using a warm voice and making sure the quality of the video helps convey the message). The designers' view of the stages of the multimodal narrative incorporates a preparation stage which covers decisions on the selection of didactic resources, developing a digital story plan; splitting the story into components of similar duration and combining them in an effective manner; deciding on the modes of representation that could be effectively combined.

The most informative panel in the discussion concerned the potential of the video to render emotional and/or cognitive import. Surprisingly, students did not leave that part to technology and vision. Rather, they perceive their own presence, personality qualities and ability to motivate the audience as the most important carrier of emotional and cognitive import in the multimodal design. Their most common answers here included simple and concise words so as not to make the demonstration difficult for the children; the accompanying music; the expressive and emotional speaking and the clear diction and slow pace of speech.

Conclusions

Based on the three-stage evaluation and focus group discussions as data mining opportunities for the design of practice-based courses on designing digital content for education majors, the following problem areas can be identified as starting points for targeted and systematic training in the creation of multimodal digital resources: (1) lack of specialized technological knowledge and skills in using software tools and platforms for creating multimodal digital narratives (e.g., Storybird, Adobe Spark, WeVideo), as well as insufficient skills in working with multimedia content such as video, audio, images, and text; (2) intuitive knowledge in the area of story composition of multimodal digital ensembles for educational purposes resulting in insufficient awareness of multimodal communication; (3) recorded inconsistencies in the processes of goal setting in and through digital multimodal ensembles, especially in view of what the designers want to achieve with their digital narrative - convey specific knowledge, develop particular skills or stimulate interest in a topic in the users of digital their narratives.

Clearly, the focus group discussions highlight the need for preparation in goal formulation, which can be successfully achieved by applying SMART goal formulation criteria in the design, planning and implementation of multimodal digital ensembles in an educational setting: Specific, Measurable, Achievable, Relevant and Time-bound.

Students participating in the study stated that their main guiding questions in creating the multimodal educational resource were: What is the main theme of the narrative? What knowledge and skills should children acquire? What is the specific age group of the audience? How can a script and storyboard be created so as to include the main points that need to be covered according to state educational content standards?

None of the study participants shared seeking feedback and reviewing or discussing the plan with colleagues and educators to make sure the goal was clear and achievable. The students also failed to plan, as part of their project implementation, methods to evaluate the effectiveness of their digital resources as an educational tool and to reflect on the process of creating and implementing their multimodal educational resource so as to identify strengths and weaknesses.

These inconsistencies, coupled with students' insufficient concern with the audience's level of knowledge, interests and preferences, imply that it is much more efficient and effective to design courses in creating digital content for education majors starting from their own perceptions and using these as points of departure to address the weaknesses in their mostly intuitive designs by bringing more awareness and digital literacy to the process. Undoubtedly, digital literacy standards can help the design of such a course, but the real point of departure is the exploration of students' own idea of what a digital story should be like and what it could do. The three-stage evaluation adapted to the needs of pre-school teachers, along with focus group discussions with students prior to organizing follow-up targeted trainings on creating digital multimodal educational resources can provide deep insights and valuable recommendations to help improve the creation and use of such resources. It is important to consider these highlights when planning and developing future research and education initiatives.

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Conflict of interests

The authors declare no conflict of interest.

Author Contributions

Conceptualization, N.T., M.L.; methodology, N.T.; formal analysis, N.T.; writing—original draft preparation, N.T. and M.L.; writing—review and editing, M.L. All authors have read and agreed to the published version of the manuscript.

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Learning Community as a Framework for the Professional Development of Preschool Teachers - Theoretical Approach and Practical Implications

Časlav Stoiljković[1*], *Tatjana Kompirović*[2], *Daliborka Popović*[3]

[1]Academy of professional studies South Serbia – Leskovac, Department for preschool teachers in Bujanovac, Serbia
e-mail: stcaslav@gmail.com
[2]University of Priština in Kosovska Mitrovica, Faculty of Philosophy, Department of Pedagogy, Serbia
e-mail: tatjana.kompirovic@pr.ac.rs
[3]State University of Novi Pazar, Department of Philosophical Sciences, Serbia
e-mail: dpopovic@np.ac.rs

Abstract: The paper addresses the importance of the professional development of preschool teachers through its positioning and action in relation to the concept of a learning community. By analyzing the literature, reviewing theoretical concepts and empirical research, the synergistic effect of the process of professional development of teachers and the concept of a learning community is determined. First of all, the benefits to which the process of professional development of teachers contributes within the learning community are determined, especially in the form of improving the educational process, professional competence and personal development of teachers, and most importantly, for the well-being of children. The aim of the paper is focused on a comprehensive understanding of the theoretical implications in the form of the influence of the learning community on the professional development of teachers, as well as the practical implications that are accordingly reflected in pedagogical practice. The above approach supports and affirms the principles of plurality and individual differences of each individual. Community is seen as a key concept within which quality and functional relationships are built, which contributes to the improvement of educational work. The proposal for the professional development of teachers within the learning community, as part of the transformation of the educational system in preschool education, is based on the belief that activities that include interaction, cooperation and exchange of knowledge and experiences contribute to more efficient results that are reflected in educational outcomes.

Keywords: *preschool teacher, learning community, professional development, preschool institution, educational work.*

Introduction

Early childhood is recognized as a crucial period in which the foundations of human development are determined and directed, both from a social perspective and from the perspective of getting to know and building interactions with the environment, which in times of rapid social change further emphasizes the professional role of teachers. Teachers must be competent to identify and value the individual rhythm and developmental capacity of each child in a knowledge society. In this sense, the continuous professional development of teachers is based on the ethical and reflective nature of the profession, which is very complex primarily because of its social responsibility and significant impact on the development and progress of children in the education system (Nedimović et al., 2022). Committed to focusing their resources and skills on empowering children and developing their potential, teachers achieve this through building quality relationships, active involvement in the educational process, maintaining balance, and respecting the individuality of each child (Osnove programa predškolskog vaspitanja i obrazovanja „Godine uzleta“, 2018).

Therefore, the learning of teachers is not limited to a specific time period, to initial education, but is an integral part of their entire professional engagement. Also, effective professional development

*Corresponding author: stcaslav@gmail.com

cannot be reduced to periodic activities, but must be a continuous process within which one's own professional assumptions and practices are continuously reviewed (Ferrarro, 2001). Therefore, the professional development of preschool teachers within the learning community, as part of the educational transformation of preschool education, is based on the views that activities that involve interaction, cooperation and exchange of knowledge and experience lead to more effective results while respecting and appreciating the principles of plurality and individual multiple diversity of each individual. This transformation, although it encompasses changes of a wide scale, also has a personal dimension, because each teacher plays a key role in its implementation. It seeks to foster fundamental changes in thinking and understanding within the learning community, whereby professional work becomes far more affirmative through collaboration, interconnectedness, and shared action, as opposed to isolated individual engagement without collaboration (Briskin et al., 2009).

Professional development and professional training of preschool teachers

In addition to the fact that the role of the teacher is crucial for encouraging the comprehensive development of the child's personality, it also contributes to the shaping of future generations and the development of their value systems.

For this reason, teachers should continuously work on improving their professional skills: co-construction of knowledge and development of competencies. The process of professional development, in this context, is a key basis for strengthening competencies and better fulfilling the requirements of the profession.

Professional development is defined as "a set of different experiences and skills that can be the result of spontaneous learning or consciously planned activities that are useful in improving educational work" by Radovanović (2019, 81). He emphasizes the importance of several factors that form the basis of professional development: compulsory education, internship period, professional development, monitoring and evaluation. According to the Vescio, Ross and Adams, 2008, professional development is a systematic activity that enables teachers to improve their skills through education, induction, professional development and continuous development in the work environment. It is also important to emphasize that professional development is a multi-directional process that encompasses the professional, personal and social dimensions of teachers (Valenčič Zuljan and Trošelj Blanuša, 2014).

According to the Regulation on Continuous Professional Development and Promotion of Teachers, Preschool Teachers and Professional Associates (Pravilnik o stalnom stručnom usavršavanju i napredovanju u zvanja nastavnika, vaspitača i stručnih saradnika, 2021) ("Sl. glasnik RS", No. 109/2021, Article 2), professional development is defined as "a complex process that involves the continuous development of competencies for the purpose of better performance at work and improving the development of children, students and trainees, i.e. the level of their achievements". Accordingly, professional development includes the acquisition of new and development of existing competencies, which is of key importance for the improvement of educational work and child care.

According to Stamatović (2006), professional development is a continuous process that begins with the choice of a profession, continues through initial education (faculties and vocational schools for preschool teachers), induction into work (internship), and then includes ongoing development, professional development and further education through work. From the viewpoint of constructivist and socio-constructivist perspectives of professional development, professional development is seen as a "dual process that contributes to the construction of knowledge and identity of a person, and includes personal, professional and socio-cultural (or organizational) dimensions" (Gosselin et al., 2014, 24). Independent professional development influences the formation of a worldview, and purposeful and meaningful experiences during the professional development process contribute to the creation of a positive attitude towards the process of advancement and future segments of professional development (Koay, 2023).

Some authors (Whitebook et al., 2009) equate professional development with the term in-service training, which refers to educational activities undertaken by preschool teachers who are already employed.

Analyzing the initiative to begin professional development, Jul and Jensen (2014) see the professional problem that arises in educational practice as the basic determinant, viewing professional development as part of the professional environment. According to the authors, professional development is "a continuous structured process in which we explore, recognize and process patterns of thinking and acting that prevent or hinder us from achieving our professional engagement, goals and potential in professional

relationships" (Jul, Jensen, 2014, 154). The aforementioned authors point out that problems in the educational process should not be seen as unexpected, but as a common part of the process that requires continuous resolution. Not only awareness of their existence is crucial, but also the approach to solving these problems, which requires continuous reflection and adaptation of teachers. Certain destructive behavioral phenomena such as some frustrations and exhaustion do not occur as a result of problems, but as a result of the suppression of the constructive potential of professionals and the courage to face these problems in an appropriate manner. Namely, knowledge and skills can be improved if the teacher has identified the problem and continuously tries to neutralize it, preventing the occurrence of similar problems. At the same time, some authors criticize the complete separation of personal and professional development, emphasizing the inextricable link between these two aspects, because professional development has a profound impact on the personal behavior of an individual, because personal development is characterized by freedom in choosing activities. It is precisely this freedom that implies the ability of an individual to develop his skills and abilities in a way that is consistent with personal values and professional ambitions, which is crucial for his successful and balanced professional and personal life.

Mizell (2010) lists three main effects of professional development: the teacher acquires new knowledge and skills, improves the management of educational work, and contributes to better achievements of children. According to the aforementioned author, all individuals have a certain role in the professional development of teachers. Parents and the community should support the professional development of teachers, and the management of institutions has a responsibility to encourage and provide support to teachers in their professional development, as well as to call on them to take responsibility for progress and continuous improvement in accordance with professional standards and the needs of the education system. Innovating the process of professional development of teachers also includes the application of a transdisciplinary approach, where the teacher acts as a proactive subject who, by actively expressing the needs for improvement, within the concept of lifelong learning, maximizes their professional potential (Serdenciuc, 2013). The three main goals of professional development relate to changing educational practices, changing attitudes and beliefs of teachers, and changing learning outcomes of children (Guskey, 2002).

When studying the professional development of preschool teachers, significant attention is paid to the analysis of the personality of the teacher, with some authors (La Paro, King, 2019) pointing out that his professional activity is largely determined by a set of individual characteristics. The effectiveness of the teacher is particularly emphasized as a key component that influences the process of professional development. In accordance with the above statement, professional development programs represent factors that not only increase the self-confidence of the teacher, but also contribute to his greater efficiency in the educational process. Another important aspect considered in the context of the professional development of teachers is their disposition for this process. Some authors, such as Oztok, 2024, emphasize that professional development brings teachers a better position in society, advancement in professional circles, and an increase in social status. Also, Ganser (2000) highlights that professional development is a constructivist activity that is realized through formal (conferences, workshops, courses) and informal activities (reading professional publications, professional meetings, watching broadcasts).

The literature (Kankaraš, 2021) mentions the term "workplace learning", which refers to an active process during which an individual acquires new knowledge and skills through the performance of tasks. In this way, the gap between the required skills that are necessary for an individual to perform a task and the acquired skills that the individual possesses, which are sometimes not sufficient to change established work patterns, is reduced. This type of learning is also seen as a way to overcome the shortcomings that arise from formal and informal education, with extrinsic and intrinsic motivation being emphasized as key factors in the success of the learning process.

Taking into account the criterion of the content of professional development, the authors Vujičić and Čamber Tambolaš (2017: 151) emphasize that "professional development must not be reduced to occasional, partial forms of professional development that are only informative in nature, but must contain transformational potential, which means that it should lead to changes in the beliefs, attitudes and values of teachers. Professional development understood in this way should primarily be based on continuous research into one's own practice as a prerequisite for its understanding and change, as well as the improvement of one's own professional competencies inherent to a teacher who is a reflective practitioner."

Learning community

"A learning community" is a social and educational environment in which individuals actively engage in the process of exchanging knowledge and experiences, in order to jointly improve their skills and competencies. In such a community, all members, including children, have the opportunity to develop through interaction and cooperation, thus creating a continuous learning process that encourages personal and collective progress.

Learning from experience is an effective way of learning for preschool children. The community in which a child engages in interactive activities plays a key role in shaping these experiences, which affects the development of each individual. The early childhood period is critical for the development of patterns that later shape behavior and life circumstances in adulthood (Weikart, 1998).

Research has shown that there is a strong connection between a high level of professionalism of teachers and their continuous professional development (Fotopoulou Ifanti, 2017). The above data suggests that the more professional development is active and focused on improving competences, the higher the level of professionalism is, which is reflected in the quality of the educational process and the learning success of the children themselves. Effective professional changes of teachers can be achieved if conditions are provided that allow them to act as active subjects who apply critical thinking in the context of joint action. Therefore, creating opportunities for cooperation and dialogue with colleagues is crucial, as it allows teachers to gain a new perspective on their own practice. In the literature, colleagues who participate in observing teachers' activities are often called "critical mirrors", because they help develop and improve the professional work of teachers (Escamilla, Meier, 2018; Radišić, Buđevac, Jošić, Baucal, 2015).

The concept of a professional learning community has gained momentum in recent years. Many sources point to data that a well-structured and organized learning community has a positive effect on educational practice and children's achievements (Ackerman, 2008; Ackerman, 2008). Such results justify the slogan "I don't know, but maybe we do" (Briskin et al., 2009).

The improvement of teaching profession is often viewed through their engagement within a professional learning community, which as a multidimensional concept consists of the interaction of three basic factors: community, learning, and professionalism (Hairon et al., 2015).

The configuration of a community in which teachers learn includes intellectual, social, and organizational aspects that, in synergy, stimulate teachers' reflection, as well as their active participation in conversations, reading, and writing about their own work, which is the basis for continuous professional growth and development in their professional practice. In this context, research defines a community of preschool teachers as "social groups of new and experienced educators who come together over time to acquire new information, challenge previous knowledge and beliefs, and construct new knowledge based on experiences, in order to work to improve and advance children's learning" (Encyclopedia of Education, 2024). Members of a learning community can be both children and adults, and in such a community all members, whether experienced or less experienced, are active. No role that an individual plays carries full responsibility, and none of the roles that individuals can play in a community is passive (Rogof, 1994). This dynamic encourages active participation and continuous learning by all members of the community.

The sources also recognize a definition that determines a learning community as "integrated, comprehensive programs in which transformative learning takes place through a community process, through which participants develop professional, civic, and ethical responsibility" (Brower and Dettinger, 1998, 21). Collaborative work can also be defined as a process in which there is a shared vision and purpose, an adequate distribution of power within the group, through the existence of networking, coordination, cooperation, and collaboration, as well as mutual learning with the presence of individual responsibility for results (Himmelman, 1994).

The elementary purpose of professional learning communities is to increase the effectiveness of professionals and improve outcomes of children (Bolam et al., 2005). A professional learning community is a team of members who work together to meet the needs of children through a shared vision that is focused on the curriculum (Reichstetter, 2006). According to DuFour (2004), a professional learning community is based on three key principles: the first principle focuses on the learning process, not on teaching; the second emphasizes the importance of collaborative work in the learning process; and the third principle requires that individuals take responsibility for their own results. DuFour also emphasizes that the success of this community depends on the persistence and commitment of the teachers who are part of this process.

There are authors (Kilpatrick, Jones, Barrett, 2003) who view the learning community through a constructivist approach to learning in which social interaction is a key factor in building values and identity. The behavior of the individual within the learning community should be empathetic and focused on the collective, with a clearly defined long-term vision. (Briskin et al., 2009).

Research (Scribner, et al.,2002) confirms the paradox that the level of professional autonomy and attention to the individual affect the strength of the professional learning community. The authors analyze the conflict between the individual (''I'') and collective (''we'') approach to development and learning. According to them, the existence of professional autonomy and individual professional identity is not an obstacle, but rather encourages the teacher to actively participate in building a common identity of the learning community, which increases his belonging and role in the learning process.

The characteristics of professional learning communities are reflected in the following: there is a shared vision and shared values, collective responsibility, reflective professional reflection, collaboration, a sense of interdependence, and encouragement of group and individual learning (Bolam, et al., 2005). Group association in joint learning leads to development that goes beyond what individual action can achieve. Collective interaction enables the creation of deeper and more meaningful experiences, which are an upgrade on what individuals can achieve on their own. In this process, it becomes clear that in interaction with others there are more elements that connect than divide, leading to the creation of something greater, more meaningful, and more sublime than what can be achieved independently (Briskin et al., 2009).

What distinguishes professional learning within a community from traditional approaches is the question of how to respond to the learning difficulties that children face (DuFour, 2004). Within the concept of community learning, different forms of knowledge are combined: practical knowledge (individual skills and experiences), publicly available knowledge (theories and research results), and new knowledge, which arises as a result of co-creation through collective activities, research and problem solving (Jackson and Temperley, 2007). Learning communities in modern society must be adaptable, respect the individuality of members and clearly define the criteria for accepting new members (Brower and Dettinger, 1998).

According to information from the Center on the Developing Child, Harvard University (Center on the Developing Child, Harvard University, 2024), the following roles of a learning community are highlighted:

- connecting people;
- setting goals and measuring collective progress;
- enabling collaborative learning;
- enabling a wide range of leadership roles;
- facilitating and accelerating progress in learning.

Some authors (Kilpatrick, Barrett, Jones, 2003) highlight two aspects of the learning community: personal, which involves the synergy of members in the exchange of experiences and knowledge, and material, focused on content and curricula.

Theoretical frameworks of the learning community find practical application in the professional development of teachers in Thailand. Analysis of the results shows a high commitment to this learning model, a reduction in potential problems among participants, and the achievement of success through a cooperative relationship and sustainability of the process (Meesuk et al., 2021). These models illustrate how collaborative learning leads to deeper and sustainable transformations in education.

Escamilla and Meier (2018) analyze the professional development of teachers within the learning community, especially through facilitation processes. Their research shows that a long-term commitment to self-reflection and inquiry contributes to the development of reflective tools, improved documentation skills, the creation of strategies for collaborative dialogue, and the strengthening of professional trust. These outcomes confirm the importance of a systematic and supportive approach to collaborative work.

Fundamentals of professional development models in a learning community

Professional development models are closely related to processes that involve building personal, interpersonal and organizational capacities. According to them, the development of a learning community, but also its stagnation, can be viewed through three key components (Mitchell, 2001):

1. **Building personal capacities** - This process includes considering personal values, knowledge and skills, as well as their deconstruction in order to identify factors that limit professional development.

Internal and external analysis play a key role in this process, while reflective work leads to the reconstruction of existing capacities.

2. **Building interpersonal capacities** - In this context, learning becomes collegial and interpersonal, and conflict is experienced as an opportunity for advancement. Communication is based on consensus and an affective climate in which each individual feels affirmative and contributes to the development of trust in the community.
3. **Building organizational capacity** - In a learning community power must be shared among all members, with a reduction in hierarchy and the introduction of horizontal stratification being recommended. Leadership is shared among community members, which leads to a sense of autonomy and belonging to the group, while the organization remains flexible and open to innovation.

Community-based learning is transformative learning through which an individual develops professional responsibility (how an individual acts in their early environment), ethical responsibility (a code of conduct that determines what is right and wrong), and civic responsibility (how an individual fits into the community and how they behave toward others) (Brower and Dettinger, 1998). According to the pyramid model, the three key components for enhancing these responsibilities are: the academic component, which refers to curricula and content, the social component, which involves interpersonal relationships, and the physical component, which refers to the space in which learning takes place.

The main purpose of all learning communities, according to Brower and Dettinger (1998), is to develop a group identity while valuing each individual, as well as to provide an environment that encourages transformative learning. This process includes the integration of social and academic experiences, the development of interdisciplinarity, and the encouragement of critical thinking. It is also important to create conditions for the continuous inclusion of new members and to evaluate the process and outcomes of learning. The goal is the development of professional, ethical, and civic responsibility.

An inevitable factor within a learning community is the process of collaboration, which is defined as a systematic process in which individuals work together, interdependently, analyze, and influence professional practice in order to improve results (DuFour and Eaker, 2009). The wisdom that emerges in this community between the known and the unknown creates space for new perspectives and knowledge (Briskin et al., 2009). The perception of collective efficacy, as a group's belief in its ability to achieve success, is fundamental to the organization and implementation of successful actions (Bandura, 1997).

Research findings (Stoiljković, 2020) indicate that during extraordinary circumstances that may affect educational work, teachers have a high commitment to the development of collegial relationships, collegial support and cooperative cooperation to solve emerging problems. Research (Thornton, Cherrington, 2018) shows that the sustainability of professional learning communities of teachers requires the existence of the following factors: clear membership and effective introduction of new members; shared focus, commitment and research orientation; clarity of individual roles in the group, including leadership roles; opportunities for dialogue and deprivatization of practices and encouragement of new ideas.

Practical implications of a learning community for teacher professional development

The practical implications of considering a learning community for teacher professional development demonstrate the importance of continuous professional development of teachers in line with the needs of contemporary education. In addition, numerous studies highlight how continuous professional development is essential for maintaining high educational standards and for creatively addressing educational challenges. Research (Gander and McInnes, 2021), which included 75 Australian university teachers, showed that professional development in a learning community led to increased motivation, self-confidence, opportunities for self-improvement and career advancement. At the same time, other research (Múñez et al., 2017) indicates that teachers consider the workshop-based form of activity as the most effective way of professional development. Also, research (Múñez et al., 2017) highlights that a high level of engagement of teachers in informal professional development activities through collaboration is an important indicator that influences teachers to have strong beliefs in their self-efficacy.

In order to identify forms of behavior that contribute to a learning community, Bulach (1996) found that surveyed graduate students highlighted five forms of behavior that contribute to the effectiveness of a learning community: reduced anxiety, readiness to listen, reward for certain behavior, spreading

friendships, and adequate use of positive and negative criticism. Also, a year-long study (Clark, 2018) on professional development of teachers through a learning community, in which nine teachers from different institutions, districts and with different educational styles participated, showed that teachers critically examined their own practice. Through this interaction, they were able to develop supportive interpersonal relationships, which allowed them to form more sophisticated and innovative views and practices in their work with children, as well as in their relationship to early childhood education and care.

Additionally, in order to understand the benefits of bringing together teachers from different levels of education, the research (Gorodetsky and Barak, 2008) focused on a learning community was metaphorically called the "ecological edge". This research involved 28 student teachers, 6 in-service teachers, and 4 university teachers. The results showed that joining together in such a learning community brings numerous benefits, which differ depending on the role that the participants have in the educational process:

- **Future teachers**: The learning community allowed students to break free from pre-established patterns of thinking and acting. This approach developed their ability to experiment with new ideas, which was in line with their professional identity. Flexibility in work fostered a sense of self-fulfillment and satisfaction. Also, students took greater responsibility for their learning, which led to a critical re-examination of their views, without suppressing personal preferences that could make them unconditionally adopt the views of the mentor. A fundamental component of the learning process were the practical aspects.
- **In-service teachers**: Secondary school teachers highlighted that the learning community represented a resource that encouraged their reflexivity in their work. Participation in the community allowed them to re-examine their routines and move away from stereotypical pedagogical approaches, which increased their self-confidence and criticality. This change in attitudes also strengthened their willingness to change and led to a deeper sense of gratitude towards the collaborators who participated in the process.
- **University teachers**: Although university teachers often face the threat of becoming desensitized to current issues in schools, the learning community has helped university teachers overcome the "illusion of the familiar" and reconnect with trends in school practice. Teachers have also managed to narrow the gap between theoretical knowledge and practical application in schools, thereby strengthening their ability to adapt to the needs of teaching practice.

Some studies (Pyanova et al., 2017) indicate that the developed reflexivity of teachers has a positive impact on their professional motivation, making them more capable of cognitive activity, task solving and self-management. They also show a greater ability to control their actions, as well as to evaluate and correct them when necessary. However, research results also show that frequent and significant changes in the work environment, as well as changes in tasks that are often part of reform processes, can lead to unstable behavior and deterioration of the emotional state of teachers.

At the same time, reports (OECD, 2014) show that teachers who participated in professional development programs through collaborative learning experience a significant increase in confidence in their capacities and abilities to successfully cope with challenges in their work environment. These processes not only increase the personal competence of teachers, but also improve the quality of the teaching process and educational practice as a whole.

The presented research findings emphasize the importance of learning communities for the development of all participants, and show how these forms of professional development can positively impact the work environment, improve pedagogical approaches, and provide a deeper understanding of the challenges and needs of contemporary education.

Conclusion

Within a learning community, teachers' reflection plays a key role in professional development, enabling them to compare their own views, values and experiences with colleagues and the wider community. According to Lumpe (2007), visual mapping of professional development shows how adopted strategies can be directly applied in practice, unlike formal processes that often do not include this phase of application and evaluation of results. Successful implementation of this system requires distributed leadership, planned time and structures that encourage collaboration and self-evaluation, thereby supporting continuous growth and improvement.

In this context, the kindergarten as a learning community is a dynamic space in which all members are actively involved in the process of learning and development. This community involves the exchange of knowledge, experiences and support among teachers, children and other professionals, where everyone feels like an equal member. Through this dynamic, each member of the community contributes to and enhances collective progress.

Analyzing the need for successful functioning of kindergartens, the importance of achieving one of the key goals of kindergartens is emphasized: the formation of a learning community in which different views are respected, as well as willingness to learn from each other and acting in favor of the quality of the institution and the needs of the child (Kompirović, 2024: 19). In order for this goal to be achieved, it is important that the community provides active participation of all members in the processes of communication, cooperation and professional advancement, as well as to support the development of a culture of research in the educational process (Zhang, 2024).

In order for a learning community to contribute to the improvement of the educational process, it is necessary to establish an organizational structure that encourages professional development and fosters a culture of research in the educational process, while providing the community member with autonomy and motivational incentives to make better pedagogical decisions (Supovitz, 2002).

However, an important aspect in this context is that learning communities are not uniform, as shown by research that indicates differences between different learning communities (Oztok, 2024). This means that the value of the components of a learning community is not universal, because its functioning depends on different circumstances, such as the relationships, approaches and concepts that exist within each community. In this sense, learning communities have a great impact on increasing interactive learning and critical thinking of participants (Salsabilla, 2023). This points to the importance of the environment in which teachers' professional learning takes place, and a revision of competencies, standards and evaluation systems in accordance with needs is proposed (Popović, 2023: 29).

The development of society, as well as the preschool pedagogical community, which is continuously changing, justifies the need for professional development that is flexible, adaptable and focused on current and future needs for professional advancement. The learning networks in which an individual participates enable various forms of learning: from others, together with others, in their own institution, with the transfer of knowledge and meta-learning that regulates their own learning process (Jackson and Temperley, 2007).

Professional development for preschool teachers in a learning community follows a linear course, focusing on improving knowledge, skills, and beliefs, which are integrated into everyday practice and positively impact children's outcomes. According to some authors (Hairon et al. (2015)), such an approach emphasizes the connection between personal learning and shared outcomes.

(Hairon, Goh, Chua, Wang, L. 2015)

Professional development of preschool teachers within a learning community enables the application of successful examples of practice, their adaptation to the specifics of work, and obtaining feedback that encourages self-reflection. This process results in improved outcomes for children in an environment that values learning and encourages continuous improvement (Schachter et al., 2019).

In the context of achieving these goals, David (2008) emphasizes that working together within a community is more effective than an individual approach, but that the key challenge lies in providing the conditions for such cooperation. The author emphasizes that joint research into one's own practice is the most promising, but also the most demanding, strategy for developing learning. Teachers who are involved in learning communities with positive development of communication, above all, experience a sense of belonging and a sense of success (Scotese, 2014).

A more advanced model of professional development of preschool teachers encourages reflective thinking, the exchange of practical experiences, and deeper collaboration with other practitioners and educational institutions. This approach includes mentoring, active learning, shared problem solving, and mutually supportive dialogue, thereby developing professional competencies (Jensen and Iannone, 2018).

The emphasis is on collaborative working methods that are developed from the bottom up, that is, through the participation of practitioners themselves, thus creating an environment that promotes professional trust and continuous improvement of practice.

Analyzing the statements of the aforementioned authors, we can conclude that learning itself and professional development within the community is primarily a collaborative process, a process of joint cooperation and exchange of experience in which both group and individual dynamics of development, both personal and professional development, are respected. Improving the competence of preschool teachers is done through self-evaluation and reflection on their work, the existence of common goals and collective problem-solving within the community, collaborative learning, practical application and respect for the principle of diversity. In order for this process to produce the most comprehensive results, it is necessary to work on continuity.

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The authors declare no conflict of interest.

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Analogy of Profiling Male and Female Serial Killers

Željko Bjelajac [1]

[1]University Business Academy, Faculty of Law for Commerce and Judiciary, Republic of Serbia
e-mail: zdjbjelajac@gmail.com

Abstract: This paper explores the similarities and differences in the psychological profiles of male and female serial killers through gender aspects, analyzing causes, motives, and methods of crime. The introduction provides an overview of basic concepts, while the sections on definitions and causes of serial murder discuss incoherent aspects due to the flexibility of conceptual determination which affects the empirical understanding of serial murder, including key risk factors contributing to the development of serial killing behavior. The identification of psychological profiles by analogy separates the characteristics of male and female serial killers, focusing on their motivations, methods, and relationships with victims. The discussion includes a comparative analysis and results of individual studies, highlighting differences in profiling strategies between genders and summarizing findings related to serial murders. The conclusion synthesizes the main findings, emphasizing the importance of a gender-specific approach in profiling serial killers for more effective investigation and prevention of these severe crimes.

Keywords: *profiling, serial murder, male serial killers, female serial killers.*

Introduction

Human nature is extremely complex and as such has no limitations. It has the adaptive quality to shape, build, and be driven. Its role is crucial in the lives of human beings, as it drives the flow of human thoughts and activities, providing support in everyday life decisions. One of the disturbing characteristics of today's society, full of contradictions, is the intensity of psychodynamics and the escalation of violence in all forms, in which anyone can become a victim due to the transformation of "ordinary" individuals who induce criminal behavior in a direct or indirect manner. This points to the need for a more comprehensive understanding of human nature, emotional, and psychological dimensions of violence, and the clear tendency towards the brutalization of this phenomenon (Bjelajac, 2023: 25). Human nature is determined by a series of natural, striking characteristics, which include ways of thinking, feeling, and acting, as products of our inherited or innate traits and our individual experiences gained in the environment in which we exist. The fact is that most people always adhere to social norms, as rules of behavior in the society that establishes them. Since these norms are directed towards human consciousness and will, yet do not allow a person to satisfy their needs, human nature is oriented towards greed, callousness, immorality, ruthlessness, or destructiveness, and often to inherent evil, which leads to various criminal activities. In fact, crime arises because the deceptive nature of human nature, which is full of inconsistencies, comes to the fore (Bjelajac, 2023: 25-26). Consequently, by murdering a human being, a fundamental and inalienable human right - the right to life - is taken away. Such an act, which annuls all other aspects of human existence, is considered the gravest crime, which is legally, morally, and broadly speaking, socially unacceptable. This unacceptability is reflected not only through the act of taking someone's life but also through the immense suffering and pain of family, friends, and acquaintances, as well as the disruption of trust, security, and harmony in community life. Although murder is simply defined as an act in which one person causes the death of another, the term "murder" can also be "neutral" as a general concept.

*Corresponding author: zdjbjelajac@gmail.com

"Murders can be "justified" or involve criminal liability, depending on the circumstances of the murder and the mental state of the killer. Suppose a falling meteor strikes a person on the head and kills them. Such a death is not murder. The victim is certainly dead, but the cause of death is not the act of another person. Suppose someone gets lost in the woods in winter, falls unconscious in the snow, and is eaten by wolves. The victim is dead, but the death is not murder because it was not caused by the act of another human being. Suppose a person is walking down the street, suffers a heart attack, and dies. The heart attack victim is dead, but the death is not murder because it was not caused by the act of another human being" (The Law of Homicide, Appendix 101: 125). Therefore, to unambiguously classify someone's death as murder, we must establish credible facts that a human being was alive, and that their death was caused by the act of another human being(s). Otherwise, if the act of another person is absent, the death cannot be treated as murder. Moreover, among the different types of murders, criminal justice systems make important distinctions, and penalties are measured depending on the form of guilt (intentional or negligent), the killer's intent, or the danger of the killer's behavior and the circumstances of the act.

Among murderers, in addition to mass murderers (who often have terrorist, religious, ethnic, and political motives) (Zirojević, Bjelajac, 2013), and/or so-called "contract killers," a particularly notable category is that of serial killers. These are individuals who exhibit specific patterns of behavior, having committed three or more murders over a certain period of time, with "cooling off" intervals between crimes. They are characterized by cold-bloodedness, brutality, manipulativeness, a desire for dominance, and a complete lack of empathy. Their crimes are severe and predominantly motivated by deep psychological drives, with a history of abuse and backgrounds of various childhood traumas, personality disorders, or sadistic impulses. The crimes of this type always attract significant attention from the mass media, which further contributes to a sense of fear, unease, and general frustration in society.

Ultimately, it is questionable to assume that the profile of serial killers is traditionally associated with men. Indeed, the tragic history of crime, supported by numerous studies, shows that women are also capable of committing such severe criminal acts. However, it is indisputable that female serial killers are a rarer occurrence compared to their male counterparts. Their motivations, psychological characteristics, and modus operandi generally differ from those of male serial killers. This paper focuses on the analogy of profiling male and female serial killers, analyzing their key characteristics, motives, methods, and psychological factors that contribute to such acts, which reflect the destructive nature of human beings. Additionally, we highlight the concept of criminal profiling as an important component of criminal investigation, most often associated with investigations of serial crimes, primarily serial murders. This concept has proven effective especially in complex cases where the perpetrator is not immediately known, and the creation of psychological profiles of individual serial killers has directed the investigation in the right direction and laid the foundation for collecting key forensic evidence that led to arrests.

Methodology

In the process of conducting descriptive research, we formalized the research questions in an adequate and concise manner to consider the perspective of identifying the psychological profiles of serial killers through gender aspects. We used qualitative research methods to perform elaboration and provide more detailed explanations, a more comprehensive and broader picture of the analogy of profiling male and female serial killers with distinctions and similarities. Through the method of comparative analysis, we discovered that the psychological profiles of male and female serial killers show significant similarities, but also key differences in motives, behavior patterns, and methods of killing. A deeper understanding of the psychological profile of serial killers can facilitate security experts, criminologists, criminalists, and psychologists in predicting and detecting possible risk factors and behavior patterns that can lead to these severe crimes. Through the skill of profiling, it is possible to more effectively view the motives and methods of these individuals, contributing to more efficient investigation and prevention of crimes.

Definition of Serial Murder

The phenomenon of serial killings is increasingly in the focus of mass media and within the realm of academic research interest. Claims by some authors (Jenkins, 1994), that the phenomenon of se-

rial killings is, in part, an exaggerated social construct, are debatable. Specifically, the estimation of the frequency and prevalence of serial killings is incoherent due to the flexibility of conceptual definitions, which affects the empirical understanding of serial murder. Holmes and DeBurger (Holmes, DeBurger, 1985) suggested that a significant increase in the incidence of serial killings could be the reason for many unsolved murders.

"Nevertheless, while the definition of serial murder is a social construct, the murders themselves are a real physical reality. Deciding which murders fall under the category of "serial murder" is a difficult process. At this point, it seems that there is no standard for making this distinction, either in the media or within scientific research. As a result, figures on the prevalence of serial murders can vary greatly, likely reflecting an individual's personal view of whether serial killing is common or unusual, rather than any objective reality. Establishing a specific definition of serial murder that demonstrates reliability would be the first step in standardizing reporting on prevalence statistics, as well as educating both criminal justice professionals and the public about what exactly is meant by "serial murder." At that point, although the definition of serial murder might still be socially constructed, at least it would be one definition, rather than many separate definitions that are used interchangeably" (Ferguson, et al., 2003). Multiple definitions of serial murder have been used for decades by criminal justice systems, crime prevention agencies, mass media, academic communities, and researchers. Generally, these definitions have shared some common elements but also differed in aspects such as the number of murders involved (variations from two to ten victims), the type of motivation, and the time frame in which the murders occur. Therefore, establishing one universal definition that would set absolute standards in this domain requires balancing all elements and focusing on the number of victims, separate events, time frame, including motivation and understanding the context of the behavior of serial killers.

In the Crime Classification Manual, Douglas, Burgess, Burgess, and Ressler define serial murder as "three or more separate events (murders) in three or more separate locations with a period of emotional cooling off between the murders" (Douglas, et al., 1992:21). "The period of emotional cooling off can last days, weeks, months, or years. This definition speaks to the timeframe in which the murders occur, distinguishing serial murder from other forms of multiple murders such as spree or mass murder. Although the specific number of victims mentioned in the definition may vary, the basis of this definition is generally common to most definitions of serial murder" (Ferguson, et al., 2003; Egger, 1984).

"In an effort to bridge the gap between the many views on issues related to serial killings, the Federal Bureau of Investigation (FBI) hosted a multidisciplinary symposium in San Antonio, Texas, from August 29, 2005, to September 2, 2005. The goal of the Symposium was to bring together a group of esteemed experts on serial murders from various fields and specialties to identify shared knowledge about serial murder. The five-day event was attended by a total of 135 experts in the field. Among these individuals were law enforcement officers who had successfully investigated and arrested serial killers; mental health experts, academics, and other specialists who had studied serial killers and shared their expertise through education and publishing; judicial officials who had judged, prosecuted, and defended serial killers; and media representatives who inform and educate the public when serial killers commit crimes. The attendees also reflected the international nature of the problem of serial killings, as there were participants from ten different countries across five continents" (Morton, Ed., 2005: 7). The initiated debates focused on important elements of the conceptual definition of serial murder, such as determining the number of murders that would constitute serial murder, as a clear criterion for initiating investigations. It was suggested that specifying a smaller number of victims would allow criminal investigation agencies more flexibility in allocating resources for potential investigative actions and capturing perpetrators. Essential distinctions were agreed upon that differentiate between serial murder (involving time separation between different murders - separate occasions, cooling-off period, and emotional cooling-off period) and mass murder (four or more murders that occurred during the same incident, without a specific time period between the murders - lack of a cooling-off period). Additionally, discussions about the motivational factor as an indispensable element in various definitions suggested that "motivation does not belong to the general definition, as it would make the definition too complex."

"Symposium participants reviewed previous definitions and extensively discussed the advantages and disadvantages of numerous variations. The consensus among Symposium participants was to create a simple, yet broad definition, designed primarily for use by law enforcement. Various discussion groups at the Symposium agreed on a number of similar factors that would be included in the definition.

This included: one or more offenders; two or more murdered victims; incidents should occur at separate events, at different times; the time period between murders separates serial murder from mass murder. Combining various ideas presented at the symposium, the following definition emerged: Serial murder is the unlawful killing of two or more victims by the same offender/offenders in separate events" (Morton, Ed., 2005: 9). The question is whether such a simple definition of serial murder confirms the limitation of defining serial murder in the context of lack of consensus and uniformity (Keeney, Heide, 1994), which is continuously present in the research literature, making it difficult for criminal enforcement agencies and the criminal justice system to create a more effective response in identification, investigative procedures, and adjudication in these complex and challenging cases.

Causality and the Serial Murderer

"After the arrest of a serial killer, the question always arises: How did this person become a serial killer? The answer lies in the development of the individual from birth to adulthood. Specifically, the behavior a person exhibits is influenced by life experiences, as well as certain biological factors. Serial killers, like all human beings, are a product of their heritage, their upbringing, and the choices they make during their development" (Morton, Ed., 2005: 11). "Every person has their own developmental path, the characteristics of which can often be identified at a very early age. The developmental perspective views the life course of all people as following a path (or trajectory) that may be filled with risk factors. Some risk factors can be described as experiences that are common in the background of many offenders, such as failure in school, alcohol abuse, antisocial peers, or victimization in childhood. Some experts believe that the more a person is exposed to risk, the more likely they are to engage in antisocial behavior throughout their life" (Wasserman, Seracini, 2001). We must understand that the life paths of adult and juvenile offenders can be different and unpredictable. Some lead to serious delinquency and crime that includes the most severe offenses, while others lead to milder forms of juvenile delinquency that disappear as an unpleasant experience after leaving the complex period of adolescence.

Researchers around the world, over a long period of time, continuously and vigorously study risk factors for criminal behavior. Of course, as in all areas of scientific endeavor, there are certain disagreements and differences in the interpretation of the phenomenology and etiology of a phenomenon. In this domain, there is absolute consensus expressed in the view that there is no single path to delinquent behavior, and it is notable that the presence of several risk factors significantly increases the chances of young people engaging in criminal behavior. Numerous studies also indicate a complex interaction of individual factors and a multiplicative effect when several risk factors are present (Bjelajac, 2023: 81). Bjelajac (2023) in his monograph *The Origin of Criminal Behavior* highlights the complex combination of risk factors at the interface of individual – family - interpersonal relations – society, which accumulates the risk of violence among youth. He suggests the following factors:

- **Social Environment Risk Factors**: Socioeconomic status, preschool experiences, educational failure and school absenteeism, quality of after-school care, peer rejection, and association with antisocial peers, among others, can be strong predictors of general delinquency.
- **Parent and Family-Related Risk Factors**: Dysfunctional family, broken home, parenting styles and practices in child-rearing, parental supervision, parental alcohol and substance abuse, sibling influence, parental psychopathology, neglect, and abuse, among others, indicate the crucial role of these factors in predicting criminal behavior.
- **Psychological Risk Factors**: These include personality traits, comorbid psychiatric conditions, value judgments and cognition, affective components, and motivation. Their interactive effects produce varying levels of antisocial states and problematic behaviors. **Attachment Disorder**—a condition affecting mood or behavior that makes it difficult for individuals to form and maintain relationships with others—may be influenced by risk factors such as caregivers with poor parenting skills, parental neglect, and emotional or physical or sexual abuse; parental anger; parents with psychiatric conditions; prenatal exposure to alcohol or drugs. Exposed children may suffer from behavioral disorders, a lack or absence of empathy—which is the ability to understand and share the feelings of others. They may also experience other disorders, such as cognitive-communication disorders, attention deficit hyperactivity disorder (ADHD), and oppositional defiant disorder.

- **Biological Factors**: There is evidence of a genetic predisposition for the development of serial killers. Genetic testing holds a promising future for studies on criminals, but there is compelling evidence of a combination of genetic, environmental, and behavioral factors that contribute to serial killing (Jarrett, Jarrett, 2023). These factors suggest inherent, hereditary, organic, physiological, and other biological functions that condition delinquent behavior in certain individuals. Within the context of antisocial behavior, two categories of genetic research are emphasized: behavioral genetics and molecular genetics. The predisposition for criminal behavior includes psychophysiological risk factors—such as temperament; environmental risk factors (neurotoxins, exposure to nicotine, alcohol, and drugs, traumatic brain injuries, brain developmental abnormalities, brain plasticity (neuroplasticity), hormones, and neurotransmitters); neuropsychological factors—with impulsivity being one of the leading personality risk factors for criminal behavior.
- **Learning and Situational Factors:** In the context of the origins of criminal behavior. Imitative aspects of social learning in the context of the imitation of criminal models. Frustration: characteristics, causes, and consequences. The role of frustration in criminal behavior. Situational determinants of criminal behavior.
- **Psychopathy, Mental Disorders, and Criminal Behavior:** Numerous psychiatric disorders and neuropsychological conditions may be associated with criminal behavior, aggression, and violence. Among these, psychopathy deserves special attention due to its high prevalence in the population and its interactions with persistent and continuous patterns of aggressive and violent behavior. Additionally, it is a reality that people with mental disorders can develop patterns of criminal behavior, suggesting that certain disorders may be risk factors for specific types of criminal acts.
- **Latent Risk Factors for the Development of Criminal Behavior:** This primarily refers to the contradictory role of mass media, particularly the internet, which represents a hypermedia environment (Bjelajac, Filipović 2020), oscillating between social responsibility and destruction. The destructive aspect is reflected in the influence of mass media on individuals' propensity toward drug abuse (Bjelajac, Matijašević, Počuča, 2012), violence, deviant behavior, and delinquency, which embodies an antisocial influence. Various criminal content featuring serial killers, drug dealers, terrorists, violent offenders, mafia members, thieves, fraudsters, pedophiles, pimps, prostitutes, and human traffickers provides a raw portrayal of certain criminal endeavors and depicts the actors committing social offenses with extensive violence. Simultaneously, it presents an image of the lavish lifestyle and power of criminals, suggesting to gullible viewers that criminal behavior can be profitable. Latent risk factors also include phenomena of alienation and dehumanization (the inability to respond to alienation). Namely, the sense of alienation between individuals can lead to various community issues, increase symptoms of mental and physical disorders, and heighten involvement in criminal activities.

"Thus, there is no single cause or factor that leads to the development of a serial killer. On the contrary, there are numerous factors that contribute to their development. The most significant factor is the personal decision of the serial killer in choosing to engage in their crimes. There were several additional observations regarding causality" (Morton, Ed., 2005: 11-12):

- The predisposition for serial killing, as well as other violent crimes, is of biological, social, and psychological nature and is not limited to any specific characteristic or trait;
- The development of a serial killer involves a combination of these factors, which coexist in rare combinations in certain individuals. They have an appropriate biological predisposition, shaped by their psychological makeup, present at a critical moment in their social development;
- There are no specific combinations of traits or characteristics that distinguish serial killers from other violent offenders;
- There is no generic pattern for a serial killer;
- Serial killers are driven by their own unique motives or reasons;
- Serial killers are not limited to any specific demographic group, such as gender, age, race, or religion;
- Most serial killers who are sexually motivated have eroticized violence during their development. For them, violence and sexual pleasure are inexplicably intertwined in their psyche;
- More research is needed to identify the specific developmental pathways that produce serial killers.

Identification of Psychological Profiles of Serial Killers by Gender Aspects

Working on the psychological profile of serial killers is highly complex and requires specific skills (Bjelajac, Banović, 2024) to overcome numerous difficulties due to the inability to form a universal profile**.** In this context, some of the key challenges include: the complexity of motives and behaviors; the arbitrariness of conclusions and the incompleteness of empirical research; gender differences in terms of motives, methods, and patterns; limited knowledge of etiology and developmental psychology; obstacles in identification and apprehension; a tendency toward lying and manipulation; a delicate combination of personality disorders; characteristics of organized serial killers; characteristics of disorganized serial killers; and the flexibility and dynamism of profiles. Additionally, sensationalism in the media and social perception generate stereotypes about serial killers, such as the beliefs that: all serial killers are dysfunctional loners; they are predominantly white males; they are motivated by sexual urges; they lack defined geographical areas of operation; they cannot control their urge to kill; they are either completely insane or evil geniuses; and they subconsciously want to be caught. These challenges complicate the creation of accurate psychological profiles of serial killers and require a holistic approach that considers many variables. The combination of psychology, criminology, and social analysis aids investigators in developing better profiles, but each profile remains adaptable and largely dependent on the specific characteristics of each individual killer.

"The first stage of analyzing the personality of a serial killer is the assessment of the case, of the victim, of the details from the crime scene and building the general psychological image of a person capable of killing in that specific way by drawing out the unique features of the victim and crime mode. The first question of psychological investigation is the assessment of the organizational typology of the crime scene and killer. One important feature is the victim and crime scene aspect, as they are the first elements to talk about the way a murderer thinks. The psychopath is usually well organized with clean crime scene, certain modalities of killing, with no additional or unneeded lesions, with certain objects placed as statements of his message or emotional involvement or the scene chosen to transmit a certain characteristic about himself. This is the reflexion of a planned murder which means the killer has critical judgment, intelligence and patience and he often does not leave much clues as he is aware of the severity of the act he commits and the importance of not being caught " (Knight, 2006; Heghes, Schiopu, 2021)**.** "The psychotic is usually not organized at all and the characteristic of a psychopathologic murder is usually the disorder of the scene and the aspect of the victim that add up to the image of impulsive, not planned, chaotic act with no emotional control. Crime scenes are usually exceptionally bloody and victims present much more violent aggression marks and deadly injuries are extreme, targeting the head or the heart, which reflects the direct intention but without clean and planned motivation. The problem about the last type of murder is that the lack of control of impulses can belong in the same time to a person with a psychiatric condition and lack of discernment, in a period of crisis (acute psychotic state) or it can also belong to somebody emotionally or intimately involved with the victim, in which case, there are is no doubt of the presence of the discernment. Also, in some individuals, a first emotional crime is the first step and motivation in becoming a serial killer " (Knight, 2006; Heghes, Schiopu, 2021). "The second important feature within psychological investigation resides in the operational model of the killer which usually evolves as the crimes proceed and new elements may appear and the quality of the existing characteristics becomes more sophisticated but also, as the crimes proceed, the ego of the offender becomes more prominent and details about him or emotional details he wants to underline will appear more consistent. This element reflects directly the killer's intelligence but also his psycho-emotional disruptions. The psychological imbalance becomes more and more contrasting. In the first place, the fact that he isn't caught feeds his ego and motivates him into developing more elaborated criminal scenarios, defying the police and building more challenges for them in order to prevent future crimes. On the other hand, frustration and emotional disruption or absence of feelings still pushes him into the search for new victims that can satisfy and balance his inner self. In other words, the imbalance creates more imbalances, and some satisfaction don't completely fill the disruptions but only creates new ones" (Keppel, Birnes, 2003; Heghes, Schiopu, 2021). "The third constitutive element of the killer's profile is the imprint of the murderer's personality and emotional state. Serial murders are characterized by the uniqueness of the crime scene which is a personal choice of the killer and by the victim bodies which tend to be displayed in certain ways that de-personalizes them

as they become a statement for the killer's identity. These elements will form the killer's signature but tis signature evolve and change in the investigation course in order to confuse the inquiry or because the killer's psycho-emotional level is changing" (Pârvulescu, Butoi and Ștefan 2014; Heghes, Schiopu, 2021).

Disrupted connections between emotional regulation and action control are among the most prominent characteristics associated with serial killers. This often involves inconsistent emotional responses and extreme fluctuations between emotional states. (Butoi, Butoi, 2004: 385-389). "Social inadaptation represents a characteristic of extreme deviant behaviors. The social unadapted have roots in a disrupted familial and financial influence with low educational levels. In some cases, the first active symptom of social inadaptation is exactly the criminal offence as many of these individuals blame their difficulties on society or try to repair their problems by eliminating reflections of their trauma from the environment" (Marono, Reid, Yaksic and Keatley, 2020). "Affective immaturity is often another characteristic within serial killer and it resides in a cleavage within the cognitive and affective processes with a stronger proportion of the last. Emotional lack of maturity leads to psychological stiffness and disrupted reactions in order to obtain pleasure in a non-realistic mode. He is capable of intense reactions as a response to lowest level of affective stimuli in order to obtain sometimes, insignificant satisfactions. He is often incapable of self-criticism, of realistic analysis and he is inconsistent and ignorant about important problems" (Keatley, Golightly, Shephard, Yaksic and Reid 2021). "The most spectacular characteristic of serial killers consists in their duplicitous behavior capacity. Being extremely conscient of the severity of his intentions he is able to plan and calculate every step in order to hide his activity and his true nature which himself often despises. He needs an alter-ego that rise to his desires an expectation so he will make all the efforts necessary in order to become a social, honest and morally preoccupied person, the perfect friend and community member, basically he will be the last person anyone would point to in a case of crime. Also, there is a contrast between the 2 sides of a killer because his desires push him and isolates him so much from the society that he needs to get as closer as he can to the community and group acceptance as he can, so, he becomes split between 2 lives and 2 identities" (Duță, 2014).

"From a psychological point of view, the personality system is a complex interconnection of cognitive features, emotional elements, personal familial history and its imprint on the individual identity, social environment influences and intelligence structure. Personality is a psychological property of self that integrates an individual into his environment by projecting his character, attitude, impulses, behavior, emotions and thinking pattern in the outer world. Basically, the biological integrity and the brain function level are the bases for upcoming cognitive and emotional filters that will form a person's bio-psycho-social balance and construct his personality. It is a dynamic structure and never a passive, static characteristic. This is the foundation of the behavior sciences, including forensic psychiatry and psychology. In this matter there are 2 plans of assessment of personality, especially in the case of serial killers and those are the personality components and personality types each being formed on biologic, psychologic and social directions" (Knight, 2007). Some of the common psychological characteristics shared by male and female serial killers include:

- **Lack or absence of empathy and emotional connection:** Emotional coldness, indifference, emotional emptiness, alienation, impaired social interactions;
- **Personality disorder:** Antisocial personality disorder – difficulties in interpersonal relationships, work, partnerships, destructiveness and/or self-destructiveness, impulsivity, manipulativeness, and callousness, as well as an addiction to adrenaline. They may also have narcissistic personality disorder, characterized by an inflated sense of self-worth and uniqueness;
- **Traumatic childhood experiences:** Neglect, abandonment, psychological and physical abuse, and sexual abuse;
- **Sadistic tendencies:** Enjoyment in hurting and humiliating others, dominance over their victims, and a sense of power through their suffering;
- **Drive for control over victims:** A reaction to emotional deprivation, heightened sexual arousal, and devaluation of the victim. This may manifest in how they select, stalk, and kill their victims.
- **Ritualization of the crime through the repetition of certain actions**: Specific patterns in the way they commit murders. Each crime holds ritual elements and symbolism for the killer, which contributes to a sense of emotional fulfillment, stability, control, and enjoyment in the act;

- **High intelligence and manipulative abilities**: The ability to plan and emotionally manipulate. Many serial killers are superficially charming and attempt to show an understanding of human emotions to get closer to potential victims (Bjelajac, Filipović, 2022).
- **Obsessive fantasies and obsessions**: Including fantasies about killing, violence, and domination. It makes sense that many serial killers are voyeurs—they experience sexual gratification from secretly observing others and fantasizing about sexual acts;
- **Masked life and dual identity**: Most serial killers skillfully conceal their true identity, posing as ordinary community members, family people, dedicated to their wives, children, and their professions.

Motives for Murder	**Male Serial Killers**: Sadism and sexual gratification; Control and domination with a sense of power; Need for excitement – adrenaline addiction; Hatred and revenge; Financial gain.	**Female Serial Killers:** Financial gain (inheritance, life insurance payout, or victim's personal property); Personal and emotional revenge; Hidden sadism; Social or family environment (regaining control over their life, eliminating a "burden," or revenge due to poor relationships); Psychopathology and mental disorders (loss of sense of reality); "Angels of death."
Methods of Killing	**Male Serial Killers:** Physical violence (strangling, stabbing, suffocating, hanging); Sexually motivated violence with murder; Use of firearms (when contact with the victim is not a priority); Torture and sadistic methods; Body mutilation; Poisoning; Experimenting with the victim and specific "rituals."	**Female Serial Killers:** Use subtle methods; Poisoning; Suffocation or strangulation; Medications and overdosing; Starvation or neglect; Insulin and injections; Suffocation with a pillow or mechanical asphyxiation; "Quiet" killing through caregiving ("Angels of Death," e.g., nurses); Manipulation of unfortunate circumstances.
Attitude Toward Victims	**Male Serial Killers:** They choose unknown victims, strangers, or people on the social margins (homeless individuals, prostitutes) or those from vulnerable groups over whom they can demonstrate control and dominance; They typically have no emotional connection with their victims and view them as objects to fulfill their sadistic or sexual needs; They often use violence or intimidation as the primary method of controlling their victims; They are frequently driven by a sense of power and control over their victims, with the act of killing being the culmination of their sadistic fantasies; They are often more explicit and brutal, and their crimes may be more visible due to the violent methods they use.	**Female Serial Killers:** They choose victims from their close environment who trust them or depend on them; They often have an emotional connection with their victims or at least rationalize their crimes through this connection; They use trust as a means of manipulation, often developing long-term relationships with their victims; They are generally motivated by pragmatic reasons, such as financial gain or a sense of solving a problem; They are more inclined to use covert methods, killing in ways that make the deaths appear as natural or accidental.
Psychological Profiles and Personality Disorders	**Male Serial Killers:** They often display characteristics of antisocial personality disorder, psychopathy, and narcissistic personality disorder; They tend to be more impulsive and exhibit a greater degree of sadism and aggression.	**Female Serial Killers:** They display less pronounced antisocial personality disorder; They may exhibit characteristics of borderline personality disorder or Munchausen syndrome, through which they attempt to elicit attention or sympathy; They may show a tendency for manipulation and a "quiet" expression of control.
Repetition and Behavioral Pattern	**Male Serial Killers:** They often develop ritualized behavior patterns, repeating specific steps during each murder; They frequently have obsessive fantasies that they envision in advance and attempt to fulfill through their crimes.	**Female Serial Killers:** They are more likely to use a consistent method, often choosing a series of crimes that appear as accidents or natural deaths; This methodical approach helps them maintain the belief that they will avoid suspicion and capture.

Figure 1. An Analogy of the Similarities and Differences Between Male and Female Serial Killers

"Enough serial killers have a history of arson, preteen bedwetting, and torturing small animals that the traits are considered signs that someone might be a serial killer. This trio, known as the Macdonald triad, is not without controversy. Some argue these traits are more likely an indicator of neglect or abuse than of future serial killing. At the same time, abuse and neglect are in and of themselves said to be indicators of serial killing. Many of them are so pleased with their crimes that they can't help but tell others. Some even get caught because they told the wrong person! And then, when in jail, some killers are known to take credit for crimes that weren't even their own just to heighten their reputation" (Kharakh, 2017).

It is evident that male and female serial killers share some common psychological characteristics, but there are also significant differences reflected in their motives, methods, and behavioral patterns. Specifically, male serial killers tend to exhibit tendencies toward physical violence and sadistic methods, while females are more inclined to use subtler methods and are often driven by financial or emotional motives. Research suggests that female serial killers possess specific characteristics. The following analogy provides an overview of these similarities and differences:

Discussion

"It a known fact that serial killers are statistically more men than females. The main characteristic of the serial killers, the disruptive emotional state, is not something to characterize women but can be a psychological trait of males. Women are known for aggressive manifestation in extreme heightened emotional states and the victim is almost always someone from the intimate close group. Searching for strangers is not something women usually do as they need to affectively connect even in a negative way. Some studies suggest that this difference between criminal acts in males and females represents a remanence of pre-evolutive instinctual characteristics of the social models. Men had the role of the hunter in order to sustain the family and women were always close to the house, keeping it organized and affectively merged. This is one of the explanations for the instinctual psychological aspects of the two genres when involved in criminal activity" (Harrison, Hughes and Gott, 2019).

"Some studies have attempted to investigate and describe the demographic, behavioral, and background characteristics of female serial killers. A series of postulates about male serial murderers were developed after an extensive literature review. Data were collected from both primary and secondary sources on 14 female serial murderers in the United States. A preliminary profile of female serial murderers was then compared to the current knowledge of male serial murderers. Overall, there were generally more differences than similarities between male and female serial murderers. Results suggested differences in nine areas: victim damage, victim torture, weapon/method, stalking versus luring behaviors, crime scene organization, reasons for the murders, substance abuse history, psychiatric diagnosis, and household composition. Similarities appeared in five areas: broken homes, childhood abuse, race, educational level, and occupation" (Keeney, Heide, 1994).

"The book *Hunting Humans: An Encyclopedia of Modern Serial Killers* describes the lives and crimes of several hundred serial killers from the 20th century and summarizes findings related to serial killings. The narratives focus on 544 cases of serial murders, involving about 750 individual murderers and an estimated 5,336 to 6,368 victims. Seventy-four percent of the murderers were from the United States, where 85 percent were male, 8 percent were female, and the sex was undetermined in the cases in which the offender was still at large. In addition, 82 percent of American serial killers were white, 15 percent were black, and 2.5 percent were Hispanic. Eighty- seven percent operated alone, while 10 percent committed their crimes in pairs or groups. Some committed their crimes in specific geographic areas, while others traveled widely. Motives were often psychological, with strong sado-sexual overtones and evidence of compulsive behavior. Six percent of the cases involved greed. Since 1969, 8 percent of the cases involved practitioners of Satanism, while another 5 percent involved members of the medical profession" (Newton,1990).

Conclusion

Despite the limitations in defining serial murder, this article appears to have fulfilled its purpose in examining current trends and issues in the way serial murder is defined. It is particularly important that it

highlights a catalog of various risk factors that, in interaction, lead to these severe crimes and that may contribute to antisocial and violent behavior in serial killers, with an emphasis on how these factors may manifest differently in men and women.

This paper emphasizes the importance of differences and similarities in the psychological profiles of male and female serial killers, as well as the need for a gender-specific approach in profiling them. Research shows that male serial killers are primarily driven by motives such as domination, sexual sadism (although there are female serial killers with sexually motivated behavior, for example, **Aileen Wuornos** – an American serial killer who killed seven men between 1989 and 1990), and the need for control, which often manifests through openly violent and brutal methods such as physical assault, strangulation, or stabbing. On the other hand, female serial killers are more often motivated by pragmatic reasons, such as financial gain—for instance, the monetary benefit from murder (for example, **Belle Gunness** – a Norwegian-American serial killer who, at the end of the 19th and beginning of the 20th century, killed numerous husbands and lovers for financial gain), the elimination of perceived burdens, or a pseudo-maternal instinct, as in cases of so-called "care-based" murders. Their methods, such as poisoning and other subtle approaches, often allow these crimes to go unnoticed for extended periods (for example, **Ana Drakšin** – known as the "Banat Witch" or Grandma Anujka, is considered one of the first serial killers in Yugoslavia and is known worldwide. Grandma Anujka is accused of being involved in the poisoning of at least 50, and by some estimates up to 150 or more people).

In terms of the "subtle" approaches toward victims by female serial killers, the aspects of motives, methods of killing, and attitudes toward victims are difficult to discern and evaluate. Historically, some female serial killers have shown brutality comparable to their "male counterparts." For example: **Elizabeth Báthory** – a Hungarian countess from the 16th century, accused of murdering hundreds of young girls; **Juana Barraza** – known as "La Mataviejitas," a Mexican serial killer who targeted elderly women; **Judith Neelley** – who, together with her partner, committed brutal murders of teenagers in Alabama and Georgia in 1982. Her crimes included kidnapping, torture, and murder, ranking her among the most ruthless serial killers; **Carol Bundy** – partner of serial killer Douglas Clark, with whom she committed a series of murders in Los Angeles in the 1980s, which included sadistic acts; **Karla Homolka** – a Canadian serial killer who, along with her husband Paul Bernardo, committed the rape and murder of teenage girls in the early 1990s, including Karla's younger sister; **Leonarda Cianciulli** – an Italian serial killer known as the "Soap-Maker of Correggio," who used parts of her victims' bodies to make soap and cakes. These women, through their brutal acts, have left a profound mark on the complex dynamics of this phenomenon.

The analysis also indicates different behavioral patterns and attitudes toward victims. While male serial killers typically choose victims who are strangers, demonstrating a sense of complete domination and control over them, female serial killers are more likely to select people from their close environment, such as family members, partners, or patients, using manipulation and trust to gain access to their victims (for example, **Mary Ann Cotton** – a British serial killer from the 19th century who killed more than 20 people, including members of her family; **Nannie Doss** – an American serial killer known as "The Giggling Granny," responsible for the deaths of around a dozen family members during the 20th century; **Gwendolyn Graham** – together with her partner Catherine May Wood, committed a series of murders in a nursing home in Michigan during the 1980s. Both worked as nurses and claimed to kill as part of a twisted game related to emotions and control). These gender differences in victim selection and killing methods indicate that understanding the context, as well as a personalized approach to profiling, is crucial for the success of criminal investigations.

Considering gender aspects in profiling serial killers contributes to the accuracy and efficiency of identifying and tracking suspicious behaviors. A differentiated approach allows investigators and criminal psychology experts to adapt profiling methods to specific behavioral patterns and motives. This research indicates that it is essential to further develop gender-specific profiling methods to achieve more effective prevention and detection of serial killers, as well as to enhance the understanding of the psychological factors behind their crimes. Generally speaking, psychological factors that drive female serial killers include a low level or absence of empathy, a pathological need for attention and control, and emotional traumatic experiences from childhood. Many female serial killers have experienced abuse in early childhood—whether physical, emotional, or sexual—which may shape their later antisocial behavior. Some are driven by anger, a desire for power/excitement, while others are led to violent actions due to psychoses or severe mental states that may involve auditory and/or visual hallucinations and paranoid, grandiose,

or bizarre delusions.

Author Contributions

Conceptualization, Ž. B., formal analysis, Ž. B.; writing—original draft preparation, Ž. B.,; writing—review and editing, Ž. B.. The author has read and agreed to the published version of the manuscript.

Conflict of interests

The authors declare no conflict of interest.

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Research and Training Center on Independent Living. (1993). Guidelines for reporting and writing about people with disabilities (4th ed.) [Brochure]. Lawrence, KS: Author.

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Schwarzer, R. (1989). Statistics software for meta-analysis [Computer software and manual]. Retrieved March 23, 2001, http://www.yorku.ca/faculty/academic/schwarze/meta_e.htm

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Zuckerman, M. Kieffer, SC (in press). Race differences in faceism: Does facial prominence imply dominance? Journal of Personality and Social Psychology.

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The new health-care lexicon. (1983, August / September). Copy Editor, 4, 1-2.

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Ganster, DC, Schaubroeck, J. Sime, WE, & Myers, BT (1991). The nomological validity of the Type A personality among employed adults [Monograph]. *Journal of Applied Psychology, 76,* 143-168.

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Woolf, NJ, Young, SL, Famselow, MS, & Butcher, LL (1991). Map-2 expression in cholinoceptive pyramidal cells of rodent cortex and hippocampus is altered by Pavlovian conditioning [Abstract]. *Society for Neuroscience Abstracts, 17*, 480 harvesters.

• Titles that are not in English, and we want them to be published in the journal in English, listed in their native language, and then in the square brackets give the title translation into English. In addition to the title, everything else remains the mother tongue.

Ising, M. (2000). Intensitätsabhängigkeit evozierter Potenzial their EEG: Sindh impulsive persons Augmenter stage Reducer? [Intensuty dependence and event related EEG potentials: Are impulsive individuals augmenters or reducers?]. *Zeitschrift für Différentiel und diagnostisch Psychology, 21*, 208-217.

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• When the list of references cites a paper published in the Proceedings of the translated, italics will print the name of the collection at the end to add when it published the original.

Freud, S. (1961). The ego and the id. In J. Strachey (Ed. & Trans.), The standard edition of the complete psychological works of Sigmund Freud (Vol. 19, pp. 3-66). London: Hogarth Press. (Original work published 1923).

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8th GVU's WWW User Survey. (Od). Retrieved August 8, 2000, from http://www.cc.gatech.edu/gvu/user_surveys/survey-1997-10/

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Cuter, LD, Frölich, B., & Hanrahan, P. (1997, January 16). Twohanded direct manipulation on the responsive workbench. Paper presented at the 1997 Symposium on Interactive 3D Graphics. Abstract retrieved June 12, 2000, from http://www.graphics.standard.edu/papers/twohanded/

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Miller, M. E. (1993). The Interactive Tester (Version 4.0) [Computer software]. Weastminster, CA: Psytek Sesvice.

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Department of Health and Human Services, National Center for Health Statistics. (1991). National Health Provider Inventory: Home health agencies and hospices, 1991. [Data file]. Available from the National Technical Information Service Web site, http://www.ntis.gov

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