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# Content

# Digital Innovation and Transformation to Business Ecosystem

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**Abstract:** The rapid advancements in digital technology have fostered significant changes in the way businesses operate, leading to the emergence of new business models, improved operational efficiency, and an enhanced customer experience (Manyika et al., 2013). This study aims to explore the impact of digital innovation and transformation on the business ecosystem, emphasizing the importance of adopting a comprehensive approach for sustained growth and competitive advantage (Westerman et al., 2011).

Introduction: The business landscape is continuously evolving due to the accelerated pace of technological advancements, with digital innovation and transformation playing a central role in shaping the business ecosystem. The adoption of digital technologies has become a necessity for businesses seeking to survive and thrive in the increasingly competitive global market (Porter & Heppelmann, 2014). This study examines the factors that drive digital innovation and transformation and investigates how businesses can harness these elements to stimulate sustainable growth and maintain a competitive edge (Bughin & Zeebroeck, 2017).

Methods: A mixed-methods research approach was employed to collect and analyze both qualitative and quantitative data from various sources, including interviews with managers, case studies, and a review of existing literature (Creswell & Creswell, 2017). The sample size comprised executives and managers from various industries who have implemented or are in the process of implementing digital transformation initiatives (Rogers, 2016). Data analysis was conducted using appropriate statistical methods, content analysis, and thematic analysis to draw meaningful insights (Braun & Clarke, 2006).

Results: In-depth interviews were conducted with 20 managers from various industries, who were either in the process of implementing digital transformation initiatives or had already done so (Kane et al., 2015). These interviews aimed to gain deeper insights into the experiences, challenges, and successes encountered during the digital transformation journey (Agarwal & Sambamurthy, 2018). The key findings from the interviews are summarized below.

Digital Transformation Strategy and Leadership: Managers emphasized the crucial role of a clear digital transformation strategy that aligns with the organization's overall business objectives. Moreover, they highlighted the importance of strong leadership support and commitment, which fosters a sense of ownership and encourages employees to embrace change.

Organizational Culture and Change Management: Managers indicated that organizational culture plays a significant role in the success of digital transformation efforts. They acknowledged the need to create a culture that fosters innovation, collaboration, and adaptability to change. Furthermore, they emphasized the importance of effective change management strategies to ensure a smooth transition, address resistance, and minimize disruption during the transformation process.

Talent and Skill Development: The interviews revealed that one of the key challenges in implementing digital transformation initiatives is the lack of appropriate skills and expertise within the organization. Managers stressed the importance of investing in continuous training and development programs, as well as attracting and retaining talent with the required digital skills.

Technology Adoption and Integration: Managers discussed the importance of adopting the right technologies that align with their business needs and objectives. They highlighted the challenges associated with integrating new technologies with existing systems and processes and underscored the need for seamless integration to achieve desired outcomes.

Data-driven Decision-Making: The interviews emphasized the increasing importance of data-driven decision-making in the era of digital transformation. Managers acknowledged the need to leverage advanced analytics and data insights to optimize business processes, identify new opportunities, and make informed decisions.

Customer-centric Approach: Managers stressed the importance of adopting a customer-centric approach in digital transformation initiatives, as it enables organizations to better understand and cater to evolving customer needs and preferences. This approach drives innovation and enhances customer experience, leading to increased customer loyalty and higher market share.

Measurement and Evaluation: The interviewed managers also highlighted the importance of setting clear performance indicators and evaluating the success of digital transformation initiatives. This helps organizations track progress, identify potential issues, and make necessary adjustments to ensure that the desired outcomes are achieved.

In conclusion, the interviews with the 20 managers provided valuable insights into the experiences, challenges, and successes encountered during the digital transformation journey. By incorporating these findings into the digital transformation strategy, organizations can better prepare for the challenges ahead, mitigate potential risks, and maximize the benefits of digital innovation and transformation in the business ecosystem.

The findings of the study reveal that organizations that have embraced digital innovation and transformation have experienced a multitude of benefits. These include improved operational efficiency, enhanced customer experience, increased market penetration, and greater adaptability to changing market dynamics. Furthermore, the study identifies four key drivers of digital innovation and transformation: 1) advances in digital technologies, 2) evolving customer needs and preferences, 3) growing competitive pressures, and 4) regulatory and compliance requirements.

Discussion: The study highlights the importance of a comprehensive approach to digital innovation and transformation in the business ecosystem, emphasizing the need for organizations to develop a well-defined strategy that aligns with their overall business goals. This strategy should incorporate elements such as continuous innovation, a focus on customer-centricity, fostering a culture of agility, and leveraging data-driven insights. By doing so, businesses can better position themselves to adapt to the ever-changing market dynamics and capitalize on new growth opportunities.

Conclusion: In conclusion, digital innovation and transformation are essential for businesses to remain competitive in today's rapidly evolving business ecosystem (Bharadwaj et al., 2013). By adopting a comprehensive approach that integrates technology, strategy, and organizational culture, organizations can unlock the full potential of digital transformation, enabling them to drive sustainable growth and maintain a competitive edge in the global market (Kane et al., 2015).

Keywords: digital innovation, digital transformation, business ecosystem, operational efficiency, customer experience, market penetration, adaptability, competitive advantage

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# Digital Innovation and Sustainable Development of Organizations: A Comprehensive Study

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**Abstract:** Digital innovation has become a driving force in the modern era, reshaping the way organizations function and creating opportunities for sustainable development (Porter & Heppelmann, 2014). The current study explores the relationship between digital innovation and the sustainable development of organizations, examining the potential benefits and challenges associated with integrating digital technologies (Schaltegger et al., 2016). Using the IMRAD (Introduction, Methods, Results, and Discussion) model, this extended abstract delves into this topic, providing insights into the research design, data collection, and analysis (Creswell & Creswell, 2017). The findings reveal a strong correlation between digital innovation and organizational sustainability, with the potential to drive growth, increase efficiency, and promote a greener environment (Bresciani et al., 2016).

Introduction: Digital innovation is an essential aspect of today's business landscape, as organizations continually adapt to the rapidly evolving technological environment (Bharadwaj et al., 2013). Companies are adopting various digital technologies to improve their operational efficiency, customer experiences, and overall performance (Laudon & Laudon, 2016). At the same time, the concept of sustainable development has gained increased attention, as organizations aim to minimize their ecological footprint, enhance social equity, and ensure long-term economic growth (Elkington, 1997). This study seeks to explore the nexus between digital innovation and the sustainable development of organizations, elucidating the potential benefits and challenges associated with integrating digital technologies into organizational processes (Nidumolu et al., 2009).

Methods: A mixed-methods approach was employed to conduct this research, combining both quantitative and qualitative data collection methods. The quantitative phase consisted of a cross-sectional survey, targeting a diverse range of organizations from different industries and sizes. The survey sought to assess the extent of digital innovation adoption, the organization's commitment to sustainability, and the perceived relationship between the two. A total of 250 organizations participated in the survey, representing a wide array of sectors, including manufacturing, healthcare, financial services, and technology.

The qualitative phase involved conducting in-depth interviews with key stakeholders, including executives, managers, and employees directly involved in the implementation of digital innovation initiatives and sustainable development practices. A total of 25 organizations were selected for the interviews, ensuring a diverse representation of industries and organizational sizes. The interviews sought to gain insights into the strategies employed, the challenges encountered, and the perceived impact of digital innovation on organizational sustainability.

Results: The survey results indicated a positive correlation between the extent of digital innovation adoption and the level of commitment to sustainable development. Organizations that reported a higher degree of digital innovation were more likely to have implemented sustainability initiatives, such as energy conservation, waste reduction, and social responsibility programs. Moreover, the survey revealed that the perceived benefits of digital innovation included improved operational efficiency, reduced environmental impact, and enhanced customer experiences. The interview findings complemented the survey results, providing a more nuanced understanding of the relationship between digital innovation and sustainable development. The interviews revealed that digital technologies could contribute to organizational sustainability through various mechanisms, such as:

- Streamlining processes and reducing resource consumption through automation and advanced data analytics.
- Facilitating remote work and reducing the need for physical office spaces, thereby minimizing the organization's carbon footprint.
- Enabling more effective monitoring and management of environmental and social performance, promoting transparency and accountability.

However, the interviews also highlighted potential challenges associated with the integration of digital technologies. These challenges included the need for substantial financial investments, workforce re-skilling, and potential job displacement due to automation.

Discussion: The current study's findings underscore the potential for digital innovation to foster sustainable development within organizations. The strong correlation between digital innovation adoption and organizational sustainability suggests that embracing digital technologies can drive growth, increase efficiency, and promote a greener environment. Nevertheless, organizations must remain cognizant of the potential challenges and strive to address them proactively.

Organizations should consider implementing comprehensive strategies to support the successful integration of digital technologies, such as employee training programs, investment in digital infrastructure, and the development of robust digital governance frameworks. Additionally, organizations should collaborate with industry peers, governments, and non-governmental organizations to share best practices, pool resources, and develop common standards for digital innovation and sustainability.

In conclusion, digital innovation holds significant promise for promoting sustainable development within organizations. The benefits of adopting digital technologies, such as improved operational efficiency, reduced environmental impact, and enhanced customer experiences, have the potential to transform organizational performance and contribute to long-term growth. However, to realize these benefits, organizations must overcome the challenges associated with digital integration, including financial investments, workforce re-skilling, and potential job displacement.

Future research should explore the specific mechanisms through which digital innovation can contribute to different dimensions of sustainability, such as environmental, social, and economic aspects. Additionally, longitudinal studies could provide valuable insights into the long-term effects of digital innovation on organizational sustainability, offering guidance on best practices for effective implementation and management. By deepening our understanding of the relationship between digital innovation and sustainable development, organizations can harness the transformative potential of digital technologies and drive meaningful progress toward a more sustainable future.

Keywords: digital innovation, sustainable development, organizational sustainability, technology integration, operational efficiency, environmental impact

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# Digital Transformation and Ethics: Navigating the Challenges and Opportunities in the Digital Age

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**Abstract:** Digital transformation has become a central aspect of modern business, as companies increasingly rely on technology to improve efficiency, competitiveness, and productivity (Bughin, Catlin, Hirt, & Willmott, 2018). As organizations undergo digital transformation, ethical considerations arise, specifically related to data privacy, security, and the potential misuse of technology. This article explores the ethical challenges faced by organizations during digital transformation and proposes potential solutions to ensure responsible and sustainable growth.

Methodology: A literature review was conducted to identify key ethical concerns and best practices in digital transformation. Academic articles, industry reports, and case studies were reviewed to understand the ethical implications of digital transformation and explore potential solutions. The analysis focused on three main areas: data privacy, security, and the potential misuse of technology.

The literature review conducted for this study encompassed a wide range of sources to gain a comprehensive understanding of the ethical concerns and best practices in digital transformation. The review included academic articles from reputable journals that discussed various aspects of digital transformation, such as the ethics of algorithms (Mittelstadt et al., 2016), responsible research and innovation in emerging information and communication technologies (Stahl et al., 2017), and the economics of cybersecurity incidents (Romanosky, 2016). Industry reports provided valuable insights into the practical implementation and real-world implications of digital transformation strategies. Reports from consulting firms like McKinsey & Company shed light on the reasons behind the success or failure of digital strategies (Bughin et al., 2018). Additionally, research from the Brookings Institution addressed the future of work and the impact of robotics, AI, and automation on society (West, 2018).

Case studies played a crucial role in understanding how organizations have navigated ethical concerns during digital transformation. These cases highlighted the experiences of companies across different industries and provided examples of both successful and problematic digital transformation initiatives. These real-world examples informed the recommendations and strategies discussed in this article.

By reviewing a diverse range of sources, the literature review aimed to provide a comprehensive understanding of the ethical implications of digital transformation. The analysis focused on three main areas: 1) data privacy, which delved into the protection of personal and sensitive information (Custers et al., 2018); 2) security, which explored the need for robust cybersecurity measures to counter threats like cyberattacks and ransomware (Kshetri & Voas, 2017; Zohar & Elovici, 2016); and 3) potential misuse of technology, which examined the ethical challenges posed by AI and ML, such as the creation of deepfakes and the manipulation of user behavior (Cath et al., 2018). By examining these three areas and drawing on the insights from the reviewed literature, this study aimed to provide a holistic view of the ethical concerns in digital transformation and offer potential solutions for organizations to address these issues responsibly.

**Results**

Data Privacy: As companies collect, process, and store vast amounts of personal and sensitive data, concerns regarding data privacy have emerged (Mittelstadt, Allo, Taddeo, Wachter, & Floridi, 2016). Data breaches and unauthorized access to data can result in severe consequences, such as identity theft, financial loss, and reputational damage (Romanosky, 2016).

Organizations must ensure that data privacy is an integral part of their digital transformation strategy by implementing strong data protection measures and by being transparent about their data usage policies (Custers, Calders, Schermer, & Zarsky, 2018).

Security: Digital transformation also brings about increased security risks, as organizations become more reliant on technology and interconnected systems (Zohar & Elovici, 2016). Cyberattacks, such as ransomware, can have devastating effects on businesses, leading to financial loss, operational disruption, and reputational harm (Kshetri & Voas, 2017). To address security concerns, organizations must invest in robust cybersecurity measures and adopt best practices, such as regular security audits, employee training, and risk assessments (Boddy, 2016).

Potential Misuse of Technology: As technology continues to advance, the potential for misuse of technology also increases. Artificial Intelligence (AI) and Machine Learning (ML) can be utilized to manipulate user behavior or create deepfakes, which can lead to the spread of misinformation and other harmful consequences (West, 2018). To mitigate the potential misuse of technology, organizations should establish strong ethical guidelines and governance structures that promote the responsible use of AI and ML (Cath, Wachter, Mittelstadt, Taddeo, & Floridi, 2018).

Discussion: Organizations must take a proactive approach to addressing ethical concerns during digital transformation. This involves creating a culture of ethical responsibility and accountability, which should be embedded throughout the organization. Companies should establish a clear code of conduct and ethical guidelines that outline expectations for responsible behavior and decision-making (Stahl, Timmermans, & Flick, 2017). Additionally, organizations should invest in employee training and education to ensure that all staff members understand the ethical implications of digital transformation and their role in upholding these principles (Boddy, 2016).

Furthermore, companies should engage in transparent communication with stakeholders, including customers, employees, and regulators, about their digital transformation initiatives and the associated ethical concerns. This includes providing clear information about data usage policies, security measures, and the organization's commitment to ethical practices (Custers et al., 2018).

Conclusion: Digital transformation presents organizations with numerous opportunities for growth and innovation. However, it also introduces ethical challenges related to data privacy, security, and the potential misuse of technology. By proactively addressing these concerns and investing in ethical practices, organizations can ensure responsible and sustainable growth in the digital age.

**Keywords**: digital transformation, ethics, data privacy, security, cybersecurity, Artificial Intelligence (AI), Machine Learning (ML)

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# The Role of SSIS and SSRS Tools in the Software Modernization of the 4GL Legacy System

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**Abstract:** After putting the information system into operation, the software aging process begins. Over time, the system loses its ability to evolve and it is difficult to adapt it to changes, primarily business and technological, and thus it becomes a legacy system. Legacy systems have many problems and practice shows that it is not easy to replace them, so some organizations decide to modernize them. The programming languages of the fourth generation have many different characteristics, and above all, they are domain-specific languages, where it is very difficult to apply concepts that were not originally designed for that business domain. As the world rapidly changes and technologies advance, new and more efficient business models appear that require the application of different concepts, which the 4GL legacy systems cannot support and are therefore a stumbling block to the organization's progress. Traditional modernization approaches such as software reengineering, overlay methods and migrations can contribute to solving these problems, and this largely depends on the specific information system. In this paper, a mixed approach to modernization will be presented, where the functionality of online sales is enabled for the legacy system. Tools that can support such a combined approach and enable reliance on the software architecture of the partner company are important for the implementation of this procedure.

**Keywords:** legacy systems, 4GL, modernization, ETL, Web services, SSIS, SSRS

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# The Role of Programmable Robots in Developing Divergent Thinking in Children

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**Abstract:** Play is the basis of a child's development, as it helps develop their physical, cognitive, emotional and social skills. Through play, children learn how to navigate the world around them (Milošević, 2018). When children play, they use their imaginations and gain the ability to come up with new ideas and solve problems in unconventional ways. The process of developing divergent thinking involves considering different possibilities and thinking outside the box. Through play, children express their creativity. Educational smart devices such as programmable robots provide children with a learning experience through play to optimize their development of cognitive and physical abilities, as well as social skills (Dorouka et al., 2020; Kevalramani et al., 2021).

Robot programming could effectively promote 21st-century skills such as communication, collaboration, and creativity in the classroom, stimulating children's critical thinking (Bers et al., 2019; Johnson, 2003; Jung & Von, 2018). Children can start playing with programmable robots as early as preschool because the tangible elements are similar to the toys that children play with every day, thus providing an intuitive interface for early development (Horn and Bears, 2019). For younger children, programmable robots should be easy to use and have basic functions. These simple robots help children learn basic programming concepts and gain confidence in their abilities. For older children, robots can be more complex and have more functions and sensors. Programmable robots can play an important role in developing divergent thinking in children by encouraging them to think about problems and find creative solutions, enabling real-time testing of ideas and getting feedback on those ideas, and learning programming in a fun way.

Programmable robots can provide different opportunities for children to play and learn depending on the model and level of complexity. They have been proposed as a developmentally appropriate tool for introducing young children to computational thinking under the rationale that as physical objects, robots can enable preschool children to learn in an unrestricted way, supporting the development of gross motor skills (Bers, 2021). Students learning robotics rely on inputting design ideas to build and program the robot and "listen" to the robot's responses (i.e., observe the robot's outputs and reactions). After that, they will decide how to debug their programs and modify their ideas about building or programming robots.

There are a number of programmable robots designed specifically for children, some of the most popular being: LEGO Mindstorms, Sphero, Dash and Dot, Ozobot, Bee-Bot, mBot, VEX Robotics, Makeblock, Robo Wunderkind, Edison, etc. What is important for parents and teachers is to explore different options and choose a robot that is appropriate for the child's age and interest and for children to play with programmable robots with adult supervision and support. There are a lot of things that children can do with programmable robots, such as motion programming, learning the basics of programming, researching science and technology, creating and building, role-playing, robot racing, going on virtual adventures, etc. Studies in this area of research show that through programming activities, children improve their skills related to computational thinking, i.e. planning, logic, and algorithmic sequences, which require different levels of guidance from adults (Critten et al., 2021).

In addition, programming activities have been observed to strengthen cognitive skills such as reasoning and working memory (Arfe et al., 2020). In addition to cognitive abilities, robot programming also promotes positive changes in learning attitudes such as motivation, confidence and interest. For example, a gamified design of robot programming could improve student motivation and interest, successfully influencing children to play again (Heljakka et al., 2019). Robot programming uses symbolic and/or pictorial commands that require children to navigate the robot's movement and design commands in the appropriate sequence to create a sequence of actions (Pea & Kurland, 1985). To program a robot to move successfully, children need to use the sequential ability to plan what happens when they apply *if, next, before, and repeat* actions, as well as procedural thinking and logical instructions to organize robot movements in sequence (Nam et al., 2019). The ability to sequence is an important early childhood skill that facilitates students to learn about algorithms and understand the world mathematically and scientifically (Kazakoff et al., 2013).

Worldwide, educational policy and curricula have led to a focus on the role of computer education in early childhood development (Manches & Plovman, 2017). In recent years, in our country, more and more have been invested in the development of education in the field of programming and robotics, and therefore in the application of programmable robots in the education of children. The aim of this paper is to indicate the importance of applying robotics in education and the need for further research to determine how programmable robots can be best used for the development of divergent thinking in children in our region.

**Keywords:** play, divergent thinking, creativity, programmable robots, computer literacy

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# The Role of Interior Design in Business Communication

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**Abstract:** Business premises represent the physical location where most business activities take place. As it represents not only a place for work but also a place where business relations and communication are established, this paper will analyze the role of interior design in business communication.

The aim of this paper is to investigate the role and importance of interior design in business communication. An analysis is presented herein that explains how the design and arrangement of the business premises can affect the perception of the company and the interaction with clients and employees. Also, the goal of this paper is to consider how business premises can affect the productivity of employees, brand creation and therefore the future of business. Through the analysis of relevant literature in the field of business communication and interior design, this paper provides an insight into the different ways in which business premises can be used to improve business communication, increase productivity and achieve a competitive advantage in the market.

The methodology used in this paper is an analysis that includes a review and synthesis of relevant scientific and professional sources and works. The data used in this paper were collected from scientific journals, books and other professional publications in the field of business communication, design and arrangement of business premises. These sources have been carefully selected to ensure the quality and relevance of the information. The paper is based on previous research and professional knowledge acquired by experts in the field of business communication and the design of business premises.

**Introduction**

Interior design plays a key role in getting a good first impression of the company. In fact, it represents the visual identity of the company and is an expression of its culture, values and business philosophy. Adequately arranged business premise helps the company make others get a good impression of the company and its services or products.

The physical environment of the workplace, corporate leaders believe, often plays a major role in fostering collaboration between employees, as well as creating a brand that attracts and retains highly talented employees. Taking advantage of ubiquitous communications technology, the open plan design of new workplaces offers a variety of settings, created more through furnishings than architecture, to support the four modes of 21st-century work: collaborate, socialize, learn, and focus. (Andrews, 2017):

Good organization of business premises and their elements, such as lighting, colors, furniture, and other decorative elements, can create a pleasant and productive working environment for employees. On the other hand, a business premise that is poorly organized, messy and inappropriate for work can negatively affect the working atmosphere and productivity of employees, which can lead to poor business results. (Lee, Y.K., & Yoon, Y.S. 2012)

**Research results**

A good interior design of a business premise plays a key role in creating a good atmosphere and affects the emotions and mood of the visitors. In this sense, business premises can serve as a tool for projecting a positive image of the company and its products or services. (Evans, G. 2003).

Communication in the business world is a key element of business. It takes place at different levels, from direct communication with clients and partners to internal communication among employees. Precisely because of this, business premises play a major role in establishing and maintaining communication.

Business premises can facilitate communication in several ways. For example, arranging premises that facilitate interaction can facilitate communication between employees, which can affect productivity and the quality of business processes. (Oseland, N.A. 2014).

In recent years, there has been a shift away from traditional ways of working, such as cubicles and assigned seating, to more progressive designs, such as fully open layouts or hotel arrangements for employees. The rapid emergence of these new work strategies has created an equally rapid increase in conflicting information regarding their effectiveness. One design strategy, open layouts, is regularly at the center of this debate (GNWT, 2012).

According to a 2018 study, employees in organizations with open office spaces are under less stress and are more active than employees in a traditional workplace (Casey M. Lindberg et al., 2018). On the other hand, a Harvard study published the same year shows completely different results. This study found that employees who work in open environments were less likely to engage in face-to-face interaction than their office-based counterparts and more likely to communicate electronically (Bernstein, Turban, 2018).

Business premises can also be used as a marketing tool. For example, companies can use the business premise as a place to present their products and services and organize promotions and other events, which can attract the attention of potential clients and thus create new business opportunities.

The interior design of the business premise is also a reflection of the company's culture. For example, companies that emphasize creativity and innovation may have a business premise that is designed in a way that encourages creativity, with unconventional furniture arrangements, colors and other elements that create a pleasant atmosphere for work. On the other hand, companies that emphasize formality and seriousness may have a business premise that is arranged in a way that reflects that culture, with classic furniture and conservative elements. (Sailer, K., Hense, J.U., Mayr, S.K., & Mandl, H. 2017).

The interior design of a business premise can also be an important element in the development of a company's brand. The business premise can be designed to reflect the company's vision and values, which can help improve brand awareness. For example, companies that emphasize sustainability and ecology may have business premises that are made of recycled materials or have built-in systems to reduce energy consumption. (Thompson, C.J. 2008).

**Concluding considerations**

The interior design of the business premise has a significant role in business communication. It can be a tool for forming a positive opinion about the company, creating a pleasant and productive working atmosphere, facilitating communication with clients and partners, and a reflection of the company's culture, as well as an important element in brand development.

It is important for companies to think about the design and arrangement of their business premises and adapt it to their needs and goals. Quality office interior design can help companies achieve their business goals and develop a successful brand.

In today's business world, where much of the work is done virtually, the business premise can be key in establishing relations with clients and partners to give them a unique experience, which they cannot get online. Therefore, although business is increasingly moving to the virtual world, business premises still play an important role in successful business communication.

In the future, we can expect that business premises will increasingly adapt to new technologies, such as artificial intelligence, virtual and augmented reality, which will enable even better and more efficient business communication.

In the end, we can say that the interior design of the business premise has a significant impact on the success of the company and its reputation. Companies should invest in quality design and arrangement of their space in order to achieve a competitive advantage in the market and make a great impression.

**Keywords:** business premise, business communication, interior design, functionality, aesthetics, branding, clients, employees, productivity, technology

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# The impact of the ProjectLibre tool used in the course Project Management on exam results

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**Introduction**

The aim of the paper is to determine the connection between the use of tools in teaching and the understanding of the material that students should master in the course Project Management. A large number of authors are engaged in research and improvement of learning methods [Hattie, 2008; Marzano et al., 2001; Robinson, 2011; Parsloe, 2009; Hattie, Yates 2013], as well as in the research on the importance of using technology in order to improve the learning process [Gudanescu, 2010; Hamidi et al 2011; Hawkridge, 2022; Kadiyala, Crynes, 2000]. If we narrow the field of study to project management, there are a large number of authors who emphasize the importance of using available tools for a better understanding of project management issues [Fabac et all, 2010; Raz, Michael, 2001; Vasic et al., 2011; Arora 2019]. This paper determines whether there is a connection between using the ProjecLibre tool and students' mastery of theoretical knowledge that is not found in that tool.

**Research method**

The research was conducted at Information Technology School. The respondents were third-year students studying Project Management.

During the theoretical classes, all students attended the same lectures, and they were not sent any materials after the lectures. The students were not told that after completing the research, they will be required to take a test that only includes questions from the lectures.

During the exercises, students learned how to develop projects through a large number of examples, and were trained to work with the ProjectLibre tool. After that, they received precise instructions for creating an independent project, with precisely determined elements that the project must contain. Each project is checked by the subject professor. After the completed projects, the students were divided into two groups, one group was finished with the research and the other group voluntarily accepted to enter the completed project into the ProjecLIbre tool.

After 2 days, the students were invited to hear the results of the research, and then they were given a test that only included questions from theoretical classes. The test contained 20 questions, 10 open-ended and 10 closed-ended. Students had 45 minutes available to do the test.

**Research results**

The research results are shown in Table 1, as well as Figures 1 and 2.

| | Students who used the ProjecLibre tool | Students who didn't use the ProjecLibre tool |
|---|---|---|
| The average grade on the test | **7.4** | **5.8** |
| The average number of correct answers to open-ended questions | **6.9** | **4.2** |
| The average number of correct answers to closed-ended questions | **7** | **6.7** |
| The percentage of respondents who passed the exam (%) | **100** | **70** |
| Number of candidates who got grade 5 (%) | / | **30** |

| | | |
|---|---|---|
| Number of candidates who got grade 6 (%) | **10** | **60** |
| Number of candidates who got grade 7 (%) | **40** | **10** |
| Number of candidates who got grade 8 (%) | **50** | / |
| Number of candidates who got grade 9 (%) | / | / |
| Number of candidates who got grade 10 (%) | / | / |

Table 1. Presentation of test results

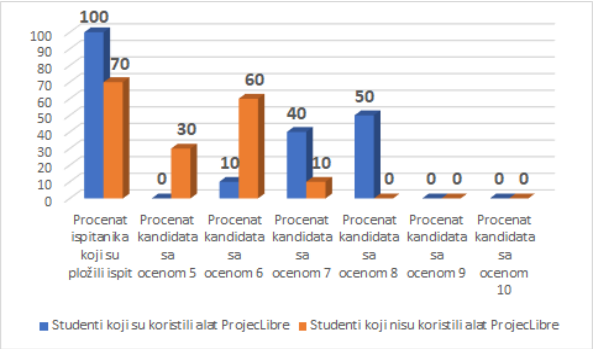


Figure 1. Presentation of students' test results

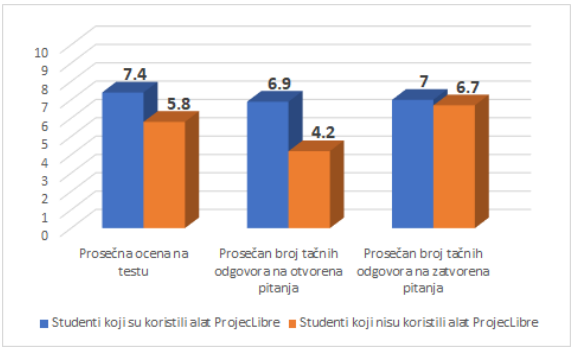


Figure 2. Distribution of student grades on the test

**Discussion**

A large number of authors talk about the advantages of using tools in teaching in terms of better preparation of students for the labor market or easier project management. The results of the conducted research show other advantages of introducing the tool into the teaching process: students who additionally used the tool to design their project have better results in the theoretical part of the exam compared to students who did not use the ProjectLibre tool. Based on the presented results, it can be observed that, in addition to the fact that more respondents passed the test, the scores they received on the test were higher for respondents who used the tool compared to respondents who did not. This may further mean that the respondents who used the tool understood and assimilated the material better.

**Limitations**

There are a number of limitations in the research itself. The number of respondents is very small, it has not been established how much the respondents can learn in the class or whether they have the same power of memory. In order to eliminate these limitations, it is necessary to increase the number of respondents, test potential respondents, and select respondents with the same ability to remember information that they hear once.

**Keywords:** ProjectLIbre, project management, teaching improvement, teaching tools, learning methods

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# Many Facets of Football Sustained by Innovative Technology

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**Abstract**

Football and IT are two different industries with huge potential to shake hands in their strive for performance and profit. The most known technologies adopted by football managers and marketers such as Digital Billboard Replacement, Goal Line Assistant, SOAT, and VAR are currently empowered by Artificial Intelligence (AI), Machine Learning (ML), and Extended Reality (XR). This paper aims to find out more about their applicability in real life to analyze their efficiency and future impact on the economy. As a research method, we used the PRISMA methodology and analyzed the scientific literature. We all associate football with rich people and enormous sums spent on players, even in sports bets. But another surprising face of football is that it helped thousands of people to save their life, career, and families as one may observe during World Homeless Cup Event. The huge sponsorships made by rich footballers in noble causes and corporate responsibility activities are different facets that prove the role of football in reaching Sustainable Development Goals. The results of this research raise many questions that I invite you to answer together.

**Keywords**: Football, Digital Billboard Replacement, Goal Line Assistant, AI, ML, XR, World Homeless Cup

**Introduction**

It is true! Football, also known as soccer in some countries, has become a global phenomenon, and innovative technology has played a significant role in enhancing the sport's various facets. Football, which has long ceased to be just a sport, but a real industry, began some years ago to resort to the latest technological discoveries to improve the training process and to make an objective analysis of the evolution of its team, but also of the opposing team.

If some time ago the coach resorted to the technical sheets to watch the matches or to obtain empirical data on the state of health and physiological parameters, in current football, the discoveries in the field of technology, adapted to the needs of the football field, make this information to be obtained directly and objectively.

Innovative technology has significantly improved various aspects of football, from the accuracy of decisions made by officials to the fan experience. As technology continues to evolve, we can expect to see even more advancements that will enhance the sport further. There are several ways in which digital billboard replacement, AI, ML, XR, World Homeless Cup, sponsorships, and Sustainable Development Goals (SDGs) can intersect and impact each other. Here are some potential scenarios:

- **Digital Billboard Replacement** – With the increasing use of digital billboards, companies can leverage AI and ML algorithms to create targeted ads based on real-time data, such as weather conditions or traffic patterns. By using XR technology, these ads can be made more interactive and engaging, providing a better experience for viewers. Additionally, companies can use these technologies to track the effectiveness of their ads and adjust them in real-time to improve their performance.
- **World Homeless Cup** – The World Homeless Cup event is an international football tournament that aims to raise awareness about homelessness and social exclusion. Companies can sponsor this event and use it as a platform to promote their social responsibility initiatives and align with SDGs, such as No Poverty, Zero Hunger, and Good Health and Well-being. By using AI and ML algorithms, companies can analyze the data generated by the event, such as the number of attendees and social media mentions, to measure the impact of their sponsorship and make data-driven decisions for future events (Olszewski, 2021; Lindsey, 2019; Da Rocha, 2022).
- **Sustainable Development Goals** – Companies can use AI and ML algorithms to develop sustainable solutions that align with the SDGs. For example, by using predictive analytics, companies can optimize their supply chains to reduce waste and improve efficiency, contributing to SDG 12: Responsible Consumption and Production. Additionally, companies can use XR technology to create immersive experiences that educate consumers about the SDGs and inspire them to take action.

- **Corporate Responsibility** – football, like any other professional sport, has a significant impact on society and the environment, and as such, football clubs have a corporate responsibility to operate in a socially and environmentally responsible manner. Corporate responsibility in football can take many forms, including promoting diversity and inclusion, investing in community initiatives, reducing the environmental impact of operations, and ensuring the fair treatment of employees and other stakeholders. One example of corporate responsibility in football is the "Football for Good" initiative, launched by the UEFA Foundation for Children. This program aims to promote social change and create opportunities for disadvantaged young people through football-related projects. Additionally, many football clubs have implemented sustainability initiatives to reduce their carbon footprint and promote environmental stewardship.
For example, some clubs have installed renewable energy systems, implemented waste reduction and recycling programs, and invested in energy-efficient stadium designs. Finally, corporate responsibility in football also involves ensuring fair treatment and equal opportunities for all employees, including players, coaches, and support staff. This includes promoting diversity and inclusion and ensuring fair compensation and working conditions. (Mura, 2020; Lauren, 2018).

Going to the area of concrete we can say that technology goes step by step with football in the following situations:

- Catapult monitoring and training – During the **training** process, the footballers are monitored by different systems/software that present objective and direct information for certain physiological parameters, statistical data on the total distance traveled, how many accelerations or decelerations, technical-tactical data, statistical data on the activity during the preparation process, but also analysis on the match in which they participated. In Romania, most coaches and physical trainers use the Catapult system, a system for monitoring the effort, and the parameters that are recorded during training. Football Catapult training refers to the use of wearable technology and data analysis to track and improve the physical performance of football players. Catapult is a company that produces wearable devices that can track various metrics related to player performance, such as speed, distance, acceleration, and deceleration (Boyd, 2011; Haller, 2019). Catapult training involves players wearing small sensors that are attached to their bodies during training and games. These sensors collect data on a range of physical metrics, which are then analyzed using machine learning algorithms to provide insights into player performance and identify areas for improvement. Catapult training can be used to monitor the workload of players, track injury risk, and optimize training programs to improve performance. For example, coaches can use the data collected by Catapult sensors to adjust training sessions and ensure that players are not overworked or at risk of injury. They can also use the data to identify individual player strengths and weaknesses and tailor training programs accordingly (Wellman, 2019).
- **Football XR training** – refers to the use of virtual and augmented reality technologies to enhance the training and development of football players. XR, which stands for "extended reality", is a term that encompasses both virtual reality (VR) and augmented reality (AR) technologies. Football XR training allows players to simulate game situations, practice decision-making skills, and improve their technique in a safe and controlled environment. It also provides coaches with new tools for analyzing and monitoring player performance. VR technology can provide a fully immersive experience for players, allowing them to feel like they are actually on the field. This can be particularly useful for practicing tactics, set pieces, and ball control in a realistic environment. AR, on the other hand, can be used to provide players with real-time feedback and instructions during training sessions. Football XR training is an innovative approach to football training that has the potential to improve player performance and enhance the development of young talent (Choi, 2022; Țoniș, 2022).
- The great support of the technology comes in the area of official matches, matches in which referees are assisted by the new **VAR** technology, which FIFA supports to make the most correct decisions possible, dispelling any doubt in the correctness of the decision made. In this sense, systems such as Goal Line Assistant, SOAT (offside technology), or VAR (Video Assistant Referee). The introduction of VAR has revolutionized football by providing referees with a better view of critical moments in a game, such as penalty decisions and offside calls. This technology has significantly reduced errors made by officials and has led to more accurate decisions (Das, 2022; Winand, 2021).
- **Goal-line Technology (GLT)** – GLT is another innovative technology that has been introduced in football to determine whether the ball has crossed the goal line or not. This technology uses cameras and sensors to provide accurate decisions, and it has helped to eliminate controversial goals.
- **Wearable Technology** – football players now wear various types of wearable technology, including GPS trackers and heart rate monitors, during training and games. This technology helps coaches and medical staff monitor the players' fitness levels, track their movements on the field, and identify any potential health issues (Wellman, 2019).
- **Virtual and Augmented Reality** – virtual and augmented reality technologies are being used to enhance the fan experience and provide immersive experiences.

For example, fans can now use VR headsets to get a 360-degree view of the stadium, watch replays from different angles, and experience the game in a more interactive way (Choi, 2022, Țoniș, 2022).

- Marketing is the biggest beneficiary of the digital age by creating strategies for development and loyalty by using all media channels and social networks and maintaining a close relationship with supporters. Advertising performs an adaptation (language, content) depending on the country where the event is broadcast. This is possible thanks to Digital Billboard Replacement technology.
- **Football strategy based on AI and ML** – football strategy is a complex and dynamic field that involves multiple variables and factors, such as player positions, opponent team formations, weather conditions, and more. Machine Learning and Artificial Intelligence can be used to analyze vast amounts of data and provide insights to help coaches and players make better decisions (Knoll, 2020; Țoniș, 2022).
- One common application of AI and ML in football strategy is in player tracking and analysis. By using computer vision and machine learning algorithms, coaches can track individual player movements and behaviors during training and games, and use this data to optimize team strategies and tactics (Scott, 2021).
- Another area where AI and ML can be applied is in-game simulations and predictive analytics. By analyzing data from past games and using machine learning algorithms to identify patterns and trends, coaches and analysts can create simulations that can help them test and refine different game strategies.
- **Blockchain technology** – has the potential to transform the way football fans interact with their favorite teams, players, and each other. Here are a few ways that blockchain could be applied to the football fan experience (Kuleto, 2022):
- **Ticketing**: Blockchain-based ticketing systems could eliminate issues with ticket fraud and scalping. Each ticket would be unique and tamper-proof, and ownership could be easily transferred between individuals.
- **Merchandise**: Blockchain could be used to authenticate and track the ownership of football merchandise, such as jerseys and collectables. This would ensure that fans are getting genuine products, and could also create new revenue streams for teams and players.
- **Fan engagement**: Blockchain-based platforms could create new ways for fans to engage with their favorite teams and players, such as virtual meet-and-greets and voting on team decisions. This could create a more direct and democratic relationship between fans and their football clubs (Winand, 2021).
- **Fantasy football:** Blockchain could be used to create decentralized fantasy football platforms, where fans can trade players and compete against each other in a secure and transparent way.
- **Football bet AI** – refers to the use of Artificial Intelligence (AI) to assist in making predictions and decisions related to football betting. The goal of football bet AI is to use data analysis and machine learning algorithms to generate accurate predictions and increase the chances of winning bets. AI algorithms can analyze large amounts of historical data, such as team performance, player statistics, and weather conditions, to identify patterns and trends. These algorithms can then use this data to make predictions about the outcome of football matches. In addition to predicting match outcomes, football bet AI can also be used to optimize betting strategies. For example, AI algorithms can analyze the odds offered by different bookmakers and identify opportunities for arbitrage, where a bettor can make a profit by betting on all possible outcomes of a match (Knoll, 2020; Yanmaz, 2020; Da Costa, 2022).

The arguments regarding the digitalization of football can continue, which leads us to consider that the digital age is increasingly invading the king sport, football, with positive effects.

**Conclusion**

In a nutshell, the intersection of Digital Billboard Replacement, AI, ML, XR, World Homeless Cup, sponsorships, and SDGs offers exciting opportunities for companies to create innovative solutions that address social and environmental challenges while promoting their brand and driving business growth.

Catapult training is a valuable tool for football coaches and players looking to improve physical performance and reduce the risk of injury. By collecting and analyzing data on player performance, coaches can make informed decisions and optimize training programs to help players reach their full potential on the pitch. Football XR training is an innovative approach to football training that has the potential to improve player performance and enhance the development of young talent.
AI and ML have the potential to revolutionize football strategy by providing coaches and players with real-time insights and data-driven decision-making tools. However, it's important to note that AI and ML are only tools, and human expertise and experience are still crucial in developing effective football strategies.

Blockchain technology has the potential to create new levels of transparency, security, and engagement in the football fan experience. However, it's important to note that these applications are still in the early stages of development, and it may take some time before they become mainstream.
Football bet AI has the potential to improve the accuracy of predictions and increase the profitability of football betting. However, it is important to note that no algorithm can guarantee a win, and human judgment and decision-making are still crucial for successful betting.
Corporate responsibility in football is essential for ensuring the long-term sustainability of the sport and its positive impact on society and the environment.

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# Application of Robots in English Language Teaching

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**Abstract:**

We live in an age where it is almost impossible to imagine life without technology. In the last few years, technology has moved into classrooms and it allows us to acquire knowledge very quickly. One of the more recent innovations that is still underresearched and is attracting enormous attention is the use of robots in teaching.

The application of robots in teaching English is a special challenge because it enables activities that include speaking, listening and reading exercises, as well as grammar exercises, and thus enables all four phases of language acquisition. As this area is insufficiently researched and not all English language teachers have the opportunity to use robots in their classes, in this paper we deal with the application of robots in English language teaching. The aim of this paper is to analyze the effectiveness of the use of robots in learning English and to point out the advantages and disadvantages of robotics in education.

Including robots as assistants in English language teaching has become increasingly popular over the past few years. A robot as a teaching assistant can help students develop their creativity, become more interested in language learning and develop their skills. The most important factor affecting the effectiveness of robots in teaching English is their ability to adapt to the individual needs of each student, different levels of knowledge, interests and learning styles (Benchak, 2018).

The work methodology of this paper is based on the analysis and systematic reading of published works dealing with this topic. First, a search of appropriate databases was conducted as well as a literature search with engines such as Google Scholar using the keywords "robot-assisted language learning", "robots in teaching English", and "technology in teaching English". Then the papers were selected in accordance with the inclusion and exclusion criteria defined for this research. An analysis was then carried out through the reading of selected papers in order to extract relevant data on the use of robots in English language teaching, as well as critical consideration and synthesis of the collected data. The collected data were used to investigate the effectiveness of the use of robots in English language teaching with a focus on challenges and shortcomings.

Finally, based on the synthesis of the collected data, a paper was written that analyzes the research that dealt with the mentioned topic. This research aims to examine the effectiveness of robots in primary and secondary schools. The elements that were examined were the improvement of reading, pronunciation, writing, grammar, listening skills and the acquisition of new vocabulary. Also, motivation, anxiety and self-confidence when speaking in English were examined.

According to research, improvements in overall speaking skills have been observed in students who are at the elementary level of learning English, but also in students who are at a higher or intermediate level of learning. Speaking ability was measured through assessment of pronunciation, grammar, vocabulary and communicative ability. Also, although it is believed that robots can help improve reading skills, the results show that the same progress can be achieved with the teacher or with other technologies (Randal, 2019). The impact of the use of robots in grammar learning is insufficiently investigated. One research that examines the influence of robots on improving grammar, brings the result that students of both intermediate and elementary levels of learning showed a significant improvement, but the advantage of robots in relation to other technologies in this area has not yet been tested (Lee, 2017). Regarding the improvement in pronunciation, several analyzed studies prove that the improvements were evident and that the students were motivated to repeat the words of the robot in the same way. Research results indicate that improvements in students' attention span, motivation and self-confidence are noticeable after interacting with robots.

Through this research, we also obtained the data that the disadvantages of using robots in the classroom are noticeable, that is, students may be too focused on the conversation with the robot, and not on each other. In addition, if the robots are not well calibrated, they can be imprecise when pronouncing and recognizing given words.

As shown through the presented results, the use of robots in the teaching process of learning English leads to the improvement of speaking skills, listening skills, motivation in learning and easier acquisition of new words. However, research on improving reading comprehension and grammar is not consistent enough (Randal, 2019).

One of the challenges of applying robots in English language teaching is RALL – Robot Assisted Language Learning which includes a robot as a teacher's assistant. Some of the research we have analyzed show that sometimes robots are focused only on technology and that pedagogy is neglected, which encourages student absenteeism (Randal, 2019).

In addition, there are other challenges such as designing long-term interactions, reducing costs to make robots available to teachers and of course, training teachers and users who do not have the appropriate technical knowledge to use them (Benchak, 2018).

Although there are various challenges, the use of robots in English language teaching has a great possibility to bring something new and different to our classrooms and thus make learning more interesting and effective. Further research and involvement of foreign language teachers in robotics education are needed so that teaching using robots can be implemented.

In conclusion, the application of robots in English language teaching brings us numerous benefits in the learning process. It provides students with hands-on experiences while developing different skills. The presence of robots in teaching also has its drawbacks, like any other educational process. However, the most important thing is to find a balance between traditional teaching and the use of new technologies in the classroom so that our students are prepared for all future successes and challenges.

**Keywords:** robotics, education, technology, English language, RALL

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# New Perspectives in Education and the Video Game Industry: Implementing VR, AI, and AR Technologies

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**Abstract:**

After the technological breakthrough mainly achieved by Western countries and Japan, the video game industry has shown rapid and remarkable progress. Today, it represents a large entertainment industry with a high market share. From the moment Facebook changed its name to Meta, and Microsoft announced the purchase of Activision Blizzard, the relevant role that video games play in modern society and economy, and therefore the aspects of investing in the video game industry, came to the fore. Thanks to the constant advancement of technology, it is expected that the video game market will continue to grow and that new types of games will appear that will be even more advanced and interactive. This has also led to the development of the research field of the application of modern technology in video games, which allow games to become more interesting, exciting and smarter, with the aim of providing an immersive experience to the player who has become increasingly demanding in terms of interactivity, realism and automation of video games.

Technologies of Virtual Reality (VR), Augmented Reality (AR) and Artificial Intelligence (AI) find wide use in the video game industry. VR and AR enable the creation of interactive and realistic virtual environments, while AI is used to enhance the learning process and create intelligent features of the player's opponents in video games. Video games imply a large number of possible combinations of factors in the game (Vast State Space), that is, a huge number of different possible states that the player can achieve depending on their position, the position of the enemy, available weapons, and other factors. The large spatial dimension of the game is a challenge for developing intelligent algorithms. In order to create a believable game experience and provide an immersive experience, it is necessary for AI algorithms to be able to deal with this large number of possible combinations so that they can make optimal decisions or solve a specific problem according to the situation they are in in real-time (Yannakakis, Togelius, 2018). In addition, video games often involve a dynamic, interactive environment in which the player is constantly moving, so they are an ideal testing ground for VR and AR technologies that allow players to easily move into the virtual world and gain experiences that are realistic and believable, which further enhances their immersion in the game. Video games are an ideal field for studying, testing and evaluating AI, VR and AR technologies due to their properties that make them challenging and complex to program (Camps-Ortueta et al., 2021).

The research is divided into two main parts. The first part refers to the theoretical research of the application of artificial intelligence, virtual and augmented reality in video games. The research is focused on the field of application, the goals to be achieved, the advantages of modern technologies and the potential of their future development, as well as the impact on education, the learning process and the creation of new and innovative experiences in the video game industry. In addition, the research also focuses on the potential dark sides of the application of the mentioned technologies, such as the current problem of AI plagiarism in the domain of 2D and 3D graphics, the question of whether AI will be able to independently create video games without the human factor, which could lead to loss of jobs in the game development industry, then the possibility of disconnection from reality and the environment due to complete immersion in the game and realistic experience due to improved interaction with the game and characters in it, potential problems with security and privacy, etc. The methods used in this part of the research include qualitative research of relevant literature and previous research mainly available through Google Scholar, examples from video game development practices, as well as a survey conducted among students, educators and gamers.

In the second part of the research which focused on the application of AI technology, AR and VR, the researchers tested the closed beta version of the Wonder Studio application. The experimental research in this part was focused on the advantages and potential of applying these technologies in the teaching of the Game Art module at the Faculty of Contemporary Arts (FCA). This app allows students to create interactive animations and explore virtual worlds using AI analysis of movements, facial expressions and voice. Also, students have the possibility to further process colors and video in order to achieve the desired visual impression.

The implementation of AI technology, AR and VR in the classroom provides students with the opportunity to immerse themselves in simulated environments and actively participate in the learning process. By using VR technology, students can explore virtual worlds, perform tasks and simulate real scenarios, which contributes to their understanding and application of the concepts studied at the university. Also, the use of AR technology enables the creation of interactive teaching materials, where students can visualize abstract concepts and real applications in a real environment. Although these technologies are still developing, the beta version of the application provides insight into their capabilities and potential in student education. However, there are several challenges that may arise in their implementation, such as access to equipment and adaptation of curricula. Also, further research and support are needed in the application of these technologies in the educational environment in order to ensure their effective and sustainable use.

The combination of the mentioned scientific methods can provide a diverse insight into this topic and provide insight into various aspects of the application of VR, AI and AR technologies in education and the gaming industry, with a focus on the impact on learning and user experience. The research highlights the potential of applying modern technology in improving education in the field of video game art and also points to the challenges in applying these technologies in practice.

**Keywords:** virtual reality, augmented reality, artificial intelligence, education, educational technologies, video games, gaming industry, interactivity

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# Logical Database Design Using a Life Cycle Approach

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**Abstract:** In order to maintain their competitiveness, or to reach the desired position in a dynamic market environment, companies use information, i.e. software systems, to support the implementation of their business processes. While the information system represents a model of the real system, the database, as its central part, represents the state of the real system. Therefore, the basis of the information system is a well-designed database, because it represents the fundamental, stable characteristics of a real system, the objects in the system, their attributes and their mutual connections. That's why the database should be a good model of the state of the real system. In order for the database to faithfully represent the state of the real system, and for any information needed to manage business processes, even those unforeseen in advance, to be obtained from the information system, i.e. database, it must be carefully designed. Designing such a database is a challenge, both in theory and in practice.

In this paper, an approach to database design based on its life cycle is proposed. [1] This methodological approach requires a precise definition of the life cycle of the database, so the design, implementation and maintenance of the system are carried out in accordance with the phases of this life cycle. Since the development cycles of such systems can take a long time, the approach enables the division of work into time phases, the selection of methods and tools adapted to the phase, as well as the assignment of the implementation of the phase to competent participants. The basic phases of the database life cycle are the following: business domain analysis and requirements specification, logical design, physical design and implementation.

The goal of this paper is the selection of appropriate methods and models for the implementation of logical database design based on the verbal requirements specification obtained from the first phase of the life cycle. The basic research hypothesis is that it is possible to apply selected techniques, methods and models in the phase of logical database design for non-trivial business domains, in an approach based on the database life cycle, and as a result, obtain a well-designed database. The illustration of the application of the selected methods and models, as well as the confirmation of the basic hypothesis, was carried out on the example of the business domain of the publishing house, limiting itself to its main functions, circulation and sale of products.

In the logical design phase, a conceptual data model is developed using, most often, the ERM technique (Entity-Relationship Model) or UML (Unified Modeling Language) class diagram. [2] In this paper, a semantically rich version of ERM, the so-called extended ERM (EER – Extended Entity-Relationship Model). [2, 3] EER is an intellectual tool with rich semantic concepts that enable the use of basic abstraction mechanisms in data modeling – classification, generalization and aggregation. A conceptual model expressed in some semantically rich data model must be translated into a logical implementation model. For the implementation, the relational data model (RM) was chosen, which is the most used in the domain of business applications. For EER, there are precise rules for translation into RM, which enable the translation of the structure and limitations of the system. [3]

The logical design phase directly uses the results of the previous life cycle phase – business domain analysis and requirements specification. Communicating the results of the business domain analysis and requirements specification in the form of a verbal description using structured text in natural language (the Serbian language was used in this paper) enables easier communication with business experts and direct use of business documents and procedures. In the analysis phase of the business domain, in order to overcome its complexity, the system decomposition technique was used, and thus business subsystems were identified and specified. The result of this phase in the context of the chosen business domain is the verbal specification of the following subsystems: joint business entities, circulation planning, generation of product numbers and circulation, and invoicing of shipped products.

Given this form of the results of the first phase, in the next phase, the logical design phase, sub-models (views, subsystems) were created at the conceptual level. [2] In doing so, the method of direct modeling was used based on the verbal model of business subsystems. Creating certain segments of the data model presented a certain challenge. In those cases, the method of creating a conceptual model based on design patterns was also used. [2] In this context, the design patterns represented confirmed good solutions for modeling specific segments of the business system.

On the conceptual sub-models, the business entities identified in the first phase, using the classification abstraction mechanism, are formally represented through the concepts of EER entities and attributes. Relationships between business entities, using the generalization and aggregation abstraction mechanisms, are represented through the concepts of links and mappings. Existential and identification dependencies between certain business entities are modeled using the concept of a weak entity type. After the creation of the EER sub-model, an integrated conceptual model was created that is consistent with the previously developed sub-models.

Based on the submodel and the integrated conceptual model, a relational model was created with defined primary and external keys of relations. In doing so, the basic principles and rules of translating EER into RM were used. [2,3] The rules were applied flexibly with the selection of options that will enable easier physical design, implementation and use of the database later.

The results of the research presented in this paper confirmed the hypothesis that the selection of appropriate techniques and tools, with the application of adequate methods, in the logical database design phase, with an approach based on the life cycle, results in a well-designed database. In this way, the logically designed database faithfully represents the state of the real system, but it also enables the storage of historical data. Thanks to this, prerequisites were created for adequate physical database design, including its optimization, in the later phases of the life cycle. [4, 5] Also, the approach presented in the paper enables the development of applications based on such a database project, which will support existing, as well as future, optimized business processes in a real system. This will contribute to business systems maintaining their competitiveness, i.e. reaching the desired position in a dynamic market environment.

The developed data models, using EER with semantically rich concepts, represent the specification of the structure and basic structural constraints of the real system. Complex value constraints and dynamic data model integrity rules were not specifically covered in the paper. [2] These characteristics must certainly be implemented in the following phases of the database's life cycle, as well as in the development of software systems based on this database. The specification of complex value constraints and business rules, by means of techniques and methods, used in this work in the phase of logical design of the database represents a plan for further work.

**Keywords:** database, life cycle, logical design, conceptual model, EER, relational model

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# Exploring the potential of new AI-enabled MCU/SOC systems with integrated NPU/GPU accelerators for disconnected Edge computing applications: towards cognitive SNN Neuromorphic computing

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**Abstract:** This paper presents an analysis of the benefits of the new generation of AI-accelerated MCU/SOC systems primarily intended for decentralized AIoT and IIoT Edge computing applications. The analysis considers the advantages of implementing such systems in general applications and with an adequate architecture. Special emphasis is given to computing solutions that utilize hardware-implemented NPU/KPU coprocessors to accelerate the processing of ANN/CNN neural networks and other machine learning algorithms. Such systems can be used on-site, where the processing of critical data sets in real-time and making appropriate decisions is essential to the implemented solution.

The paper conducted research on several MCU/SOC systems designed for AIoT and IoT Edge computing, utilizing appropriate AI ANN models. The research involved benchmarking their performance in AI-related applications and comparing them to other similar solutions currently available in the market. The results clearly highlight the enormous potential of the proposed architecture concept, which emphasizes the usability of disconnected AI Edge computing. The paper also discusses the possibilities of using new MCUs/SOCs based on new neuromorphic design concepts in current Edge computing scenarios. These new concepts are based on a new architecture that is much closer to the latest scientific knowledge of the function of living neural cells. As a result, with a much smaller energy footprint, they are expected to achieve much higher performance and build more complex AI systems.

The possibilities for the application of architecture based on new neurosynaptic/neuromorphic SOC/MCU designs in the field of application for Disconnected Edge computing critical applications in real-time are analyzed in this paper.

**Keywords:** IoT, AIoT, Artificial Intelligence of Things, Edge Computing, IoT Edge Gateway, Neural Networks, CNN – Convolutional Neural Networks, Neural networks coprocessor, Kendryte K210, Kendryte K510, machine learning, Disconnected Edge computing, Neurosynaptic AI, SNN – Spiking neural networks, Neuromorphic architecture, Cognitive computer

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# Definition and Extraction of Mel-Frequency Cepstral Coefficients from Audio Signals for Machine Learning using Python's library Librosa

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**Abstract:** Sound and speech recognition are very important and sometimes critical components of today's applications in industry, science, and other fields. The purpose of this paper is to analyze and present one of the most popular procedures and methods for extracting sound characteristics from audio signals. These sound features are very important for audio analysis as they are used as the basis for further procedures and algorithms. Our article examines and demonstrates this process using Python and its open-source library Librosa. Extracted Mel-Frequency Cepstral Coefficients (MFCCs) have properties that are helping specialized mathematical and machine learning models to work with efficiency and accuracy very close to human perception of hearing sound. They are performing well in terms of error reduction and in noise environments. Machine learning models and other applications can be built on top of these extracted sound features as datasets. The performance of machine learning models directly depends on the number and quality of extracted sound features.

**Keywords:** MFCCs, Sound Recognition, Machine Learning, Python, Librosa

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# Navigating the Financial Landscape: Challenges and Opportunities in Funding, Investment, and Revenue Generation for Creative Industries

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**Abstract:** Creative industries represent a crucial factor in contemporary economies, providing a wide range of business opportunities and contributing significantly to economic growth. This paper aims to explore the financial aspects of creative industries, focusing on the challenges and opportunities in funding, investment, and revenue generation. The study has employed the IMRAD model (Introduction, Methods, Results, and Discussion) to present a comprehensive analysis of the financial landscape in creative industries. It further discusses the role of government and private sector support, as well as the implications of financial policies for the growth and development of these industries.

## Introduction

Creative industries, encompassing fields such as arts, design, media, and entertainment, have been experiencing rapid growth over the last few decades (UNCTAD, 2018). Their economic impact and potential for employment generation have gained significant attention from policymakers, investors, and academics. However, the financial aspect of these industries remains an understudied area (Eikhof & Haunschild, 2006). This article aims to explore the financial landscape of creative industries, focusing on the challenges and opportunities related to funding, investment, and revenue generation.

## Methods

The study utilizes a systematic literature review approach to analyze existing research on finance in creative industries. The literature review focuses on articles and reports published between 2010 and 2021. Key databases, such as Web of Science, Scopus, and Google Scholar, were used to identify relevant studies. The search terms included combinations of "creative industries", "finance", "funding", "investment", and "revenue generation". The selection criteria for the inclusion of studies in the review were: (1) empirical research or case studies focused on the financial aspects of creative industries, (2) published in English, and (3) available in full text.

## Results

The literature review identified several challenges and opportunities related to finance in creative industries. Key findings are summarized below.

### 3.1. Funding Challenges

Creative industries face several funding challenges, including limited access to traditional bank loans (Oakley & O'Connor, 2015), the high-risk nature of creative projects (Banks & Hesmondhalgh, 2009), and the intangible nature of intellectual property (Caves, 2000). These factors contribute to a "finance gap" that may hinder the growth and development of creative businesses (Bakhshi et al., 2017).

### 3.2. Alternative Funding Sources

In response to these challenges, creative industries have turned to alternative funding sources, such as crowdfunding (Gerber et al., 2012), venture capital (Florida & Kenney, 1988), and public funding schemes (Matarasso & Landry, 1999). These alternative sources of finance offer opportunities for creative businesses to access the capital required to grow and innovate.

3.3. Revenue Generation

Creative industries generate revenue through a diverse range of channels, including direct sales, licensing, merchandising, and advertising. However, the digitalization of creative content has disrupted traditional revenue models and raised concerns about piracy and the devaluation of creative products.

**Discussion**

The findings of this study highlight the complex financial landscape of creative industries. Government and private sector support play a crucial role in addressing the finance gap and fostering the growth of these industries. Policymakers should consider targeted financial instruments, such as tax incentives, grants, and low-interest loans, to support creative businesses (Oakley & O'Connor, 2015). Additionally, creative entrepreneurs need to develop financial literacy and business skills to navigate the financial challenges and opportunities in their industry (Bridgstock, 2011).

Furthermore, the digital transformation of creative industries offers both challenges and opportunities for revenue generation. Policymakers and industry stakeholders should collaborate to develop strategies and policies that protect intellectual property rights and foster fair revenue-sharing models. In this context, the adoption of emerging technologies, such as blockchain and smart contracts, could potentially enhance transparency and trust in the creative industries' financial transactions.

Finally, this study has some limitations. The systematic literature review approach may have excluded relevant studies not indexed in the selected databases or not published in English. Future research could expand the scope of the literature review to include studies from different regions and languages. Additionally, further empirical research, particularly in the form of case studies or longitudinal studies, could provide deeper insights into the financial dynamics of specific creative industries and their implications for economic growth and development.

The results of this study offer valuable insights for policymakers, investors, and creative entrepreneurs. For policymakers, the findings emphasize the need for targeted financial support mechanisms that can address the unique challenges faced by creative industries. This support can take the form of grants, low-interest loans, tax incentives, and specialized incubators that provide both financial and non-financial assistance to creative businesses (Oakley & O'Connor, 2015).

For investors, the study highlights the potential of alternative funding sources, such as venture capital and crowdfunding, in financing creative projects. These funding sources can help bridge the finance gap faced by creative industries and facilitate innovation and growth (Gerber et al., 2012). However, investors need to be aware of the high-risk nature of creative projects and adopt appropriate risk management strategies (Banks & Hesmondhalgh, 2009).

Creative entrepreneurs, on the other hand, can benefit from the study by understanding the financial landscape of their industry and developing relevant financial and business skills. This can help them in identifying and securing appropriate funding sources and revenue-generation channels for their businesses (Bridgstock, 2011). Moreover, creative entrepreneurs should be proactive in engaging with policymakers and industry stakeholders to advocate for supportive financial policies and a fair digital ecosystem that protects their intellectual property rights and ensures sustainable revenue streams (Benghozi & Paris, 2013).

In conclusion, the financial landscape of creative industries is complex and dynamic, offering both challenges and opportunities for funding, investment, and revenue generation. By understanding these intricacies and working collaboratively, policymakers, investors, and creative entrepreneurs can contribute to the growth and development of creative industries, ultimately fostering economic growth and job creation.

**Conclusion**

This article has provided an overview of the financial landscape in creative industries, highlighting the challenges and opportunities related to funding, investment, and revenue generation. The findings underscore the importance of government and private sector support in addressing the financial gap and fostering the growth of creative businesses. Moreover, the digital transformation of creative industries calls for collaborative efforts from policymakers and industry stakeholders to develop strategies and policies that protect intellectual property rights and foster fair revenue-sharing models. Further research is needed to expand our understanding of the financial aspects of creative industries and their implications for economic growth and development.

**Keywords**: creative industries, finance, funding, investment, revenue generation, economic growth

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# Xamarin Platform – Development of cross-platform C# apps for mobile devices

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**Abstract:** This paper focuses on a brief comparison of different operating systems for mobile devices and their characteristics, that is, specifics in programming mobile apps. Xamarin is a platform that offers a comprehensive approach to app development for all mobile environments. Xamarin.Forms is a good example of how it is possible to easily design apps with a single shared codebase written in the C# programming language while having little or no obstacles to using such an app on multiple platforms (Android, iOS, Windows Mobile).

**Keywords:** Android, iOS, WindowsMobile, Xamarin, Xamarin.Forms, C#, XAML

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# Analysis of Employee Competencies and the Role of New Technologies

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**Abstract:** One of the most crucial aspects of corporate management is employee competency. They have an impact on corporate performance and market success, but they also have an impact on how happy an employee is to work for a particular organization. The widespread use of computers in business-to-business communication has fundamentally altered how job hopefuls and employers interact. The development of the Internet, related technologies, and mobile services made it simpler, easier, and ultimately more affordable for both parties to communicate with one another. Candidate databases, social networks, and websites have drastically accelerated the transmission of information while also considerably facilitating their information. A brief review of staff competencies and the significance of new technologies is included in the article.

**Keywords:** competency, corporate management, employee recruiting, new technologies

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# Artificial Intelligence in the More Effective Application of Marketing on Various Multimedia Platforms

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**Abstract:** A growing number of businesses around the world are using artificial intelligence to monitor, process and analyze data collected about customers who make transactions at points of sale or online. By forming a database, it is possible to determine multiple aspects of customer behavior, as well as to predict their needs. The companies that master this, with the lowest degree of statistical errors, are in an excellent market position compared to competitors. The application of learning machines is noticeable in the field of customer relations, integrated marketing activities and operational marketing. The emergence of large language models (LLM) has accelerated the creation of artificial general intelligence, which is expected to perform almost all intellectual processes that are currently the privilege of a human being. Investments in the mentioned areas at the beginning of 2023 are significant, which should accelerate improvement and expand the use of machines not only in marketing but also in all other areas of life and activity.

**Keywords:** Artificial intelligence, integrated marketing activities, multimedia platforms, large language models, ChatGPT

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# Application of Web Design and Advanced Web Design in the work of CMS platforms

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**Abstract:** The role of web design and advanced web design in the work of no-code development platforms is multifaceted and established with the intention of complementing commercial software intended for widespread use, through which users can create visually structured and functional applications and websites. With dynamic and diverse functionalities, these platforms provide a simplified and consistent content management system with possible application of web design and advanced web design in multiple ways. This makes it possible to create functional and modern applications by connecting content, applying filters that are logical, improving visibility, and applying integrations to improve the work of more complex, demanding and powerful applications. This paper highlights the advantage of applying this way of web design and advanced web design synthesis, integrated into the work of platforms that do not require knowledge of programming languages, but offer content management. At the same time, the synergism of the work of the two visual systems that the user uses when creating the mentioned content, unites modern trends and tendencies in the creation of web content. The methodological review and application of the functionality and components of these platforms by users led to their popularity and the importance of the application of these platforms in the field of digital multimedia and modern content management flows in the digital space today.

**Keywords:** web design, advanced web design, content management, CMS

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# The impact of e-business on customers repurchase intention formation in e-commerce

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**Abstract:** The dominant position of e-commerce is especially being articulated in the retailing industry due to several constraints that the world faces in the COVID-19 pandemic era. In this regard, this study explores the significant role of consumers' neurotic traits in the framework of trust-satisfaction-repurchase intention in the e-commerce context based on a survey with 90 Serbian e-commerce consumers. The results of the analysis show that offline-online trust transference occurs in e-commerce, and the conveyed trust significantly influences satisfaction and consumers' repeat purchase intention through satisfaction. Neuroticism also has significant positive effects on trust transfer in e-business. The results show heterogeneous characteristics that considerably differed from the results obtained in other research. The implications of this study will be beneficial to field practitioners in the e-commerce industry in addressing the importance of trust transfer, negative neurotic traits as well as heterogeneous aspects of consumers.

**Keywords**: electronic business, repeat purchase, consumers, e-commerce, neuroticism

**Introduction:** According to Milena Ilić, Valentin Kuleto and Slavko Pokorni (2022), science is the greatest collective undertaking; it generates solutions for everyday life and helps us solve the great mysteries of the universe. It is one of the most important channels of knowledge. According to Seifert et al. (2023), a business that is based on modern digital technology and that enables business transactions to be primarily carried out electronically is called e-business. Radenkovic et al. (2015), presented the detailed possibilities of applying modern information and communication technologies in different spheres of business, as well as the encouragement to find new and innovative ways of doing business. Recently, electronic services distributed via SMS have become popular. Business partners communicate via the Internet, exchange electronic offers, make purchase agreements electronically, sign orders with an electronic signature, send electronic orders for the delivery of ordered goods, make electronic payments, report their purchases to customs, create electronic invoices, etc. The development path of electronic business in Serbia should include, in addition to the development of electronic commerce, the development of electronic business whose subject is service. However, in the future, we can expect more projects whose business orientation will be exclusively services in electronic business. Many users are still not satisfied with the work done by electronic businesses, but they should keep in mind that security can never be absolute and that currently, the security of electronic money is at least equal to or greater than the security of real, paper money. Radenković (2002) states that electronic business enables companies to connect internal and external processes, as well as to perform processes with suppliers and business partners in a more efficient way.

**Literature review:**

According to Jung et al. (2020), organizations can no longer consistently develop their business without the cooperation of society. Marketing managers, therefore, focus on meeting the social and ethical needs of consumers, such as providing cultural promotion, environmental protection, and disaster relief activities. Jung et al. (2020) conducted a study focusing on sustainable marketing activities of the traditional fashion market and their performance. Jung et al. (2020) found results showing that sustainable activities in the traditional fashion market have a positive effect on brand image, trust and satisfaction. Bock et al. (2012) conducted research that attempts to evaluate the effects of antecedents of online trust in the context of multi-channel retailers at different phases, taking into consideration the moderating effects of product types. Bock et al. (2012) state that the results reveal that multi-channel retailers' trust is transferred from the offline channel to the online channel. Javed and Wu (2020) report in a study that empirically examines the influence of after-delivery services on customer perception of satisfaction, trust, and repurchase intention.

Javed and Wu (2020) report an analysis indicating significant mediating effects of customer satisfaction and trust with after-delivery services upon repurchase intention. The results of Javed and Wu (2020) reveal that customer satisfaction with services also mediates the relationship between after-delivery services and consumers' trust in the retailer. Mark and Ganzach (2014) state that studies that have examined the relationship between personality and Internet use so far were largely conducted on the basis of small, non-representative samples, and have yielded conflicting results. In the current study, we estimate the relationship of the Big 5 personality traits and Internet use. Mark and Ganzach (2014) found results suggesting that global Internet use is positively related to Extraversion, Neuroticism, and Conscientiousness. Furthermore, Mark and Ganzach (2014) examine the relationship of the Big 5 with online communication, leisure, academic, and economic activities. Zabkar et al. (2017) state that while personality traits have repeatedly been shown to influence consumer behavior, their impact on willingness to buy global brands has yet to be empirically investigated. Their findings show that extraversion, neuroticism, conscientiousness and openness to experience impact purchase intentions mediated through consumers' global brand associations, domestic country bias and price sensitivity. Barnett et al. (2015) found that consistent with expectations, conscientiousness and neuroticism are associated with perceived and actual use of technology, with conscientiousness demonstrating a positive association with both perceived and actual use and neuroticism, a negative association. Shao et al. (2015) found that demographic variables such as gender and age were found to be significantly related to Facebook user motivation and segmentation. They state that practical implications – for marketers who communicate with market segments via social media, the findings of this study are highly significant. Shao et al. (2015) agree that this research provides marketers with a motivation and demographic segmentation strategy for Facebook users. Seifert et al. (2017) conducted a study showing the results of Big 5 personality factor behavior with overall job satisfaction. The results of the correlation factor of job satisfaction were – 0.29 for neuroticism, 25 for extraversion, 0.2 for openness to experience, 17 for agreeableness and 26 for conscientiousness. The results further indicated that only the relations of neuroticism and extraversion with job satisfaction were generalized across studies. Seifert et al. (2016) state in their research that they measured leadership qualities and used individual ratings of the Big Five. As expected, conscientiousness and emotional stability are closely related to ethical leadership. According to Perkins et al. (2015), neuroticism is a dimension of personality that captures trait individual differences in the tendency to experience negative thoughts and feelings. The authors explain neuroticism in terms of sensitivity, such as creativity and negative psychological states. Perkins et al. (2015) claim that their theory explains that neurotic individuals can be more creative than the average person.

Sharif et al. (2014) state that consumer trust plays an important role in the adoption of any technology. This study targets to determine the psychological elements that affect the consumers' trust in the adoption of e-commerce. This study focuses on the partition of psychological factors that revolve around three main categories, i.e., personality-based, internal perception-based and external perception-based factors.

## Methodology

### Hypotheses

H1: trust has a positive effect on satisfaction from the perspective of consumer loyalty.

### Instruments

To assess the effect of e-commerce on consumers' repurchase intention in the e-commerce context and the effect of neuroticism. We used a Likert scale to examine the subjects. Answers were offered on a five-point Likert (1932) five-point scale, from 1 – strongly disagree to 5 – strongly agree.

### Procedures

Based on the overall structure of users of electronic business services, the questionnaire participants were recruited from the Autonomous Province of Vojvodina and the city of Belgrade. The contacted users were randomly selected with the prior consent of the service company. Users were surveyed via the Internet. In the user guide, attention is drawn to the fact that the survey is anonymous.

**Results**

Table 1
Demographic data on sample users

| Variables | N=90 | N=90 | χ2 (df) |
|---|---|---|---|
| Gender | n | % | |
| male | 33 | 36,7 | ns |
| female | 57 | 63,3 | ns |
| Age | | | |
| 25–35 years | 4 | 4,5 | 31,2 *** |
| 35–45 years | 36 | 40 | |
| 45–55 years | 32 | 35,5 | |
| 55–65 years | 18 | 20 | |
| Years of service | | | |
| up to 5 years | 6 | 6,7 | 18,54 *** |
| 5–15 years | 40 | 44,3 | |
| 15–25 years | 34 | 37,7 | |
| more than 25 years | 10 | 11,3 | |
| Labor relation | | | |
| indefinite period of time | 62 | 68,8 | ns |
| definite period of time | 28 | 31,2 | |

Note: ns – no significant differences; ***p ≤ **.001**

Table 1 shows the basic demographic data on the users of electronic business that are included in the research. User groups differed significantly in terms of gender and type of labor relation, and very significant differences were found in age and length of service. There were more users that fall into the category with 5–15 years of service. Among surveyed users in service activities, most users fall into the category of 35–45 years of age. Based on the obtained results, it can be seen that 68 users have employment contracts for an indefinite period of time, and 28 have employment contracts for a definite period of time.
First, we examined statistical criteria for evaluating the measurement model, including internal consistency (i.e., Cronbach's $\alpha >$ 0.7), composite reliability (CR > 0.7), convergent validity (i.e., average variance extracted, AVE > 0.5), diagnosis of collinearity (i.e., variance inflation factor; VIF < 3.3) and discriminant validity (i.e., Fornell and Larcker criterion and hetero-trait-mono-trait ratio). The table shows that the reliability and validity of the constructs and items have been rigorously confirmed.

**Discussion**

The results on the connection of age and length of service with the user's job satisfaction are not unanimous, but there are indications that the influence of these factors must be significant. The analysis showed that consumers who trust retailers' offline channels also trust their online channels. The results of this research show that e-commerce users have a significantly higher level of job satisfaction. Meanwhile, neuroticism, a negative personality trait, was positively related to the transfer of consumer trust. However, when purchasing, highly neurotic consumers tend to hedge against risk and uncertainty regarding their purchases. Therefore, these consumers are reluctant to switch from one channel to another compared to consumers who are relatively less neurotic. So, this ultimately confirmed that consumer loyalty in e-commerce is firmly based on trust in offline channels rather than trust in online channels or negative consumer personality traits.

**Conclusion**

The practical implication of the study is that marketing strategies require the analysis of undiscovered heterogeneous consumer behavior. In e-commerce shopping situations, including offline, online and mobile channels, very complex factors, such as neuroticism, which can manifest in unpredictable patterns and can nullify the efforts of marketers, influence purchasing decisions and consumer behavior. In particular, if we take into account the fact that today's e-commerce business is intensely competitive, recognizing the hidden characteristics of consumers should not be neglected, because it can affect the ability of a company to survive. Therefore, firms and managers must follow different methods in order to discover heterogeneous patterns in the behavior of their consumers according to our proposed consumer segmentation. In summary, this paper contributes to the academic community by answering three research questions. These findings would be helpful to researchers and managers in the field of consumer studies. Our study demonstrated its relevance for the transfer of trust by considering only one negative consumer personality trait, neuroticism. Future studies should find more emotional states. Finally, our study used a specific technique to identify unobserved heterogeneity in the data. Future research calls for consideration of various other analytical methods, such as neural methods that can advance the path to consumer decision, to expand our understanding of the effects of unobserved data heterogeneity.

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# The Importance of Communication Skills for Success in the Modern Business of IT Companies

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**Abstract:** In the modern business world, communication skills have become essential for success. In this paper, we will present the role and importance of communication skills with special emphasis on their importance in the IT sector. Research has shown that the lack of communication skills directly affects business results through negative consequences that affect productivity, employee satisfaction, and therefore the quality of products and services. This paper will present several methods that can help in developing and improving communication skills.

**Introduction**

In today's business world, and especially in the IT sector where high-tech companies are dominant, communication skills have become a key success factor. However, it is generally assumed that in the IT sector, it is actually the most important to know and understand the technology and that communication skills are less important. When we grasp the fact that communication skills in the IT sector are equally important as technical skills, it will open the possibility for a new way of thinking, doing business and becoming successful.

The aim of this paper is to investigate the importance of communication skills for success in the modern business of IT companies. This paper explores and analyzes various aspects of communication that are essential for business success in this sector.

The first part of the paper presents the basic concepts of communication skills and their role in the business world. Different types of communication that are essential to the business of IT companies will be considered, such as written, verbal, and non-verbal communication.

The main focus of the second part of the paper will be on the analysis of the importance of communication skills in the business of IT companies. Through research, we will show how these skills can help in making decisions, solving problems, improving productivity, as well as in improving teamwork and successful cooperation within IT teams, which are the basic form of business organization in this field.

In the third part of the paper, practical examples were presented, which analyzed how communication skills helped IT companies to achieve success in the market. The research showed how IT companies achieved better results and retained clients when they successfully implemented communication skills in their business. They also showed how communication skills helped in the development of new products and services.

In the fourth part of the paper, we will present the challenges and obstacles that arise when implementing communication skills in the business of IT companies. We explored how IT companies can deal with these challenges and how they can actually influence the building of a culture that would support the development of these skills.

In this paper, a descriptive research method was used. The data was collected from various sources, such as scientific papers, professional books, research and case studies. An analysis of various IT companies operating in this field and their application of communication skills was carried out.

**Research results**

Today, information technologies play a significant role in business, thus opening up new opportunities for the development of companies and the economy in general. It is important to note that in addition to the importance of developing technical

knowledge and skills, in order to successfully perform their work, employees in IT companies must also possess and develop "soft skills", among which are communication skills. (Anne F., 2019).

The ability to clearly and effectively express opinion, to listen carefully to the interlocutor and to establish successful communication, actually represents the possession of good communication skills. Due to the need for cooperation in teams, negotiations with clients, presentations of products and services, as well as for solving problems that require an understanding of clients' needs, these skills become even more important in IT companies. (Carol M. L. & Debbie D. F., 2015)

Research shows that employees in the IT industry often have difficulty explaining technical concepts in a simple way, which can lead to misunderstandings with other team members or clients. It has been observed that poor communication also leads to misunderstandings regarding project goals, thus increasing the time required to complete the project and increasing costs. And finally, the lack of communication skills significantly affects relationships with clients, which can lead to a loss of trust and business. (Barbara, G. S., 2020)

On the other hand, the importance of communication skills for business in the IT industry can be seen from several different aspects:

1. Effective communication in teamwork can lead to a better understanding of project goals, which allows team members to work together on the same goal and thereby improve the quality of the project.
2. Professional communication with clients significantly contributes to the success of the company because employees negotiate more effectively, understand the needs of clients and explain technical concepts to them in a simple way. All this leads to better relations with clients and an increase in their trust in the company, thus making long-term cooperation possible.
3. Good communication skills contribute to the successful presentation of the company's products and services. In the IT industry, there is often a need to present complex technical concepts and products in a simple way. A good presentation of products and services leads to an increase in the interest of clients, and therefore to an increase in sales.
4. Communication skills contribute to solving problems in the company. In IT companies, technical problems arise that require an understanding of clients' needs and effective communication within the team. With good communication, employees can collaborate more effectively with other team members, understand clients' needs and solve problems faster.

The company Google emphasized the importance of communication skills in its success. Google is known for its culture of open communication and collaboration. This kind of approach enables the development of innovative ideas faster and solves problems more easily. In order to achieve this kind of success, Google invests a lot in training employees and improving their communication skills, as well as in the organization of internal training.

The example of the company Apple shows how critical communication skills are to sales success. Apple is known for its employees having excellent communication skills, which allow them to present their products in the best possible way and thus increase sales. Like Google, Apple invests a lot of money and time in training its employees and improving their communication skills in order for them to improve communication with clients.

We have already pointed out the importance of good communication for teamwork. In the IT industry, teams are formed consisting of different experts, who must work together to achieve a common goal. This requires effective communication and information sharing among team members. (Courtland L. Bovée & John V. T., 2018). A good example is the company IBM, which is known for its successful organization of teamwork, which is partly based on its advanced communication systems.

We have shown that customer relations are also a key success factor in the IT industry. We can see that in the example of the company Microsoft, which emphasized the importance of communication skills in customer relations. Microsoft invests in training its employees so that they are able to communicate effectively with clients and provide them with the best service.

As already stated and seen from the previous examples, the lack of communication skills can affect the success of the project and the company as a whole, so it is crucial that employees are trained in this area.

In order to improve the communication skills of employees, it is necessary for companies to implement various activities and measures. Some of the possible ways of improving communication skills are employee training, monitoring of success, mentoring and support, involvement in teamwork as well as increasing awareness of the importance of communication.

**Concluding considerations**

Communication skills are crucial for success in modern business, especially in IT companies. That is why it is important that IT companies recognize the importance of communication skills and invest in the training of their employees. Good communication improves relations with clients, increases sales and brings better results in teamwork. Investing in the communication skills of employees is an excellent investment for the long-term success of the company.

Despite technology constantly changing and advancing, communication skills remain critical to success in business. If companies want to remain competitive in the market and develop, they must invest in the training of their employees, as well as establish a culture of open communication and cooperation in all aspects of their business.

Finally, we can conclude that the application of communication skills can be the key factor that distinguishes a successful from a less successful IT company. Therefore, companies should include the development of employees' communication skills in their business strategy, because only in this way can they achieve the best results and long-term success on the market.

**Keywords:** communication skills, IT industry, modern business, teamwork, employee satisfaction, product and service quality, training.

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# The Use of NLPs in Cryptocurrency Markets

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**Abstract:** Cryptocurrencies still instigate strong interest across the globe due to considerable returns, and the prospect of being used as means of exchange (Corbet et al., 2018; Chuen et al., 2017; Angelis & Da Silva, 2019). Since the initial appearance of the blockchain and bitcoin, the first and, until today, the most valuable currency based on this proof-of-work technology, its development has been explosive and multifaceted. Already in 2017, initial coin offerings (ICOs) were the mainstream investment opportunities in the crypto world (Pineiro-Chousa et al., 2021), where digital projects promised the use, stake, or governance roles via tokens. With a price downturn in 2018, the cryptos headed for the so-called "crypto winter". The headwinds subsided in the summer of 2020, with projects offering the possibility to trade, lend, borrow, and insure, without an intermediary, in a decentralized manner and as a specific category to be analyzed (Piñeiro-Chousa et al., 2022b; Corbet et al., 2021a). The total value locked (similar to bank deposits) in all DeFi projects went from USD 1 billion in June 2020 to USD 247 billion in December 2021 (Stepanova & Erinš, 2021).

In the study of cryptocurrency markets, it is possible to apply sentiment analysis to examine the impact of perceptions demonstrated by market participants on the return or volatility of returns of a specific cryptocurrency (Lopez-Cabarcos et al., 2021). NLP (Natural Language Processing) is a system of artificial intelligence commonly used in similar studies, and authors decide what phenomenon will be examined. In cryptocurrency studies, it could be the sentiment about the currency itself or perceptions about a market proxy, which could be linked then to the cryptos. If messages on Twitter or similar platforms are scanned to measure the impact across platforms or via various influencers, then we strive to evaluate social metrics (Pineiro-Chousa, 2023).

The data availability had an impact on the majority of studies focusing on leading currencies, such as Bitcoin and Ethereum, which even today account for almost 70 percent of the cryptocurrency market's total capitalization (coinmarketcap.com). With the advancement of other crypto products, there is an attempt to examine specific markets such as DeFis (Piñeiro-Chousa et al., 2022; Piñeiro-Chousa et al., 2023). If large news databases have been scrutinized, such as LexisNexis, based on specific terms related to the cryptocurrency market, then a range of indices relevant to cryptocurrency markets (Lucey et al., 2022; Wang et al., 2021a, and Wang et al.,2021b) could be offered. These authors have created the Cryptocurrency Uncertainty Index (UCRY), Central Bank Digital Currency Uncertainty and Attention Indices (CBDCUI and CBDCAI), Index of Cryptocurrency Environmental Attention (ICEA), and Non-Fungible Token Attention Index (NFTAI).

Researchers increasingly pay attention to VADER (Valence Aware Dictionary and sEntiment Reasoner), that among machine-trained models, seems to be quite accurate (Hutto and Gilbert, 2014). With the advancement in AI (Artificial Intelligence) and ML (Machine Learning), ChatGPT and further iterations of the same system will make a strong impact on our society, but in the sphere of language processing, it is necessary to use specifically tailored models.
In view of these recent advancements in data processing, it is not difficult to assume that the currently inevitable intervention of programmers will be rendered superfluous quite soon. The machines will be able to perform as expected, and even outperform, in the hope that biases will be minimized and potential threats to humankind eliminated.

**Keywords:** NLP, Artificial Intelligence, cryptocurrency, Bitcoin, DeFi, VADER

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# Issues of determining the essential and formal differences and similarities between the terms "Artificial Intelligence" and "Machine Learning"

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**Absract:** The terms artificial intelligence, machine learning, deep learning, and neural networks are in everyday use in the field of computing. They represent technologies that have been developing at a high speed in recent decades, and which form the core of high-tech development, whether it is data analysis for the purpose of drawing relevant conclusions and obtaining certain knowledge, filtering unwanted electronic messages, diagnosing diseases, using software for voice and text recognition, playing chess against the computer or driving a self-driving car. In order to understand the main concepts of artificial intelligence, the paper, in addition to the interpretation of definitions, discusses various subcategories of artificial intelligence through examples of application. In this constellation, machine learning is seen as a subcategory of artificial intelligence, deep learning a subcategory of machine learning, while neural networks could be called the backbone of a deep learning algorithm. These terms are used interchangeably, which can create confusion if the similarities and differences between them are not observed. What are the similarities and differences between artificial intelligence, machine learning, deep learning, and neural networks? What makes each of these technologies unique? The aim of this paper is to answer these questions through a theoretical approach to the basics and a review of practical examples.

**Keywords:** algorithm, deep learning, machine learning, model, neural networks, training set, artificial intelligence

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# Perspectives and Challenges of Artificial Intelligence and Machine Learning

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**Abstract:** In order to smartly use the potential of new technology, with the aim of improving the quality of life, it is necessary to understand that it can enable us to open a new chapter in the development of humanity, but in such a way that it does not condition us to turn off and stop using our own brain. Modern humans (Homo sapiens) appeared about 200,000 years ago. Even then there were certain phenomena that were terrifying for them. What are today's Homo sapiens afraid of? One of the answers lies in the concepts of Artificial Intelligence – AI and Machine Learning – ML. Are the reasons for our fear justified or is today's dilemma something we can use in the right way to make humanity better? There is a certain amount of uneasiness, and many ethical and legal concerns about AI and ML, and the key question that arises is whether the "pros" or the "cons" are prevalent. Are autonomous machines a threat to human free will? Do AI algorithms threaten data privacy? What is the relationship between AI and human discrimination? Does today's society need superintelligence? How do fairness, responsibility, the welfare of humanity and the absence of evil intentions as ethical principles relate to everyday life in our personal and professional lives? The aim of this paper is to answer all these questions through the analysis of practical examples.

**Keywords:** ethics; data security; machine learning; data privacy; artificial intelligence; data protection

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# Digitalization of tourism in Serbia

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**Abstract:** The Internet represents an important influence on marketing activities, especially in terms of communicating with consumers. Access to the web is unlimited, and it provides the creation of a multimedia presentation of a tourist product that is perceived as tangible, and consumers can communicate with the management of tourist offers at any time and from any place. The influence of new technologies contributed to the promotion and sales activities in tourism. So the role of the e-marketing mix of tourist offers is primarily reflected in the tourist offer and demand, and sales are carried out from physically distant destinations. Therefore, with the help of Internet promotion technologies, the gap is achieved and the tourist offer is presented in the best possible way. The Internet is a modern platform, so it is suitable for selling tourist products, and customers are one of the main tools for searching for travel-related information. This type is suitable for selling a large number of destinations. For example, rural, hunting and other types of tourism are the most suitable for the promotion and sale of products. The aim of this paper is to find out how IT technologies are applied in Serbian tourism. Empirical research has indicated the growth of the use of IT technology in users who use tourism services. Also, the paper analyzes the advantages of using online reservations. The results obtained in this paper will benefit tourist destination management.

**Keywords:** tourism, research, Serbia, digital marketing, promotion and sales

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# The Use of *English Grammar Test* Application for English Language Learning

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**Abstract:** In this day and age, the use of Web 2.0 tools has become a very important factor in language teaching and learning and these tools are implemented by many schools. Although there is a myriad of tools available, certain factors should be taken into consideration when choosing tools for specific learning goals. This paper covers the use of the Google Play Android Application called *English Grammar Test* in English language teaching and learning at ITS. A questionnaire was used in order to learn about the frequency of use of the application outside the classroom as well as the experiences of students regarding its assistance in the preparation for the exam(s). The students were handed out questionnaires in paper form. The questionnaire was anonymous in order to obtain more honest answers. The data suggests that there is room for implementing additional tools for learning. The results of this study may assist in further qualitative research of students' opinions regarding the abovementioned application and other learning tools.

**Keywords:** English language learning, English language teaching, Google Play Apps, online learning, teaching tools, learning tools

## Introduction

The world witnessed the birth of Google in 1998. Google was constantly working on its improvement and that led to the result of it being the most visited website. Its growth did not stop there – various tools and apps were developed later on. Among others, Google apps for education were created. [1]

Web 2.0 refers to the second generation of the Internet. The web-based applications like Wikis, DropBox, Blogs, Evernote, SkyDrive and Google Apps, etc. can be used for collaborative work. These applications are used with ease by both teachers and learners. [2] The use of Web 2.0 tools has facilitated the teaching and learning of foreign languages as well as the learning and teaching process in other fields. There is new content created every day and users are able to interact with it. If we compare Web 1.0 and Web 2.0 tools, one of the main characteristics is just consumption of the created content without any option of interacting with it. [3]

During the COVID-19 pandemic, Google Meet was used in order to provide additional support for students alongside the lectures they were able to watch. Google Meet was used to display the teacher's computer screen, along with additional online tests that were created on in-house platforms. All students were sent an invitation and they could participate in solving the test, and they shared their ideas, comments, and questions regarding the test.

The idea of using applications for teaching and learning initially came from the Information Technology School management in 2017. At that time, ITS handed out free tablets with the Android operating system to newly enrolled students in order to help them in their learning efforts. Professors gave their suggestions regarding the applications that could be installed and used during the lectures as well as for studying outside the classroom. Among applications for English language practice and learning, the app English Grammar Test [4] was chosen. The application was presented during the introductory lecture and students were suggested to install it on the spot in order to see the options it offers. It was not used during that first lecture since it was the introductory lecture. The application was used during the subsequent lectures. In addition, students were encouraged to use the application outside the classes since it would aid them in preparing for the exam(s). When used during lectures, students were invited to ask additional questions regarding the tasks and provide their comments and thoughts.

When choosing the application, several criteria were taken into account. Since the students mostly want to concentrate on passing the exam(s), it was important to find an application that resembles the type of tasks they get in the exams. One task type in the exam is multiple choice questions. The students are given four options to choose from. The application fits that criterion since it contains the named task type and that is the only type it contains.
Furthermore, bearing in mind that the level of the course taught is Intermediate, the application had to be of the same level. The

levels available in the application are Intermediate and Upper-intermediate.
Also, the application needed to contain most of the grammar points covered in the lectures within the Intermediate level. Another important characteristic was that the application was free. In addition, the application should not have taken up much memory space.

**Methodology**
During the summer semester of the school year 2022/2023, a questionnaire in paper form was handed out to a group of seven students. **The questionnaire was anonymous and it contained five questions.**

**Results and discussion**
The results of the questionnaire are presented below.
The number of students who gave a particular answer is provided in the brackets.

Question 1
Did you install the English Grammar Test application on your smart device during the first lecture when it was first presented?
Yes. (5)
No. (2)

Two students answered that they did not install the application during the introductory class. It would be interesting to find out whether they did not do it because they were not present for that class or if they had other reasons for not installing it.

Question 2
Do you use the English Grammar Test application after every lecture in order to check your knowledge related to the lesson that was covered?
Yes, after every lecture. (1)
Periodically, after several lectures. (1)
Only prior to the exam(s). (1)
Never. (4)

Four students answered that they never use the application outside the class to check their knowledge. This opens a doorway for asking whether they use other tools or they do not practice at all.

Question 3
Are the explanations related to the answers that are given below every question suitable?
Yes, they are suitable. (5)
They are mostly suitable. (2)
I find them more unsuitable than suitable. (0)
They are not suitable. (0)
No viewpoint. (0)

One of the additional reasons why this application was chosen is the fact that after the student gives the answer, the explanation is revealed of why a certain answer is correct and the grammar behind it is explained. Certain explanations are more detailed than others and that partly depends on the complexity of the question. There are explanations that could be more detailed. The students are mostly content with the explanations given for the answered questions.

Question 4
Do you think that the application should contain questions where you need to type the answer(s)?
Yes. (6)
No. (0)
No viewpoint. (1)

Since the application contains only multiple choice questions, six students answered that they would also like to do gap-filling

questions. Gap-filling is the type of task that is present in the exams and available in other tools that are used. Bearing in mind the answer, using some additional applications with this question type should be considered.

Question 5
Did the application assist you in the preparation for the exam(s)?
Yes, it helped me. (2)
It helped me partially. (1)
It helped to a smaller extent. (0)
It did not help me at all. (1)
No opinion. (3)

This question opens a doorway for further investigation of whether the students who gave the last two answers did not use the application at all or whether there are other factors involved.

**Conclusions and recommendations**

The findings of this study showed the use frequency and satisfaction of students regarding the English Grammar Test application. Even though this application is not frequently used by certain students outside the classroom, it is helpful for practice and learning and promotes additional discussion during classes. The results of the questionnaire may be a base for further research which could provide us with additional answers regarding this application and probable additional tools students use.

The study comes with some limitations and that is the number of students who answered the questionnaire. Secondly, the focus of the study is a single application for English language learning. In order to learn more about the students' perception of learning tools further research is necessary.

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# The Book of Graphic Standards – a guide for brand development

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**Abstract:** The Book of Graphic Standards is a key tool in creating and maintaining the consistency of a company's corporate identity. It describes specific guidelines for visual branding and communication, both internally, within the organization, and externally, towards customers, users, partners and the like. The main task of this book is to ensure that all materials produced by an organization, whether they are intended for print or in digital form, are visually consistent and adhere to the defined branding strategy of that company.

By setting clear and precise guidelines, it becomes significantly easier for designers to create new branded materials, without constantly returning to old solutions and reanalysing them to maintain the identity and emotions that the brand wants to show and convey. Likewise, it is important to ensure that the brand, through its unique presentation, gives the impression of stability and instills a sense of security.

In order to understand the importance of the Book of Graphic Standards, this paper aims to show, explain and analyze its development and evolution starting from its creation at the beginning of the 20th century, following its development until today, with the ultimate goal of implementing the best-observed practices on a real project, that is, the creation of a Book of Graphic Standards for the Brainfinity brand.

In the first chapter, the origin of the brand is discussed and the essence of the corporate identity is explained. The main elements of a brand's corporate identity are listed and it is explained how they affect the perception of customers, consumers and users. [14] It also lists what conditions branding must meet in order to maintain the visual unity of the company and how standardization enables addressing that issue. Also, attention is given to the impact of emotions on the company's reputation.

The second part of this paper presents a review of the historical aspect of the Book of Graphic Standards. As selected examples from the past that significantly influenced what the Book of Graphic Standards represents today, the following were mentioned: the first edition of the "Graphic Standards of the American Institute of Architects" [15], the "Book of Zelig Harris" [16] and the first edition of the Graphic Standards of the American Institute of Graphic Arts [17]. Each of the books mentioned represented some kind of innovation for the time in which it was created, and the best practices have been maintained to this day.

After reviewing the background, the third chapter is dedicated to the position of the Book of Graphic Standards in the present time of some of its best examples. For this purpose, three Books of Graphic Standards of the world-renowned brands – NASA, Coca-Cola and Starbucks, were used in this paper. These books were chosen because, apart from their time of creation, they also differ significantly in their approach to presenting standardization. NASA Graphic Standards Manual is very simple and, relatively speaking, represents a collection of strictly presented rules. In the Coca-Cola Book of Standards, the presence of design can already be seen in the preparation and display of the book, and Starbucks takes its standardization to a whole new level by taking advantage of information technology and setting up an interactive presentation of its graphic standards.

The fourth chapter includes standardization, that is, the implementation of observed rules in the practice of a real example, which is also the project part of this paper.

The result is a practically applicable Book of Graphic Standards that provides multiple benefits for the brand:

- Consistency – The Book of Graphic Standards ensures that visual elements are consistent across all media platforms, including print and digital.
- Recognition – By maintaining the consistency of visual elements, the brand increases its recognition among the public.
- Clarity – The Book of Graphic Standards provides precise guidelines for design elements.

- Professionalism – The existence of precise standardization of the brand conveys an image of professionalism and thus builds trust.
- Efficiency – Significantly saves time in terms of creating branded material and simplifies the design process.
- Adaptability – The Bok of Graphic Standards provides guidance on how elements of the corporate identity adapt to different platforms, backgrounds, and conditions.
- Better user experience – Consistent branding can significantly increase satisfaction and loyalty among the public.

**Introduction**

The Book of Graphic Standards significantly affects the perception of the brand. It is extremely important that the visual identity of the brand be standardized so that in practice there are no mistakes in the form of inconsistency in the application of elements of the corporate identity. In order for this paper not to be only theoretical, it also contains a direct application of best practices on the example of improving the Brainfinity brand through the introduction of standardization.

Brainfinity is a brand that has been working for several years on improving problem-solving skills through student competitions and corporate workshops. By carefully analyzing the visual identity on the websites of that brand, inconsistency and numerous omissions caused by the lack of standardization and precisely set rules for the use of elements of the visual identity were noticed.

The goal of this paper is to provide a complete Book of Graphic Standards for the Brainfinity brand through the project part, which will provide the basis for its further development.

In order to achieve this goal, this paper is devoted to the historical development of the brand, as well as the elements of the corporate identity. In addition, the paper provides the historical aspect of the Book of Graphic Standards through several examples that laid the foundations in the form of standardization, and the analysis of best practices was carried out on the example of modern books of standards of globally successful brands.

Finally, as a result of the research and the analysis of the collected information, the Brainfinity Book of Graphic Standards was designed.

The greatest importance and contribution of this paper is that, apart from the research part, it also includes the direct application of knowledge through the improvement of the existing project, giving it an important tool for future branding.

**Research method**

At the time of the creation of the Brainfinity brand (that is, two segments of one brand), only the basic elements of the corporate identity were set, namely the name, logo, corporate colors and corporate typography.

The error that was made refers to the omission of the definition of the correct application of the set elements, or more importantly, the definition of the prohibited application.

As a result of such a deficiency, numerous, conditionally speaking, errors occurred in practice. [12] Such errors arose due to the absence of precisely defined rules and guidelines of use, and thus designers unknowingly made unwanted deviations.

Research into the visual identity of this brand consisted of careful observation and analysis of all the materials that this brand has published so far. Examples of visuals from the website, Instagram and Facebook page, diplomas for contestants and the like were taken for analysis.

**Research results**

Wrong use of the logo, inadequate choice of typography, poor transparency, as well as deformations of the logo are just some of the examples of errors that were observed during the detailed analysis.

All these elements are included in the introduced Book of Graphic Standards in order to ensure the improvement of the visual representation of the brand as well as to ensure consistency over time.

**Discussion**

The rules set by the Book of Graphic Standards are in no way and should not be understood as restrictions but as guidelines.

Redesign is a very important part of branding. In essence, it implies modification, innovation and, above all, change (for the better). However, this change must be implemented very skillfully and subtly in order not to cause negative reactions from the most loyal consumers. On the other hand, change is more than necessary in order for the brand to remain relevant over time.

**Conclusion**

The point of standardizing visual identity elements is very simple – ensuring uniqueness over time and across all branded material. As we mentioned at the very beginning within the framework of explaining the very existence of the brand, identity consistency is of key importance in order for the brand to differentiate itself on the market, and also to become and remain recognizable by its symbols.

By introducing the rules through the Book of Graphic Standards, even designers who see the brand for the first time will get a precise insight into the exact characteristics and rules according to which they should create future content, and observers will always and without mistake know exactly which brand it is.

**Keywords:** Book of Graphic Standards, rules, design, continuity, brand, problem-solving, standardization

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# Time Series Forecasting using Neural Networks

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**Abstract:** Throughout human history, forecasting has fascinated and continues to fascinate people today. In some cases, it was considered a sign of divine inspiration, and sometimes it was considered a criminal activity [1]. The different fortunes of forecasters arise because good forecasts seem almost magical, while bad forecasts can be dangerous. Nowadays, modern science and technology give us the ability to apply very reliable forecasting methods. These methods can be repeated and tested, and the results of their forecasting accuracy can be verified. In this paper, we will deal with the issues of forecasting a particular data structure, called *time series*.

Some processes are measured over time (every minute, every day, etc.), such as the price change of a product or resource. In addition, natural phenomena, such as earthquakes, fires, hurricanes, weather phenomena and other events that occur in nature, are often recorded over time [2]. A time series is a set of data collected at constant time intervals. Time series differ from other data in that, in addition to rising and falling values, the data also depends on time. Furthermore, most time series also have trends – variations that are specific to a certain time frame. Time series are analyzed to determine a long-term trend, to forecast future values, or to perform some other form of analysis. There are also special situations, such as price forecasting, when time series forecasts are expected to yield positive forecast values or expected forecast values to be within a certain interval.

Time series forecasting is difficult. Unlike simpler classification and regression problems, time series forecasting problems have additional complexity: time series have a well-defined order of data and time dependence of the data. As mentioned, an additional complexity and challenge for time series forecasting is the ordering of the data, which can be yearly, monthly, weekly, daily, etc. Weekly data is difficult to work with, because the seasonal period (number of weeks in a year) is not an integer, and most methods require the seasonal period to be an integer [1]. On the other hand, periods that are daily or less than daily (e.g. hourly) may include multiple seasonal patterns, so it is necessary to use methods that deal with complex seasonal patterns.

There are traditional methods used in time series forecasting. Among these methods, linear methods dominate, such as ARIMA (autoregressive integrated moving average) method. These methods are sufficiently understandable and effective in solving many problems. Compared to classical methods, machine learning methods can be more effective in more complex time series forecasting problems [3]. Machine learning uses algorithms that iteratively learn from data and make it possible to find hidden information or relationships between data. Artificial neural networks are the most popular and one of the most widely used machine learning methods which are capable of automatically learning complex relationships between input and output data. They are a powerful tool that can be applied to problems with complex dependencies between data, as well as for multistep-ahead prediction. Time series machine learning models make a set of predictions based on a "window" of consecutive samples from the data, given a list of input data, and then the data is transformed into an input data window and a label window. The main characteristics of the data windows are the width (number of time steps) of the input and label windows, the time gap between them, and which features are used as inputs, labels, or both. Depending on the research and the type of model, it is possible to generate different data windows. If it is about monthly data, it is possible to create a window with data for a model that will make a forecast one month ahead, based on data from the previous 12 months, and it is possible to create a window with data for a model that will make a forecast 12 months ahead, based on data from the previous 12 months. One such study was concerned with predicting the number of tourists at a time when there was a sudden decrease in the number of tourists due to the COVID-19 pandemic [4]. The possibility of applying different models of neural networks for time series forecasting is presented here.

**Keywords:** time series, machine learning, neural networks, forecasting, data

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# Application of IDS system for IT security in data centers

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**Abstract:** Data centers face various methods of security threats that are becoming increasingly difficult to detect. Attacks and malicious activities adapt to the development of Information Technologies. In modern organizations, IT infrastructure and applications are becoming key elements in business processes and electronic public services. Blocking or compromising IT services can cause economic damage or damage reputation, which is unacceptable for the organization. In this paper, we will describe in detail the concept of defense that aims to provide a solution for protecting security using an intrusion detection system (IDS).

Intrusion Detection System (IDS) that monitors computer resources and sends reports of any anomalies or unusual patterns of activity has attracted much attention from researchers. The aim of this paper is to explain in detail the evolution of the idea of IDS, to highlight its importance for researchers, data centers, for the security of organizations, and to study various aspects of IDS such as categorization, classification and application in specific places to reduce risk from unauthorized access to the IT infrastructure.

**Keywords:** intrusion detection systems, data security, information technology, security risk, intrusions

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# Network Barriers and Their Role in IT Security

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**Abstract:** Information Technology (IT) security has become an increasingly important topic in the modern business environment. This paper discusses the role of network barriers as a key mechanism in preventing attacks on the IT infrastructure of a retail

company. The aim of the research is the analysis of network barriers in detecting, blocking and preventing different types of attacks. At the beginning of the research, we studied the different types of attacks that organizations can experience. We then focused on the role of network barriers in protecting IT systems from potential attacks. We analyzed the various techniques and mechanisms that network barriers use to detect and block attacks, including packet filtering. In the second part of the research, we conducted a study based on real data about attacks and their detection by network barriers. We used metrics such as detection time, detection accuracy, and blocking efficiency to improve the performance of network barriers in preventing attacks. We conducted the research in a retail company that operates in different locations. The company decided to improve its information technology security in order to protect sensitive data about customers and its business operations. Also, we analyzed the advantages and limitations of this approach and considered possible strategies for improving the effectiveness of network barriers.

**Keywords:** network barriers, security, information technology, attack detection, attack prevention

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# Copyright – Challenges of the digital age

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**Abstract:** Information technology has greatly influenced the ways of using copyrighted works, as well as the ways of their abuse and infringement. This paper will first analyze the influence of technology, especially digital, on the publication of works, and its influence on the exercise of the author's property rights (public communication of the work, reproduction of the work, putting it into circulation, etc.). On the other hand, the influence that technology has on copyright users will be observed, and their position

as users of technology and as potential infringers of other people's copyrights will be analyzed, as well as the possibilities of protection against possible violations in the new digital environment.

**Keywords:** copyright, information technology, internet, copyright protection

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# The Impact of Kahoot! Software on Student Motivation and Learning Outcomes in Computer Networks Teaching

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**Abstract:** The aim of the conducted research was to examine whether the introduction of gamification elements in the teaching of computer networks can enhance the quality of acquired knowledge and student motivation. The subject of the research is the analysis of the impact of the interactive software Kahoot! applied within the implementation of the course Computer Networks. The research was conducted at the Information Technology School – ITS. The participants were first-year students who chose the

Computer Networks course in the academic year 2022/23. Students were tested at the end of each teaching week through knowledge assessments using Kahoot! quizzes. The percentage of correct answers, the time it took the students to answer the questions and the teaching units that were more challenging for students to comprehend were analyzed. The results of the colloquium of students who participated in Kahoot! testing were compared to the results of the students who did not participate. The findings indicate that the application of Kahoot! software in the teaching of computer networks can increase students' active participation in class, contribute to better learning outcomes, and enhance student motivation.

**Keywords:** computer networks; Kahoot; interactive software; gamification; education

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# Design and AI: Is human creativity irreplaceable?

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**Abstract:** This paper discusses the role of Artificial Intelligence (AI) in the creative process, specifically within the domains of interior design and architecture. The aim of this paper is to point out the positive and negative aspects of AI's role in the field of design while examining whether and to what extent can AI replace human designers by taking over their role. Fundamental questions arise concerning how AI can reshape the field of interior design and architecture. In the introductory part, these pivotal questions are asked, and subsequently, employing comparative analysis of AI application in design, and statistical data, the

research findings are presented. These findings encompass the role of AI in design and the associated advantages of artificial intelligence, such as improved design processes and the accelerated, streamlined, and innovative aspects facilitated by AI. Furthermore, the emergence of AI tools in the design sphere and the continued relevance of human involvement in the design process are explored. In the ensuing discussion, it was pointed out that the symbiosis of designers and AI, i.e. harmony in the design process, can be achieved with an even greater focus on people, categorization of users and continuous development of solutions. Key conclusions drawn from the research underscore the irreplaceability of the designer's role, and the impossibility of AI completely taking the lead in the design process, and propose that the future of design lies in establishing harmony between humans and AI.

**Keywords:** artificial intelligence (AI), interior design, architecture, creativity, design process

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# Digital Marketing and Media

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**Abstract:** Digital marketing is the promotion of products or services using digital technologies. Its goal is to advertise and market products and services on one or more digital platforms, including social media marketing (such as Instagram, Facebook, MySpace, YouTube, Twitter, etc.), search engine marketing (Google, Bing, Yahoo, etc.), and email marketing.[1]

When discussing digital marketing in the 21st century, we are essentially referring to marketing itself. To understand the digital era, we must adapt to the conditions of today. Since we live in a digital age, it is expected that marketing is primarily internet-based. In a matter of minutes, individuals or companies seeking service will search for information online, which is not feasible with traditional marketing methods.[2]

The aim of this paper is to demonstrate the advantages of digital marketing over traditional marketing.

The research analyzes the developmental stages of digital and traditional marketing, focusing on digital marketing using the Google AdWords method and traditional marketing using print media, specifically flyers. The budget allocated for both

advertising methods was the same, yet the results were drastically different. The Google AdWords campaign reached 2,000 individuals within a month, with 237 website visits, 50 inquiries, and 45 successful collaborations. On the other hand, the flyer campaign had zero reaches in terms of the number of individuals reached.[3, 4]

The conducted research provides evidence that digital marketing is an essential and primary component of contemporary business operations, whereas traditional marketing methods have a limited impact.

**Keywords:** digital marketing, internet, advertising, entrepreneurship, digital technologies, digital era, digitization, Google Adwords

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# Collaborative problem-solving using information technologies in higher education

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**Abstract:** The emerging education paradigm known as Education 4.0 emphasizes solving complex problems through teamwork. Higher education faces increasingly complex challenges that require a holistic approach and multidisciplinary knowledge. Collaborative problem-solving represents a methodology that promotes teamwork, inclusivity of diverse stakeholders, and interaction among students, professors, university administration, and the local community in order to identify and solve these challenges. This paper highlights several key elements of collaborative problem-solving in higher education, including team formation, problem identification, analysis, brainstorming, evaluation, and solution implementation. It emphasizes that such an approach not only enables students to apply theoretical knowledge in practice but also develops teamwork skills, critical thinking, analytical abilities, innovation, and adaptability. The paper is based on a three-year experience of working with students in the elective course "Collaborative Problem-Solving in Business" at Information Technology School – ITS. It analyzes students' progress in teamwork, problem-solving skills, and the development of critical thinking, as well as their attitudes toward problem situations, including the growth of self-confidence and a proactive approach when facing problems in both business and everyday environments.

**Keywords:** collaborative problem-solving, higher education, teamwork, critical thinking, innovation, adaptability

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# Artificial Intelligence in Physical Education and Sports

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**Abstract**

The article gives some examples of gaining innovation in sports by means of AI. AI provides countless options, and novel technologies are continually being invented, which can increase the variety of data processing options. With the advancement of artificial intelligence (AI), humans are now better able to predict the future than in the past. Because of the ability to process information more quickly, we may now take on challenging tasks and study data from a variety of perspectives.

Artificial intelligence (AI) has changed how we watch and analyze sports during the past 20 years. Among its many other benefits, artificial intelligence is increasingly being used in sports ***to track athletes' performance, enhance fans' experience, improve the gaming experience, organize sports training (to tailor classes, evaluate psychological traits, and for personal identification), enhance forecasting and decision-making (evaluating and designing sports strategies and tactics), as well as in eSports.***

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# Advanced AI-based algorithms as relevant participants in the communication process

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**Extended abstract:**
In the last few decades, artificial intelligence (AI) has made significant advancements and become a key factor in a wide range of industries and societal segments. One of the most prominent aspects of AI development is its ability to effectively participate in communication processes based on new technologies.

In this paper, we explore the role of advanced AI-based algorithms that are playing an increasingly important role in communication. We also consider the possibility of considering AI algorithms based on new technologies as relevant participants in a communication process predominantly composed of human communicators.

Artificial intelligence has become an indispensable technology in many aspects of modern life. Advanced AI-based algorithms are transforming the way we communicate, both personally and professionally. These algorithms can perform various tasks, including natural language processing, speech recognition, machine translation, and text generation. As a result, AI now has the ability to analyze, interpret, and generate messages that are relevant to different situations and user needs.

In this scholarly study, we examine three key aspects that illustrate the role of advanced algorithms in the communication process:

a) Natural Language Understanding and Generation (NLP) (NLP)
b) Improving communication between humans and machines
c) Social and ethical aspects of AI in communication

Natural Language Understanding and Generation (NLP)
Natural Language Processing (NLP) is a key research area in artificial intelligence that deals with understanding and generating human language. Advanced NLP algorithms enable machines to comprehend, interpret, and generate text in a way that mimics

human communication. These algorithms have already been integrated into many applications and platforms we use daily, such as chatbots, search engines, recommendation systems, automatic translators, and voice assistants.

Improving communication between humans and machines

The use of advanced AI-based algorithms in various applications and platforms, such as chatbots, search engines, recommendation systems, automatic translators, and voice assistants, has significantly improved communication between humans and machines. Instead of simple textual or voice commands, users can now interact with AI systems in a more natural and intuitive manner. These algorithms have become increasingly successful in understanding the context, nuances, and emotional aspects of human language, thereby enhancing user efficiency and satisfaction.

One key factor contributing to the success of AI algorithms in communication is their ability to adapt to the individual needs and communication styles of users. This is achieved through deep learning, data analysis, and artificial neural networks, which enable AI systems to learn and evolve over time. Additionally, integrating AI algorithms with technologies such as emotion recognition sensors, sentiment analysis, and facial recognition can further enhance their communication effectiveness.

Improving communication between humans and machines

While artificial intelligence has the potential to enhance communication processes and enable users to achieve greater connectivity and productivity, it is important to consider the social and ethical implications of this technology. Issues such as privacy, data security, bias in AI algorithms, and the impact on social interactions and employment are crucial to understanding the overall impact of artificial intelligence on communication.

One of the key questions regarding AI in communication is the impact of this technology on human interaction and social relationships. While AI can enhance information access and facilitate communication, there is concern that replacing human interaction with AI systems may lead to a reduction in social skills and emotional intelligence in humans.

Ethical issues related to privacy and data security also pose challenges in the development of AI technologies. Artificial intelligence algorithms must be carefully developed and implemented to protect user privacy and prevent data misuse. This includes compliance with data protection legislation, such as the General Data Protection Regulation (GDPR) in the European Union, as well as the development of comprehensive security protocols and mechanisms for obtaining user consent.

Bias in AI algorithms is another important ethical challenge. Algorithms can develop biases if they are (a) trained on biased data, (b) if their development processes are flawed, or even (c) if they are intentionally designed in that direction. Bias in AI can negatively impact the communication process, creating discrimination and undermining fairness in communication. Addressing bias in AI requires carefully designed methods for data collection and processing, as well as transparency in the development and evaluation of algorithms.

**Conclusion**

Advanced AI-based algorithms play a crucial role in modern communication and have the potential to significantly improve the way people communicate and exchange information. Understanding and generating natural language, enhancing communication between humans and machines, and considering the social and ethical aspects of AI in communication are key factors contributing to the development of this technology.

However, it is important to emphasize that the potential of artificial intelligence in communication can be fully realized only if all relevant social and ethical aspects are carefully considered and adequately addressed. This includes protecting privacy, ensuring data security, combating bias, and preserving human interaction as a fundamental value of communication.

In the future, it is expected that advanced AI-based algorithms will continue to evolve and become increasingly sophisticated, further improving communication processes and enabling users to achieve greater connectivity, productivity, and satisfaction. In this context, it is essential to continue researching, developing, and implementing AI technologies, taking into account their social and ethical implications.

**Keywords:** advanced algorithms, artificial intelligence, communication process, media, natural language, ethics

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# Influence of voice characteristics in Consumption of audio-video Content in Classes

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**Abstract:**

This qualitative study explores the relationship between voice characteristics and the consumption of audio-video content during classes. The study uses a mixed-methods approach, with surveys and interviews conducted with students to understand how voice quality, pitch, tone, and other characteristics affect their ability to engage with and understand audio-video content in the classroom. Findings suggest that voice characteristics can impact the effectiveness of consuming audio-video content during classes and provide positive effects on their engagement and understanding, with some students reporting a positive impact on their memorization of the content and content understanding. This study highlights the importance of considering the role of voice characteristics when using audio-video content in the classroom and emphasizes and supports that educators should consider the potential impact of voice characteristics when incorporating audio-video content into their teaching methods.

Research in the field of voice, specialized in characteristics, over the years, has shown that voice can be a powerful tool for human relations and can affect how speakers will be perceived by others. For example, speakers with lower voices have been found to be perceived as more authoritative, confident, and trustworthy, whereas speakers with higher-pitched voices are often seen as more enthusiastic and approachable [1]. These perceptions can have a significant impact on how listeners engage with and remember spoken content.

The paper [2] explores the role of voice in human communication and the types of socially relevant information that can be extracted from it beyond speech perception. The author presents an example of a conversation in a foreign language on a plane, where even without seeing the speakers' faces or understanding the speech content, an individual can evaluate physical characteristics, associate identities with different voices, and form an idea of the speakers' mood, affective state, attractiveness, and dominance. The paper reviews an emerging field of voice perception research, discussing acoustical cues that carry vocal

information and how the brain processes and analyzes this information. This research can inform diverse fields such as education, psychology, and speech therapy.

Subjective and objective characteristics of voices can also be a very powerful tool in the perceptions of the speaker and listeners. The study [3] examined the subjective and objective voice measures of seven female physical education teachers over the course of a semester of student teaching. Voice measures, including acoustic and aerodynamic data, perceptual rating scales of vocal quality and vocal fatigue, and an end-of-semester questionnaire, were collected at three-time points: baseline, middle, and end of the semester. Results indicated that the subjective and objective voice measures showed significant changes at the middle and end of the semester compared to baseline, suggesting that the vocal mechanism was adapting to the increased vocal demands of teaching physical education. These findings could have important implications for understanding how teachers' voices may change over time and how to support their vocal health in the classroom.

Audio-video content has become an increasingly popular tool for delivering instructional content in educational settings, with the potential to enhance student engagement, understanding, and retention. However, the effectiveness of audio-video content depends not only on the quality of the content but also on the characteristics of the voice delivering it. The voice of the speaker can have a significant impact on the way students consume and understand the content presented. Understanding this impact can help educators improve the delivery of instructional content and enhance the learning experience of their students. This study explores the relationship between voice characteristics and the consumption of audio-video content during classes.

Four themes were carefully chosen to represent diverse topics or subjects relevant to the educational context. These themes aimed to cover a range of content areas and provide a comprehensive exploration of the influence of voice characteristics. Two videos were selected for each theme, resulting in a total of eight videos.

The selection process ensured that the videos varied in terms of content, length, and instructional approach. This approach aimed to capture different voice characteristics and their impact on students' engagement with the audio-video content.

A qualitative approach was used in the form of questionnaires. Participants were provided with questionnaires that included open-ended questions, allowing them to express their opinions, experiences, and perceptions regarding the voice characteristics in the audio-video content. The questionnaires aimed to gather rich and descriptive data on participants' thoughts and feelings. A quantitative method was employed through structured or semi-structured interviews. Participants were interviewed to gather specific data on their responses and experiences related to the voice characteristics in the audio-video content. The interviews aimed to provide more precise and measurable insights into the impact of voice characteristics.

By combining qualitative questionnaires and quantitative interviews, this mixed methods approach aimed to gather comprehensive data on the influence of voice characteristics in the consumption of audio-video content in educational settings. The integration of both methods allowed for a more holistic understanding of students' engagement and their perception of the instructional content.

The importance of audio-video content as an essential tool for delivering instructional content in educational settings cannot be overstated. The quality of the content itself is crucial, but it is equally important to consider the characteristics of the voice delivering the content. Extensive research has demonstrated that voice characteristics go beyond mere speech perception and can effectively convey valuable information related to physical characteristics, mood, affective state, attractiveness, and dominance. By recognizing the impact of voice characteristics on the consumption of audio-video content, educators have the opportunity to enhance students' engagement, understanding, and retention. This understanding allows them to improve the delivery of instructional content, leading to an enriched learning experience for their students.

In conclusion, audio-video content has become an essential tool for delivering instructional content in educational settings. While the quality of the content plays a crucial role, the characteristics of the voice delivering the content also have a significant impact on students' engagement, understanding, and retention. Research has shown that voice characteristics can convey valuable information beyond speech perception, such as physical characteristics, mood, affective state, attractiveness, and dominance. By understanding the impact of voice characteristics on the consumption of audio-video content, educators can improve the delivery of instructional content and enhance the learning experience of their students.

**Keywords:** education, motivation, motivational prosody, teaching, learning

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# Media literacy in the age of deepfake technology

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**Extended abstract:**
In this scholarly study, we explore the impact of deepfake technology on media literacy and analyze possible strategies for improving media literacy in the age of ubiquitous deepfake content. The study consists of six main parts: an introduction to deepfake technology, the development of deepfake technology, the influence of social media in the spread of deepfake content, an analysis of the impact of deepfake technology on media literacy, the presentation of strategies for improving media literacy, and a conclusion.

In the first part of the study, we introduce the concept of deepfake technology, which is based on artificial intelligence and enables the creation of realistic fake video and audio recordings. We explain how deepfake technology works and consider its increasing popularity among a wide range of users, from hacker groups to political activists. We also highlight how the rapid development of this technology has led to significant challenges in understanding and verifying information spread through the internet.

In the second part of the study, we discuss the development of deepfake technology, from its origins to its current state. We explain how generative adversarial networks (GANs) and other methods have been used to create realistic fake content, becoming increasingly sophisticated and accessible over time. We also explore how various factors, including researchers, programmers, and users, have contributed to the development and spreading of this technology.

In the third part of the study, we focus on the influence of social media in the spread of deepfake content. We analyze how social media, with their ability to rapidly and widely disseminate information, play a crucial role in the distribution of deepfake content. We consider how social media algorithms can inadvertently amplify the spread of deepfake content and how users, unaware of their origins, can contribute to their virality.

The fourth part of the study is dedicated to analyzing the impact of deepfake technology on media literacy, focusing on its implications for individuals, media, and society as a whole. We explore how deepfake content can manipulate public opinion, foster the spread of misinformation, and generate distrust in media sources. We also shed light on how deepfake technology can impact individual privacy by creating fake videos depicting individuals in compromising situations.

In the fifth part of the study, we present strategies and approaches for improving media literacy in light of the challenges posed by deepfake technology. We emphasize the importance of media literacy education, both formal and informal, which should encompass understanding how artificial intelligence creates deepfake content and developing skills to recognize them. Additionally, we propose collaboration among media outlets, educational institutions, and technology companies in the fight against misinformation.

Within the fifth part, we also highlight the significance of critical thinking and the ability to identify false information as key skills in combating the negative consequences of deepfake technology. We underscore the need for the development of digital skills, such as a basic understanding of algorithms and source verification, to equip individuals for navigating the digital environment filled with deepfake content. We also emphasize the role of media organizations in promoting transparency and objectivity to build trust among users and ensure that truthful information prevails in the media landscape.
The sixth part of the study presents the conclusion, summarizing the main findings and recommendations presented in the preceding sections. This study highlights the need for continuous adaptation of media literacy strategies to respond to rapid changes in technology and the media environment. In the era of deepfake technology, developing skills to recognize and understand false information becomes crucial for preserving the integrity of the media space and protecting individuals' privacy.

Overall, this scholarly study provides a comprehensive overview of deepfake technology and its impact on media literacy.

Through analyzing the development of deepfake technology, the influence of social media in the spread of deepfake content, the challenges posed by deepfake technology, and proposing strategies for improving media literacy, the study offers practical guidelines for educational institutions, media organizations, technology companies, and individuals. The aim of this research is to stimulate further discussion and the development of comprehensive solutions to address the challenges brought about by deepfake technology, ensuring the safety and integrity of the media space in the digital age.

By analyzing the development of deepfake technology, the influence of social media in the spread of deepfake content, the challenges posed by deepfake technology, and proposing strategies for improving media literacy, the study provides practical guidance for the development and implementation of educational programs and workshops focused on media literacy. It also emphasizes the need for the development of tools and technologies that enable the rapid and efficient detection of deepfake content, reducing its impact on the spread of misinformation and manipulation of public opinion.
Furthermore, the study underscores the importance of coordinated collaboration among different stakeholders in the fight against deepfake content, as well as the promotion of media literacy and healthy critical thinking. This involves partnerships between educational institutions, media organizations, technology companies, researchers, and political actors to collectively develop strategies to combat the negative consequences of deepfake technology.

Finally, the study calls for proactivity and engagement from individuals in the fight against disinformation and fake news, as well as the cultivation of a culture of critical thinking and responsible information consumption. In light of the challenges posed by deepfake technology, media literacy becomes not only a means to protect the integrity of the media space but also a crucial skill for preserving democratic values and protecting individuals' privacy in the digital age.

**Keywords:** deepfake, social networks, media literacy, education system, ethics, transparency

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# Application of digital devices in e-learning as a segment of e-business

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**Abstract**

The aim of the study was to investigate the application of digital devices in e-learning as a segment of e-business (with reference to the measurements on a scale we designed ourselves). The survey was conducted on a sample of 55 primary school students – grades 5 to 8. The respondents are students of "Sonja Marinković" Primary School in Zemun. The Google Forms application was used to process data obtained in the survey. The survey yielded the following results – 49,1% of the respondents were female, and 50,9% were male. When it comes to the learning purpose for which a digital device was used the most, this question was answered by 40,7% of the respondents, whereas 35,2% of the respondents answered that the most frequently used device among them is a laptop. This study confirmed the application of digital devices in e-learning as a segment of e-business. The digital environment, the Internet, social media, and applications were the basic ideas behind this research, which aims to protect primary school students from the upcoming wave of new problems.

**Keywords**: digital devices, e-business, e-learning, students, social media, apps, Internet

## Introduction

Distance learning is the broadest term among non-traditional forms of education which do not involve going to an educational institution and attending classes. The beginnings of distance learning at the university level can be traced to the 18th-century USA when correspondence studies appeared. In 1960, the first designed educational courseware for interactive distance learning was

created. Distance education can be defined as the basic educational framework implemented through the delivery of learning material, activities and educational programs via a portable medium. With the development of information and communication technologies, modern distance education has come to rely on multimedia and Internet technologies, which is why it is also known as electronic education. Online education is the narrowest term and refers to electronic education that is solely implemented online.

E-learning does not have to be carried out entirely online, instead, it can be an additional (e.g. using Intranet networks during practical classes), or supplementary form of teaching in the traditional model of education. In this context, we distinguish between the traditional model of education (Face 2 Face) – the traditional auditory system of teaching where students and teachers are physically present in the educational institution, e-learning model – in this model, the educational process is implemented with the help of ICT (distribution of teaching materials and interaction), and a hybrid model of education which combines the previous two.

Electronic education requires different techniques for planning instruction, different delivery methods, and communication methods compared to traditional education. E-learning is a complex model of education, and as such, requires a different approach. Implementing distance teaching and learning when teachers and students are separated by space and time. Teaching and learning materials in electronic form (text, audio and video material). Instead of the traditional role of a teacher behind a lectern, we have tutoring combined with various other forms of communication, from remote teamwork of student groups to the application of multimedia technologies and infrastructure for electronic education. Such applications can be very useful supplementary material for learning foreign languages for example. Trends in e-learning: Virtual reality: an innovative tool for 3D simulation of visual and audio experiences, applied to enhance traditional or online teaching, digital classroom for delivering teaching content that can look identical to traditional ones, extremely effective in those areas of education that require simulation of real events.

Learning through the application of social media: the ubiquity of social media has shaped their application in the teaching process, primarily to take advantage of their popularity among students, student projects that make use of these channels for group work or presentations, assigning tasks, announcing events, sharing links related to teaching material and interactive communication between teachers and students, a fun way of learning and acquiring knowledge adapted to their popularity among the current generations. Ashmanov and Kasperska state that lately, we have been hearing numerous warnings regarding the dangers of the digital sphere, among others, from those working in the information technology industry. They also state that the direction of these changes is not determined by us. We accept innovations as they are, and obediently conform to the changed world.

**Literature review**

In their book, Radenković et al. (2015) presented the possibilities of applying modern information and communication technologies in different areas of business in more detail, as well as the incentive to seek new and innovative learning methods. Barzut and Sajfert (2022) argue that throughout history, we have always used distribution channels that were available and adequate at the given moment: letters, radio broadcasts, TV broadcasts, and multimedia (diskettes and CDs), but now they have all been replaced by the Internet. Barzut and Sajfert (2022) state that m-learning is a new segment in e-education, which follows the trends in other areas of e-business, where mobile devices have taken over. In addition to LMS platforms, which possess their own mobile applications to be able to adapt the teaching material to the form of smaller, portable devices, information education applications are gaining in popularity. Jurić et al. (2014) profess that the real revolution on the Internet was made by web tools with the attribute "social". They changed the original purpose of the Internet from storage and communication, helping it to acquire a cooperative and interactive function, as well as the ability to create one's own items and share them. Social media have supported the transfer of knowledge and the building of shared knowledge and collective intelligence.

However, social media have also brought undesirable effects, such as compromised privacy, and creating a false image of oneself and others. They have created a certain paradox – that which is by its very definition social can now lead to antisocial behavior in which one's level of socialization is measured by the number of virtual contacts and friends, while in reality, friendship and contact have all but disappeared from human life. The number of registered users or the availability of social media is not a guarantee of the quality of content shared on them; quite the contrary, among the youngest population, they can foster bad taste, as well as a predilection to use the Internet and social media solely for entertainment. Just as all web tools developed and improved over time, so have social media developed to counter and avoid negative connotations. In his book that aims to equip current and future managers with some of the knowledge and practical skills that will help them steer their organizations toward digital business, Dave (2015) argues that the key objective of his work is to identify and review the key management decisions in organizations

transitioning toward digital business and reexamine the process by which such decisions can be made. Ivković et al. (2011) state that e-education implies the use of multimedia and the Internet for the purpose of improving the quality of learning by enabling access to remote resources and services. In addition to the default transmission of educational content via the Internet and computers, it also includes various administrative and strategic tools as support.

Depending on the degree of use of information and communication technologies, e-learning can be classified into the following groups: Traditional teaching – lectures in the classroom without the use of computers and the Internet; ICT-supported teaching – traditional teaching, but in this model, students can use ICT; and Hybrid teaching – teaching in the classroom is reduced, but not eliminated entirely, and the emphasis is on online learning; Online learning – a form of distance learning. Glušac (2012) states that electronic learning, which has been present and used in practice for over a decade, is now facilitated and enhanced through the application of ICT. At the moment, such ICT devices include the computer with additional devices, digital television, portable and pocket computers and mobile phones. In their book, Ashmanov and Kasperska argue that the digital environment – Internet, social media, applications – those are an integral element of the "multi-reality" in which modern man exists. They add that in addition to its undisputed benefits, virtual reality also brings huge risks into our lives. According to them, the result (or rather the price) of accepting the new technologies in our lives is a multitude of unusual, harmful or outright negative phenomena: spam, addiction to social media that eats up our time every day, the constant need to look at our smartphones, short attention span and inability to maintain focus, as well as a continuous stream of fake news, mass manipulation, propaganda, scaremongering and scams.

## Methodology

### Hypothesis

Primary school students in grades 5 to 8 are interested in the application of digital devices in e-learning.

### Sample

The survey was conducted in 2023 on a sample of 55 students in grades 5 to 8 from "Sonja Marinković" Primary School in Zemun. Students were told the survey was anonymous and that its results would be used for scientific purposes.

### Instruments

The Google Forms application was used to process the data obtained in the survey. One of the instruments used was the survey shown in Table 1. We designed the survey independently, in line with the need to protect primary school students from modern digital technologies.

Table 1

**Demographic data on the respondents**

| Variables |
|---|
| **1. Gender** |
| Male |
| Female |
| **2. Age** |
| 11–12 years |
| 12–13 years |
| 13–14 years |
| 14–15 years |
| **3. Most frequently used digital device** |
| Phone |
| Laptop |

| |
|---|
| Computer |
| Tablet |
| Smartwatch |
| **4. How much time do you spend using the device?** |
| Up to 1 hour |
| Between 1–2 hours |
| Between 2–3 hours |
| Between 3–4 hours |
| More than 4 hours |
| **5. What do you use the device for?** |
| Learning |
| Video games |
| Social media |
| Music |
| Drawing |
| **6. What apps/social media do you prefer?** |
| Scratch |
| Python |
| Facebook |
| Snapchat |
| Instagram |
| PowerPoint |
| Photoshop |

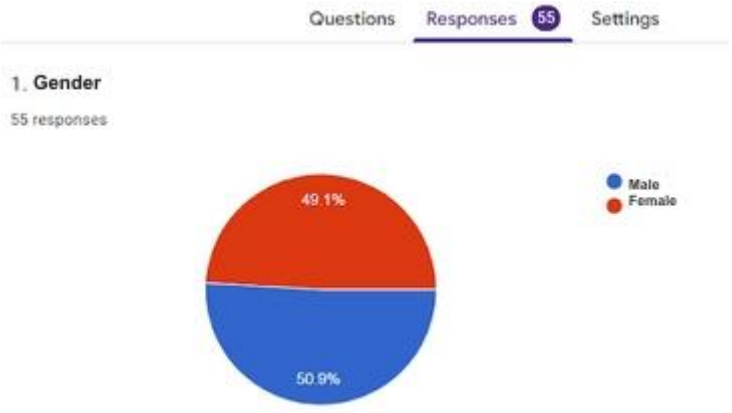
**Results**

After obtaining the results in Google Forms, we decided to present them in six pie charts.

In pie chart number 1, random selection showed that about half of the respondents were male, and the other half were female.

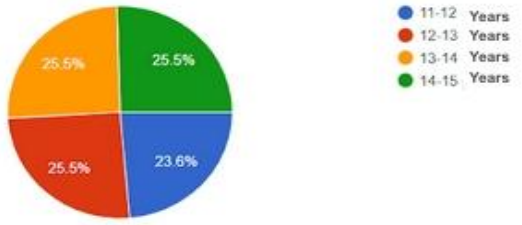
In pie chart number 2, each group of students makes up one-quarter of the total number.

In the remaining pie charts (3,4,5,6), the answers are heterogeneous, so they are interpreted in detail in the discussion.



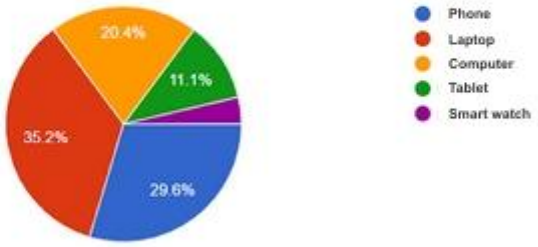
2. **Age**

55 responses



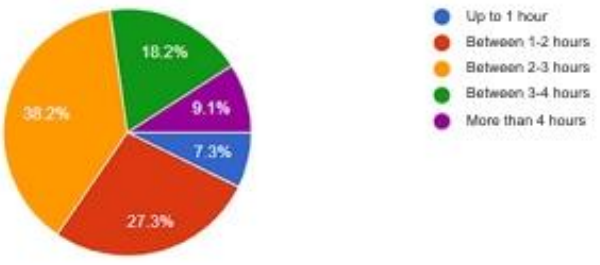

3. **Most frequently used device**

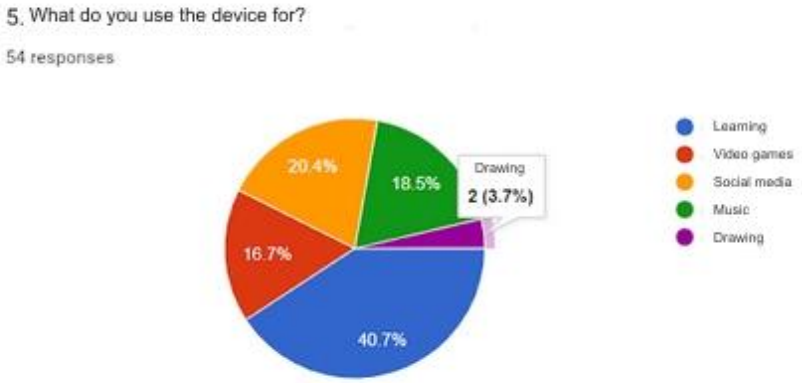
54 responses

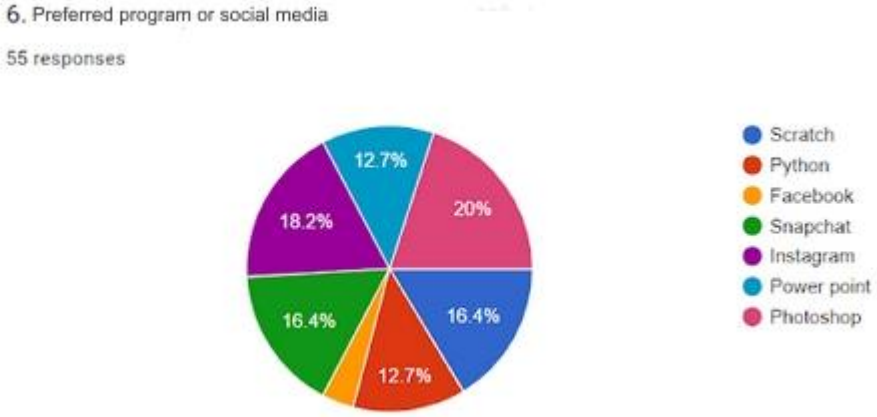



4. How much do you spend using the device?

55 responses






**Discussion**

The pie charts show the results of the surveyed 55 students in grades 5 to 8.

Out of 55 respondents, 49,1% are girls, and 50,9% are boys, as shown in pie chart 1.

Out of 55 respondents, 23,5 are aged 11–12, 25,5% are aged 12–13, 25,5% are aged 13–14, and 25,5% are aged 14–15, as shown in pie chart 2.

The most frequently used devices are the following: phone – 29,6%, – 35,2%, computer – 20,4%, tablet – 11,1%, and smartwatch – 3,7%, as shown in pie chart 3.

The answers to the question – How much time do you spend using the device? – are as follows: up to 1 hour – 7,3%, between 1–2 hours – 27,3%, between 2–3 hours – 38,2%, between 3–4 hours – 18,2%, and more than 4 hours – 9%, as shown in pie chart 4.

The answers to the question – What do you use the device for? – are as follows: learning – 40,7%, video games – 16,7%, social media – 20,4%, music – 18,5%, and drawing – 3,7%, as shown in pie chart 5.

The answer to the question – What app-social media do you prefer? – are as follows: Scratch – 16,4%, Python – 12,7%, Facebook – 3,6%, Snapchat – 16,4%, Instagram – 18,2%, PowerPoint – 12,7%, and Photoshop – 20%, as shown in pie chart 6.

**Conclusion**

The digital world is nowadays a jungle, sometimes populated by not very attractive and extremely dangerous forms of life. In the paper, we attempted to analyze the problems of digital addiction and alienation among primary school students in grades 5 to 8, as well as other phenomena present in the digital environment. The situation online is changing rapidly, creating new dangers, so the main task of this research is not only to address existing risks but also to show parents and students how to navigate the digital realm and protect themselves from the dangers of the digital industry. In doing so, the authors did not limit themselves to the identification of existing digital challenges faced both by primary and secondary school students but also sought to recognize and identify the logic behind the processes and find the common thread that unites students, parents and teachers in solving this common problem.

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# The Use of IT Tools in Teaching Music

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**Abstract**: In teaching Music, certain teaching topics can be enriched by using IT tools. Based on the outcomes of teaching Music which are outlined in the Syllabus (syllabi according to the recommendation of the Institute for the Improvement of Education) and refer to music performance, singing and playing, at the end of the class, the student will be able to: apply the correct singing technique (correct breathing, posture, articulation), use different means of expressive singing and playing, sing and play independently and in a group, develop coordination and motor skills through playing and movement, apply the principle of cooperation and mutual encouragement in making music together, understand that different elements of musical expressiveness (melody, rhythm, tempo, dynamics) affect the body and feelings. Therefore, we conclude that the use of IT tools in teaching would only be an additional motivation for students in their progress.

When discussing the segment of music literacy in student education, several applications can be helpful and can be installed on computers, tablets, and mobile phones. These include "My Ear Training" and "Noten Lernen." These applications offer elementary levels exercises but can also be used at advanced levels, making them suitable for both elementary school students and students in music schools. "My Ear Training" serves to simplify and enhance the process of sound recognition. With this application, students can master over a hundred exercises that cover various aspects of music. It starts with simple intervals, chords, and rhythms, and progresses to seventh-chord inversions, complex chord progressions, and exotic scale modes.

The application can be customized to align with different school syllabi, as well as individual student competencies. It encompasses intervals, chords, chord construction, tonal exercises using solfege, rhythmic exercises, and singing exercises, and provides the option to create and adapt exercises while providing precise statistics essential for monitoring learning progress. "Noten Lernen" is a tool that facilitates easy learning of musical notation at different levels and helps recognize notes. With the help of this application, students can assess their knowledge and evaluate their performance. This instructional resource enables teachers to continuously monitor students' progress, identify their auditory aspects, identify errors, and provide guidance on how to correct them. Among various tools for teaching music, this application has received exceptionally high ratings from teachers and the research center Forschungsstelle Appmusic (UdK Berlin). In conclusion, the use of IT tools enhances the teaching process in music education. The research on the application of IT tools in Music classes, specifically the use of IT tools, was conducted using methods of analysis, synthesis, and deduction. This research study examines the utilization of information technology (IT) tools in music education, specifically targeting Music teachers in primary schools, music subject teachers in music schools, and music art teachers in grammar schools.

The research instrument employed was a questionnaire designed for this purpose, which was distributed through Facebook groups, namely the group "Svi mi koji predajemo muzičko" and "Udruženje nastavnika muzičke kulture". A total of seventy participants were surveyed, and the questionnaire consisted of ten questions related to the use of IT tools in music teaching, specifically focusing on their direct implementation with students. Out of the respondents, sixty reported using IT tools frequently,

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while ten indicated not using them. Furthermore, the study investigated the impact of the "My Ear Training" application on student progress, with fifty-five respondents reporting significant progress and ten indicating partial progress.

Additionally, the questionnaire explored the usefulness of interval exercises and rhythmic exercises within the "My Ear Training" application, where fifty-four of them answered that it benefits them a lot, six of them benefit a little, and no one answered that it does not benefit them at all. When it comes to the rhythmic exercises in the "My Ear Training" application, fifty-seven of them answered that they are useful, and three answered that they are not. Similarly, respondents' perspectives on the effectiveness of singing exercises within the same application revealed positive responses from fifty-three participants, contrasting with seven negative responses. Questions pertaining to the "Noten Lernen" IT tool examined whether its use in teaching facilitated students' progress in sight-reading, with fifty-six respondents reporting positive outcomes and four expressing negative experiences.

The study also explored whether teachers found the "Noten Lernen" application beneficial for monitoring student progress, with fifty-seven affirming its usefulness, whereas three respondents did not find it useful. Furthermore, sixty respondents agreed that the application enabled continuous assessment of students' work, while no one disagreed. When it comes to keeping track of students' listening skills, fifty-one agreed that they find the application useful, while nine disagreed. Based on data analysis and statistical methods, it can be concluded that IT tools are commonly employed by teachers in their direct interaction with students, with sixty out of seventy participants utilizing such tools. Teachers who incorporate IT tools in music teaching believe that they facilitate easier tracking of students' progress and find singing and rhythmic exercises beneficial for students and that functional knowledge in the field of music theory, construction of intervals, chords, and scales is acceptable.

The study suggests that the application of IT tools in music education can lead to desirable educational outcomes in an engaging manner. Furthermore, the integration of informational content in music education can streamline the teaching of complex musical concepts.

**Keywords**: Music, outcomes, My Ear Training, Noten Lernen, musical literacy, musical performance

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# Immersive technologies in the educational information system model based on multimedia learning

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**Abstract:** Information systems in education, in addition to their role in managing communication between a large number of users in educational institutions, also represent educational platforms that should provide appropriate methodological access to teaching materials and the student in the learning process. The use of modern technologies in the educational process has a positive effect on the engagement of students, which can contribute to positive learning outcomes. The paper presents one approach to the use of immersive technologies within the educational information system based on multimedia learning. In addition to the description of relevant terms, the model was discussed and the advantages and possible challenges in its implementation were pointed out. The aim of this paper is to point out the advantages of using immersive technologies in optimizing the cognitive load during multimedia learning.

**Keywords:** information systems, multimedia learning, immersive technologies, augmented reality, virtual reality

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# Management and Marketing in E-Sports: Harnessing the Digital Frontier for Competitive Success

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**Abstract:** The rapid rise of e-sports has given rise to new frontiers in the management and marketing landscapes. This article comprehensively explores the e-sports industry, focusing on the crucial dynamics of effective management and marketing strategies. The study reveals that successful management in e-sports extends beyond team management to include event planning, compliance with regulatory standards, and strategic partnership handling. Equally, innovative marketing strategies that involve engaging content creation, leveraging social media and influencers, and data-driven approaches are central to the industry's success. Additionally, the article highlights the need for sustainable business models, cross-cultural management, international marketing, and player welfare considerations in the face of the industry's continuous growth and evolution. The findings offer valuable insights for e-sports organisations, marketers, and event managers seeking competitive advantage in this rapidly evolving industry.

## Introduction

E-sports, or competitive online gaming, has exploded in popularity over the past decade, becoming a significant player in the global entertainment industry. This article explores the critical dynamics of e-sports management and marketing and highlights strategies that have paved the way for successful e-sports businesses.

## The Growth of E-Sports: An Overview

The e-sports industry has shown remarkable growth, with revenue forecasts suggesting it will surpass $1.6 billion by 2023. The primary drivers of this growth include increased internet penetration, improved technology, the popularity of streaming platforms, and demographic shifts towards digital entertainment. This growth, however, also comes with increased competition, requiring excellent management and marketing to ensure success.

## Management in E-Sports

Successful management in e-sports goes beyond mere team management; it includes orchestrating events, ensuring compliance with regulatory standards, securing and managing sponsorships, and overseeing broadcast rights, among others.

**Event Management**

E-sports events, whether online or offline, require significant planning and coordination. The goal is to create a seamless experience that captivates audiences, encourages participation, and promotes brand engagement. Successful events can drastically increase an e-sport organisation's visibility, attract more players and viewers, and potentially lure high-profile sponsors.

**Compliance and Governance**

Given the international nature of e-sports, compliance with various legal and regulatory requirements is crucial. This could range from international contract laws when signing players from different countries to copyright issues when broadcasting games. Missteps can lead to costly lawsuits and reputational damage.

**Sponsorships and Partnerships**

The lion's share of e-sports revenue comes from sponsorships. This necessitates a proactive approach to securing and managing partnerships, often involving negotiation skills, industry knowledge, and relationship management.

**Marketing in E-Sports**

E-sports marketing revolves around understanding the e-sports audience, a young, digital-native, and globally dispersed demographic. This unique demographic calls for marketing strategies that are as innovative as they are effective.

**Content Creation**

E-sports fans consume vast amounts of digital content. Effective content marketing in e-sports involves creating engaging, relatable, and shareable content, such as highlight reels, player interviews, behind-the-scenes footage, and more.

**Social Media and Influencer Marketing**

The social media landscape plays a pivotal role in e-sports marketing. Platforms like Twitch, YouTube, and Twitter are integral to the e-sports community. Meanwhile, partnering with influencers, such as popular streamers, can significantly boost visibility and brand image.

**Data-Driven Marketing**

The digital nature of e-sports provides access to vast amounts of data. Utilising this data to understand consumer behaviours, preferences, and trends can greatly enhance marketing effectiveness.

**Compliance, Sponsorship Management, and Innovative Marketing Strategies**

Effective event management, understanding the nuances of regulatory compliance, and effectively handling sponsorships form the backbone of successful e-sports management. On the marketing front, creating engaging content, leveraging social media and influencers, and implementing data-driven strategies is crucial to capturing the attention of the e-sports audience. The ability to successfully navigate these dynamics will determine organisations' competitive success in the rapidly growing and evolving e-sports industry.

**Discussion**

The findings indicate the need for a nuanced approach to managing and marketing in the e-sports industry. A crucial challenge is the development of sustainable business models and diversification of income streams (Wagner et al., 2022). In addition, globalisation presents challenges in cross-cultural management and international marketing. Finally, attention to player welfare is also vital due to increasing pressures in the industry.

**Future Perspectives**

As the e-sports industry evolves, management and marketing professionals must remain adaptable and innovative. The industry's growth is anticipated to present new challenges in maintaining sustainable business models, managing player welfare, and navigating international marketing due to the increasingly global nature of e-sports (Wagner et al., 2022; Hallmann & Giel, 2022). These findings suggest that successful future strategies must emphasise the diversification of revenue streams, prioritise player well-being, and enhance cross-cultural management and marketing practices.

**Implications for Practice**

The findings of this study have important implications for e-sports organisations, marketers, and event managers. Effective management and marketing strategies are central to success in the rapidly evolving e-sports industry. Understanding the unique dynamics of the e-sports audience and the importance of compliance, event management, and strategic partnerships can guide organisations towards sustainable growth and competitive advantage.

**Conclusion**

E-sports has transitioned from a niche hobby to a mainstream entertainment industry with a global audience. As a result, the competitive success of e-sports organisations will increasingly hinge on their management and marketing capabilities. By harnessing the power of digital platforms, engaging with their audience, ensuring regulatory compliance, and establishing sustainable business practices, e-sports organisations can position themselves for a successful future in the fast-paced and dynamic world of e-sports.

**Keywords:** e-sports, management, marketing, content creation, data-driven marketing, event management, compliance, sponsorships, partnerships, social media, influencer marketing, globalisation, player welfare, sustainable business models.

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# Augmented Reality in Healthcare: Enhancing Diagnosis, Treatment, and Training

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**Abstract:**

Augmented Reality (AR) offers a substantial potential for healthcare improvement across diagnostic procedures, surgical operations, and medical education. This paper reviews recent studies to explore AR's impact on healthcare, revealing benefits such as improved interpretation of medical imaging data, enhanced surgical precision, and superior knowledge retention in medical training. However, several challenges remain, including needing more robust clinical trials, addressing data privacy concerns, and overcoming technical limitations like high computational power requirements and user discomfort. The promising outcomes indicate AR's capacity to revolutionise healthcare, but substantial research, rigorous clinical trials, and comprehensive solutions to identified challenges are essential. In addition, future studies should focus on standardising AR application protocols, examining its long-term effects on patient outcomes, and devising cost-effective integration strategies.

**Introduction:** Healthcare delivery evolves with innovative digital technologies, including augmented reality (AR). AR's ability to overlay digital information onto the physical world can potentially enhance healthcare provision across various areas, including diagnostic procedures, surgical operations, and medical education (Bork, F., & Primig, B., 2022).

**Methods:** This paper draws on a comprehensive review of primary studies from peer-reviewed journals, case reports, clinical trials, and systematic reviews focused on AR applications in healthcare, published between 2018 and 2023 (Smith, J., & Jones, M., 2022). The focus is on examining AR's impacts on patient outcomes, the efficiency of healthcare delivery, and medical training quality.

**Results:** Emerging evidence indicates that AR can substantially enhance healthcare delivery. In diagnostic procedures, AR can facilitate more accurate and efficient interpretation of medical imaging data (Kumar, N., & Smith, R., 2023). AR's capacity to visualise complex anatomical structures in real-time can improve surgical precision for surgical procedures, leading to enhanced patient outcomes (Johnson, A., & White, P., 2023). AR allows for interactive, realistic training experiences in medical education, potentially enhancing knowledge retention and skills development (Lee, S., & Kim, M., 2023). The benefits of AR in healthcare are diverse and significant. AR helps doctors visualise complex medical imaging data intuitively and comprehensively in diagnostic procedures. By overlaying 3D visualisations onto the physical world, clinicians can gain better insight into patient conditions, facilitating more precise diagnoses and targeted treatment plans (Kumar, N., & Smith, R., 2023).

AR technology is reshaping the surgical landscape in surgical procedures by providing surgeons with real-time 3D visualisations of the patient's anatomy. This ability enhances surgical precision by guiding the surgeon during intricate procedures and reducing the risk of surgical complications. Studies have shown reduced surgery time, minimised invasive procedures, and improved patient outcomes when AR is implemented in surgical procedures (Johnson, A., & White, P., 2023).

Regarding medical education, AR transforms traditional teaching methodologies by providing interactive, immersive learning experiences. This technology bridges the gap between theoretical knowledge and practical application, enabling medical students and professionals to practice procedures in a controlled, virtual environment. Initial studies show that AR enhances understanding, skills development, and knowledge retention in medical education, making it a powerful tool for training the next generation of healthcare professionals (Lee, S., & Kim, M., 2023).

Moreover, AR's potential is also being explored in patient education and rehabilitation. AR applications that provide visual and interactive explanations of medical conditions, treatments, and rehabilitation exercises can enhance patients' understanding and adherence to treatment plans. Preliminary studies have shown promising results in patient engagement and rehabilitation outcomes (Brown, C., & Thompson, N., 2023).

Despite these promising findings, more extensive and rigorous studies are needed to validate and extend these initial results. In particular, further investigation is required to determine how these benefits of AR can be maximised while minimising potential risks and challenges.

**Discussion:** While AR's potential in healthcare is considerable, several challenges need addressing, including robust clinical trials to establish the technology's efficacy conclusively (Miller, L., & Davis, T., 2023). Moreover, there are issues related to data privacy and technical limitations, such as the requirement for high computational power and potential user discomfort (Clark, J., & Thompson, K., 2023).

**Conclusion:** Augmented reality promises to revolutionise healthcare delivery by enhancing diagnostics, treatment, and medical training. Despite the promising outcomes in patient care efficiency and improved medical education quality, extensive research, rigorous clinical trials, and comprehensive solutions to data privacy and technical constraints are necessary to realise AR's potential in healthcare fully (Miller, L., & Davis, T., 2023; Clark, J., & Thompson, K., 2023).

**Future Work:** Future research should focus on developing standardised protocols for AR application in different medical settings, exploring its long-term effects on patient outcomes, and identifying cost-effective strategies for integration into routine healthcare practice. Moreover, large-scale studies are required to validate the preliminary findings of AR's impact on medical training (Lee, S., & Kim, M., 2023).

Implications: AR could significantly transform the healthcare landscape with further development and research. It could facilitate improved patient outcomes, better resource utilisation, and enhanced education for medical professionals. However, stakeholders must consider the ethical and technological issues that arise with the implementation of AR in healthcare to ensure fair and safe use of this promising technology (Bork, F., & Primig, B., 2022).

**Keywords**: Augmented reality, Healthcare, Diagnosis, Treatment, Medical Education, Digital technology

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# Multisensory Teaching in Interior Design Education: The Role of 3D Modeling and Animation in the Application of VR/AR Technologies

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**Abstract:**

Viewed in a broader context, digital technology concepts for displaying and rendering environments, such as virtual reality (VR) and augmented reality (AR), are equally important in the field of interior design and planning, although their contribution may differ. These technologies are widely used, primarily in the stage of checking solutions and presenting interior designs and their components and elements to potential clients (Lee, 2009). The main research question raised in this paper is: What benefits do VR and AR technology bring to the field of interior design when implemented in teaching, and what key aspects should we focus on when using these technologies for academic purposes to educate future interior designers? The paper examines the use of 3D modeling software and animation in the process of creating virtual environments and augmented realities in the field of interior design (Wang & Hu, 2022). The research in this paper will point out the importance, as well as the positive and negative aspects, of the application of VR and AR as teaching methods. The research results will open up several important questions for further studies in this area, and offer suggestions to help develop and improve the application of VR and AR technology as teaching methods in interior design education (Kalantari, 2020). The research method used to analyze the aspects of VR and AR technology mentioned above is a comparative qualitative analysis.

The virtual environment or virtual reality (VR) as a digitally generated environment simulates a multisensory experience of the real environment, by engaging the senses of sight, hearing, touch, and smell. By using VR devices, users can communicate with each other and interact with objects in the digital environment, thus influencing and shaping the experience of the real environment. As it happens, the VR device is the forerunner of the personal computer. The first VR machine, known as the "Sensorama", was patented in 1962 by the American cinematographer Morton Heilig in the form of a theater for four people which used a combination of technologies to achieve multisensory stimulation (Wang et al., 2022). Six short films displayed in the "Sensorama" using a stereoscopic 3D color screen, stereo speakers, chair vibration, atmospheric effects and odor emitters (such as wind) introduced the device to users as the very first portal to virtual reality.

In interior design, VR technology is used, both in the early stages of concept development to facilitate communication between project participants, in the process of presenting the project to clients, and finally, in the final stage of project implementation. Experiencing the project through virtual reality facilitates communication between the architect and the client, as well as between the architect and contractors. Instead of photorealistic renderings that show a two-dimensional image of space, VR allows users to interactively change the properties of the environment, e.g. changes in spatial organization, furniture, materials and textures, color

palette, lighting, etc., thus speeding up the process and finalization of a design solution, i.e. the concept of the final solution. Modern portals into virtual reality are devices such as VR glasses and headsets (Meta Quest 2, VIVE Cosmos, PlayStation® VR, Gear VR, Google Cardboard).

Augmented reality (AR) is an interactive version of spatial organization that combines three-dimensional elements and environments from the real world with digitally generated content – visual elements, sounds, odors, haptic and other sensory stimuli through holographic technology. The chief medium for using augmented reality in interior design is primarily mobile applications, and one of the most successful examples is IKEA Place launched by IKEA in 2017. This app allowed buyers of IKEA furniture to visualize furniture items in their own space via mobile phone or tablet, thus checking if that item fits into a particular space depending on its size, upholstery color, etc. (Oliveira, 2022). Statistics show that 60% of IKEA buyers are inclined to use AR when choosing furniture.

In the scientific article "Application of VR Technology in Civil Engineering Education", the development status of the VR environment and its applications as a teaching model is analyzed, and the advantages and feasibility of VR-supported teaching aimed at improving the learning experience and outcomes are illustrated (Wang et al., 2022). Certain international colleges and universities use VR technology to attract students and promote their campus culture. In addition, many colleges and universities actively study VR technology and its applications, and in this way, by simulating systems through applications, they effectively translate scientific research achievements into the domain of practical technology, using the advantage of virtual research laboratories over traditional ones. However, this article also argues that the application of VR technology in the education system of some countries, e.g. China, is limited to research and research-based teaching in colleges and universities, and still hasn't taken root among students.

In order to achieve a dynamic, interactive, and multisensory experience in interior design education through the use of VR and AR technology, as well as the immediacy of user control and participation in interior design, one of the recommendations highlighted in this article as an effective solution for the implementation of these technologies in teaching is creating a virtual simulation laboratory. This laboratory can help create an environment and conditions for intuitive and visual learning, thus overcoming the limitations of the spatial context, and allowing users to easily conduct experimental research on their computers, by setting arbitrary parameters. A recommendation for improving the effectiveness of this experimental teaching method, and teaching in general, is the method of multisensory teaching, especially in multimedia learning, which improves the efficiency of reception of information, and in turn, the efficiency of memorization and learning. Research has shown that multisensory reception of information – by hearing, smell, touch and taste, in addition to visual memory, i.e. their combination and integration in the process of knowledge acquisition, helps improve memory efficiency, and thus speeds up the learning process. Predictions are that the application of VR and AR technology in the process of multisensory teaching can help shape more advanced and effective teaching methods.

**Keywords:** 3D modeling, virtual environment, augmented reality, interior design, multi-sensory, teaching methods

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# How can AI and ML become the utmost tool for handball handicap training?

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**Abstract**: Training individuals with disabilities can indeed have positive effects on society and potentially reduce economic pressure in several ways: offering new employment opportunities, increasing tax revenue, decreasing healthcare costs, social inclusion and reducing stigma. It is important to note that training individuals with disabilities should go beyond mere skill development. It should encompass creating accessible environments, providing reasonable accommodations, and fostering a supportive and inclusive culture. By investing in the training and development of individuals with disabilities, society can reap economic, social, and cultural benefits while promoting equality and inclusion for all. This article identifies some methods that AI can be used in persons with disabilities practising a team sport, such as handball.

Keywords: Handball, AI, ML, Sports 4 All, Handicap

**Introduction**:

Providing new employment possibilities, increasing tax income, lowering health care expenses, promoting social participation, and reducing stigma are just a few of the ways that training people with disabilities may positively impact society and perhaps lessen the economic burden.

Employment Opportunities: Providing training and education to individuals with disabilities can enhance their skills, knowledge, and employability. Enabling them to participate in the workforce reduces dependency on social welfare programs and increases their contribution to the economy. This increases productivity and reduces economic pressure on the government and society.

Increased Tax Revenue: When individuals with disabilities are trained and employed, they earn an income and become taxpayers. The additional tax revenue generated from their employment contributes to government funds and helps offset social welfare costs, reducing the economic burden on society.

Decreased Healthcare Costs: Training programs for individuals with disabilities can focus on improving their overall health and well-being. Promoting healthy lifestyles and providing access to appropriate healthcare services may decrease the likelihood of costly medical interventions and hospitalisations. This reduces healthcare expenditures and alleviates the economic pressure on healthcare systems.

Entrepreneurship and Innovation: Training individuals with disabilities can foster entrepreneurship and innovation within this population. By supporting and encouraging disabled individuals to start their businesses or contribute innovative ideas, they can become active contributors to economic growth. This diversification of the economy can lead to job creation, increased competitiveness, and reduced financial pressure.

Social Inclusion and Reduced Stigma: Training individuals with disabilities enhance their skills, promotes social inclusion, and reduces stigma. When people with disabilities are given opportunities to learn, grow, and participate fully in society, it leads to a more inclusive and equitable community. This can positively impact social cohesion, mental health, and overall societal well-being (Morgan, 2019).

It is crucial to remember that training for people with impairments should go beyond only developing their skills. It should include cultivating a supportive and inclusive culture, establishing accessible surroundings, and making reasonable concessions. Society may profit economically, socially, and culturally from supporting the training and development of people with disabilities while advancing equality and inclusion for everyone.

Before analysing how we can use AI and ML in handball handicap training, we might need to define the main concepts of this article, such as

In sports, a *handicap* is a system that equalises the competition between participants of different skill levels. It allows individuals or teams with varying abilities to compete on a more level playing field. Handicaps are commonly used in sports like golf and horse racing. In handball, handicaps may be applied to adjust the score or playing conditions to create fair competition between teams of differing abilities (Legea 448/2006).

"*Sports for All*" is a broader concept that promotes inclusivity and accessibility in sports, aiming to provide opportunities for everyone, regardless of age, gender, ability, or background, to participate in and enjoy sports activities. The goal is to remove barriers and create an inclusive environment where individuals of all abilities can engage in physical activities and experience the benefits of sports. Sports for All initiatives may involve adapting rules or equipment, providing coaching and training programs tailored to different needs, and creating inclusive sports facilities and events. The focus is on promoting diversity, encouraging participation, and fostering social integration through sports (Uyar, 2022).

In the context of handball, a Sports for All approach may involve organising inclusive handball programs that cater to individuals with disabilities, providing adaptive equipment or modified rules to accommodate different abilities, and promoting awareness and acceptance of diversity within the handball community (Popa, 2020).

Artificial Intelligence (AI) refers to developing computer systems that can perform tasks that typically require human intelligence. AI aims to simulate intelligent behaviour, reasoning, learning, and problem-solving. It involves the creation of algorithms and models to enable machines to perceive, reason, and make decisions (Kuleto, 2022).

Machine Learning (ML) is a subset of AI that focuses on enabling machines to learn and improve from data without being explicitly programmed. It involves developing algorithms and models that can automatically learn patterns, make predictions, and adapt their behaviour based on the available data. Machine learning techniques like neural networks and decision trees can analyse large datasets to extract meaningful insights and improve performance over time (Ilic, 2021; Kuleto, 2021).

Handball AI refers to the application of artificial intelligence (AI) technologies in the sport of handball. AI can be used in various aspects of handball, including player performance analysis, referee decision-making, and coaching assistance.

**AI in handball**

In this section, we present a few ways AI and ML can be applied in handball:
Bringing these concepts together, AI and ML can be applied in handball in various ways:

A. Player Performance Analysis: AI and machine learning algorithms can analyse player performance data, such as movement patterns, shooting accuracy, or decision-making, to provide valuable insights for coaches and players. This analysis can help identify areas for improvement, optimise training programs, and enhance overall team performance.

B. Referee Decision Support: AI technologies can assist referees in making accurate decisions by analysing real-time video feeds and detecting potential rule violations or controversial incidents. This can help reduce human error and ensure fair play during handball matches.
C. Game Simulation and Strategy: AI and machine learning can simulate handball matches and create virtual environments to test different strategies and game scenarios. Coaches and players can use these simulations to refine tactics, evaluate performance, and make informed decisions during actual games.
D. Injury Prevention: AI techniques can analyse player movement data to detect patterns that may increase the risk of injuries. By identifying potential issues, coaches and sports scientists can develop training programs that minimise the risk of injuries and improve player safety.
E. Fan Engagement: AI-powered platforms and applications can enhance the fan experience by providing real-time statistics, highlights, and personalised content. In addition, AI algorithms can analyse match data to generate interesting insights and predictions, enabling fans to engage more deeply with the sport.

It is important to note that while AI can provide valuable insights and assistance, the final decisions in handball are still made by human players, coaches, and referees. AI technologies are meant to support and augment human capabilities rather than replace them.

**Conclusions**

Handball, handicap systems, and the concept of Sports for All represent different aspects of sports and inclusivity. Handball is a specific sport, handicap refers to levelling the playing field in competitive sports, and Sports for All advocates for inclusivity and accessibility in sports activities for everyone.

Successful application of AI and machine learning in handball requires access to quality data, appropriate algorithms, and expertise in implementing these technologies. Moreover, human judgment and expertise remain crucial in utilising AI as a supportive tool in handball rather than replacing human decision-making entirely.

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# Artificial Intelligence and Smart Learning Environment – Challenges of the Future of Higher Education

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**Abstract:** The concept of a smart learning environment is a new paradigm in education. Smart learning environment is a new e-learning model that constitutes the synthesis of technological and pedagogical approaches to education. It is an open, interactive, and intelligent system for teaching and sharing knowledge, adaptable to the student and based on the application of new technologies (Fourth Industrial Revolution technologies or 4IR technologies). Smart learning environment (SLE) is an adaptive system that puts the student at the forefront, providing them with an extended and enhanced, controlled, and interactive learning experience. It allows continuous access to resources and teaching aids, offering an abundance of necessary information and knowledge. SLE creates a stimulating learning atmosphere where students are encouraged to explore, analyse, and ask questions, choose their learning methods, and can plan and organise their learning according to their needs, interests, and goals.

SLE utilises a set of smart technologies and devices that form a suitable technological portfolio or platform. It should be emphasised that these technologies are constantly advancing and improving, thus they have not yet reached their full potential. These technologies include Artificial Intelligence, Internet of Things (IoT), Virtual Reality (VR), Augmented Reality (AR), Brain-Computer Interface (BCI), exoskeleton, holographic technology, and similar. The development of these technologies and the emergence of other new technologies contribute to the continuous expansion, differentiation, and responsiveness of the SLE system. This technological portfolio within the SLE system enables effective and creative interaction, as well as the fusion of pedagogical and technological approaches to learning.

The role of Artificial Intelligence (AI) in the SLE technological platform is of critical importance. AI provides continuous monitoring, analysis, and interactive, contextual communication with the student. Within the SLE system, AI performs the most complex tasks, replacing human teachers, mentors, or professors, acting as an active autonomous agent. It manages the SLE system, connecting all its constituent elements, coordinating its functioning, participating in the production of required digital content, delivering it to the student, and engaging in communication with the student throughout the learning process. AI also performs surveillance and control functions, making appropriate corrections, adjustments, and interventions in the mode, scope, and dynamics of learning if deemed necessary. It can monitor students, control their behaviour, and notify instructors in case there occur some problems, unauthorized student behaviour, or deviations from the rules.

Connected with the Internet of Things (IoT) and various sensors, AI can monitor the working conditions and atmosphere in the classroom, providing a safer and environmentally friendly context. This includes adjusting lighting, ventilation, temperature, and other conditions in the classroom. Higher levels of interactivity in communication and continuous monitoring encourages students

to express creativity and show initiative. Overall, AI contributes to increasing human productivity and improving the quality of student work, enhancing, and accelerating the learning process.

SLE technologies, such as VR or AR, offer a radically different approach to learning, providing new dimensions and experiences throughout the entire learning process. VR, AR, and Mixed Reality (MR), as their combination, offer a completely new perception of reality and enable "immersion" in the subject and topic of learning, which results in spectacular outcomes and encourages students to show initiative, to explore and experiment.

The integration of AI into VR, AR, and MR contributes to greater efficiency of the SLE system and opens countless new possibilities for learning. AI-based techniques are used to generate so-called avatars, digital humanoid characters, which can perform various tasks and successfully replace humans in the virtual world. The concept of the metaverse has been developed due to the increasingly widespread use of VR, AR, and AI technologies. Metaverse represents a parallel digital universe in which users (students) can reside, work, and perform various tasks. In the metaverse, users can have intense and multisensory interactions. The metaverse environment provides the opportunity to influence virtual objects, explore them and understand them in depth.

The application of the metaverse concept in education is still in its early stages, but the possibilities it brings are immense. The metaverse can serve as a digital space where students, through their avatars, can meet, learn together, communicate, exchange experiences, or discuss what they learned. However, alongside the numerous advantages the metaverse can offer in the learning process, there are several challenges, such as privacy concerns, data theft risks, metaverse stability, costs, the issue of efficiency, and especially the impact it may have on the users' mental health, which includes the potential for addiction and various psychological disorders that may arise, for instance, issues with perception, disorientation, self-isolation, alienation, depression, and other mental health problems.

AI is combined with other technologies, giving rise to new technological possibilities. Educational robots equipped with sensors and AI are emerging, capable of assuming the role of teachers. Chatbots, which represent a combination of AI and Natural Language Processing (NLP) technology, are also being applied.

The latest trend in AI development is the use of large language models (LLMs), which are a type of machine learning model that can perform various tasks in natural language processing (NLP). This includes generating textual or graphical content, answering questions, engaging in conversations, or translating text from one language to another. The emergence of chatbots like ChatGPT 4 has revolutionised communication, learning, and knowledge management. The application of such chatbots in education raises numerous questions and necessitates critical reassessment and rethinking of education and the role of teaching staff in the learning and education process.

There are many open questions and challenges implied by the implementation of the SLE system. The role of teachers, mentors and professors is the key question. New 4IR technologies offer the possibility of replacing human teachers with metaverse, robots equipped with AI, virtual mentors, facilitators, and chatbots. Can these technological possibilities truly replace human teachers, mentors, and professors? Currently, this is not achievable, however, with further advancement in 4IR and the development of new concepts and techniques, such possibilities are becoming a reality. Society needs to prepare for these dramatic changes. Teachers should accept a new role within the SLE system, one that would involve coordinating, supervising, correcting mistakes and controlling how this technology functions.

Society must find ways to reconcile the excessive growth and expansion of 4IR technologies with the needs of society, and to prevent potential negative effects on the economy and society, such as increasing unemployment, questioning the role of educators, promoting unethical practices, and creating a technologised, automated environment that leads to alienation and dehumanization. Therefore, it is necessary to create specific political and legal conditions that ensure security for employees in education, establish clear legal and ethical limitations and standards, ensuring a balanced and sustainable technological and social development for the benefit of all.

**Keywords:** smart learning environment, artificial intelligence, higher education, 4IR technologies

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# Conceptual Analysis and potential Applications of DL NN Transformer and GPT Artificial Intelligence models for the Transformation and enhancement of Enterprise Management, EIS/ESS, and Decision Support Integrated Information Systems

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**Abstract:** This paper deals with the conceptual analysis and possibilities of application of DL NN Transformer and GPT mode of artificial intelligence in the context of transformation and improvement of company management systems, integrated company information management systems (EIS/ESS) and decision support systems. The first part of the paper gives a theoretical overview of DL NN Transformer and GPT models, their architecture, functionality, and applications in various fields. The key characteristics of these models and their potential application in the company's management systems, EIS/ESS and decision support systems were analyzed. The potential challenges and limitations of implementing these models in the business environment are discussed below. The paper presents a proposal of the concept of applicability of these solutions in the domain of DSS and EIS information systems (which is a novelty) as well as examples of new market solutions that confirm the feasibility of the proposed concept. The advantages and possible benefits of applying DL NN Transformer and GPT models in the company's integrated information systems were highlighted. Guidelines for further research and development of these solutions are presented. Research results can be useful for organizations that strive to take advantage of advanced AI models in business process optimization and decision-making.

**Keywords**: DL (Deep Learning), NN (Neural Networks), Transformer model, GPT (Generative Pre-trained Transformer) model, Artificial Intelligence (AI), Machine Learning, Enterprise Management, Decision Support Systems, Information Systems, Data Analysis, Business Processes, Optimization, Intelligent Systems, Digital Transformation, Data-driven Decision-making, AI Applications, Management Information Systems - MIS (Srb. UIS), ES, ERP, CRM, ESS, DSS.

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# Artificial Intelligence as a Creative Partner: Innovations and Ethical Implications in the Field of Music Composition and Production

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**Abstract**: This topic encompasses various aspects of artificial intelligence in the music industry, including algorithms for generating musical compositions, adaptation and personalization of musical content, as well as ethical issues related to copyrights and responsibilities in the process of creating music with the help of artificial intelligence.

**Introduction:**

Artificial Intelligence (AI) is becoming an increasingly important tool in many fields, including the music industry. This paper explores the role of artificial intelligence as a creative partner in musical composition and production, focusing on innovations and ethical implications arising from such a partnership. In recent years, numerous studies have investigated how AI-based algorithms can generate musical compositions (Briot et al., 2020), and how AI can contribute to the personalization and adaptation of musical content (Herremans, & Chuan, 2017).

**Methods**:

This paper uses a combination of qualitative and quantitative methods to analyse the role of artificial intelligence in musical composition and production. First, a literature review is conducted to identify key algorithms and technologies used in AI in the context of musical composition (Briot et al., 2020) and music production (Herremans, & Chuan, 2017). Then, an analysis of case studies of AI in music projects is carried out to illustrate different aspects of AI as a creative partner.

**Results**:

The results of this research show that artificial intelligence can contribute to musical composition and production in several ways. First, AI can generate original musical compositions, using algorithms based on deep learning or artificial neural networks (Briot et

al., 2020). These algorithms enable AI to learn from large data sets and create new musical compositions reflecting different styles and genres.

Second, AI can contribute to the personalisation and adaptation of musical content, allowing users to customize their musical experience based on personal preferences (Herremans, & Chuan, 2017). This includes recommending music based on previous listening, as well as adapting musical compositions in real time according to the listener's preferences.

Third, AI can enhance music production, allowing producers to create music works more efficiently and quickly. This includes tools for automatic mixing, mastering, and optimizing audio signals (Briot, et al, 2020)).

We also present several case studies illustrating the application of artificial intelligence in music:

AIVA (Artificial Intelligence Virtual Assistant) is an AI composer developed in 2016, which uses deep learning to compose original music in various styles and genres. AIVA is trained on a large dataset of classical music and can create music pieces for movies, video games, and other media projects. AIVA is the first AI to receive author status from SACEM (French Society of Authors, Composers, and Music Publishers).

OpenAI's MuseNet is an AI that uses OpenAI's Generative Pre-trained Transformer (GPT) to generate musical compositions. MuseNet can create new melodies in various styles, combining genres and styles of different composers. The AI is trained on a wide spectrum of musical genres, from classical and jazz music to rock and pop.

Google Magenta is a research project that uses TensorFlow, Google's open-source library for machine learning, to explore the possibilities of applying AI in art and music. The project has developed a number of AI tools and applications for generating and modifying music, such as NSynth, MusicVAE, and Magenta Studio. These tools use various deep learning techniques, such as Generative Adversarial Models (GAN) and Variational Autoencoders (VAE), to create new sounds and musical compositions.

These examples illustrate how artificial intelligence can be applied in music to generate new compositions, modify existing sounds, and explore new musical styles and genres.

**Discussion**:

While artificial intelligence offers numerous benefits in musical composition and production, ethical implications arise from using AI as a creative partner.

In addition to generating new compositions and modifying existing sounds, AI can contribute to music personalisation and adaptation, allowing users to tailor their musical experience based on personal preferences (Herremans, & Chuan, 2017). This includes recommending music based on previous listens, as well as adjusting music compositions in real time according to the listener's preferences.

Thirdly, AI can enhance music production, enabling producers to create musical pieces more efficiently and quickly. This includes tools for automatic mixing, mastering, and audio signal optimisation (Briot et al., 2020).

We also present several case studies that illustrate the application of artificial intelligence in music:

AIVA (Artificial Intelligence Virtual Assistant) is an AI composer developed in 2016, which uses deep learning to compose original music in different styles and genres. AIVA was trained on a large classical music dataset and can create musical works for movies, video games, and other media projects. AIVA was the first AI to be granted authorship status by SACEM (the French Society of Authors, Composers, and Music Publishers).

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These examples illustrate how artificial intelligence can be applied in music to generate new compositions, modify existing sounds, and explore new musical styles and genres.

Discussion: While artificial intelligence offers numerous advantages in music composition and production, ethical implications arise from using AI as a creative partner. One of the key issues is the question of copyright and ownership over music pieces generated with the help of AI (Sundararajan, 2021). Given that artificial intelligence algorithms often learn from existing musical works, it raises the question of whether AI-generated music represents an original work or a derivative of previously existing music. Also, consideration should be given to whether artificial intelligence can be considered an author of a work and how this relates to the traditional understanding of copyright.

Another ethical dilemma related to AI and music is the question of responsibility. When AI generates music that could be controversial or harmful, who is responsible for the content of that music? Is it the person who developed the algorithm, the user who uses it, or the AI itself? These questions require further consideration to find appropriate solutions per legal and ethical frameworks (Mittelstadt et al., 2020).

**Conclusion**:

This paper explores the role of artificial intelligence as a creative partner in music composition and production, focusing on innovations and ethical implications arising from such a partnership. The research results show that AI offers numerous advantages in music composition and production but also brings ethical challenges that require further research and consideration. Adopting appropriate legal and ethical frameworks can help address these challenges and enable AI to contribute to the music industry in a sustainable and ethically acceptable way.

In this study, we explored the role of artificial intelligence as a creative partner in music composition and production, focusing on the innovations and ethical implications that arise from such a partnership. The research results show that AI offers numerous advantages in music composition and production but it also brings ethical challenges requiring further research and consideration. Adopting appropriate legal and ethical frameworks can help address these challenges and enable AI to contribute to the music industry in a sustainable and ethically acceptable way. Through this research paper, we hope to initiate a Discussion about the importance of proper regulation and ethical standards in the field of music and artificial intelligence in order to facilitate further innovation and growth in this area while respecting the rights of all participants in the music creation process.

As we continue to integrate AI into our daily lives, the dialogue around the intersection of artificial intelligence, music, and ethics needs to be ongoing. Research must be dedicated to developing AI technology that is sensitive to copyright issues and ensuring the correct attribution of creative outputs.

Future Directions: Avenues for future research could explore the potential for AI to not only mimic existing styles of music but also to create entirely new genres. Furthermore, studying how AI algorithms interpret, learn from, and innovate upon the vast array of global music traditions could lead to fascinating discoveries.

A particularly interesting area to investigate is the emotional connection between music and the listener. Can AI-generated music evoke the same depth of emotional response as human-composed music? Research could delve into AI-generated music's neuroscientific and psychological aspects, providing insight into our cognitive and emotional responses.

Finally, integrating AI into live performances, improvisation, and real-time audience interaction is another exciting field for further exploration. Current technologies such as AIVA, MuseNet, and Google Magenta have largely focused on composition, but the real-time applications of AI in live music have yet to be thoroughly examined.

In summary, artificial intelligence has made significant strides in the field of music composition and production, proving itself as a competent, creative partner. However, as we invite AI into our creative spaces, we must continue to explore and address the ethical implications. Only by maintaining this balance can we fully harness AI's innovative potential in music while respecting and protecting the essential human element at the heart of all musical endeavours.

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# Leveraging Artificial Intelligence in the Finance Industry: A Transformative Paradigm

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**Abstract:** The rapid evolution and integration of Artificial Intelligence (AI) into various sectors are significantly transforming traditional paradigms, with the finance industry being a prominent field of application. This paper explores the current impact, potential opportunities, associated challenges, and prospects of AI in finance through a systematic review of scholarly articles, industry reports, and case studies. The results indicate that AI has significantly influenced risk management, trading, customer service, fraud detection, and personalisation of financial services, enhancing efficiency, security, and customer satisfaction. However, the paper also discusses critical challenges accompanying AI adoption, including ethical issues like data privacy and biases, the 'black box' problem of AI explainability, and potential job displacement due to automation. The paper concludes that while AI holds transformative potential for the finance industry, it is essential to address the associated ethical, trust, and regulatory challenges to maximise its benefits. Future research should focus on developing ethically aligned, transparent, and robust AI tools that comply with and thrive within the financial industry's regulatory landscape.

**Introduction:** Artificial Intelligence (AI) technology has profoundly influenced diverse sectors globally, and the financial industry is no exception (Chen et al., 2019). AI technology has introduced sophisticated tools that can interpret financial markets' complexity, offering possibilities for unprecedented efficiency and customer experience. This paper critically examines AI applications' current status, opportunities, challenges, and future prospects in the financial sector.

**Methodology:** Our methodological approach includes a systematic review and synthesis of scholarly articles, industry reports, and case studies on AI's role in finance. This extensive review allows us to gauge AI's impact on financial services and to identify emerging trends and potential future directions (Hansen et al., 2020).

**Results:** AI is transforming the finance industry across multiple dimensions. In risk management, AI-driven predictive models outperform traditional methods in identifying and quantifying risk (Będziński et al., 2021). Automated trading algorithms leverage AI to execute trades at superhuman speeds and accuracy (Kim et al., 2021). AI-powered chatbots have revolutionised customer service, providing round-the-clock, personalised service (Pereira et al., 2020). Additionally, AI helps detect fraud, predicting suspicious activities more effectively than traditional systems (Ngai et al., 2011).

Our research reveals AI's transformative influence on several core areas within the financial industry. For example, in risk management, AI-driven predictive models significantly outperform traditional methods, efficiently identifying and quantifying

risks with higher precision (Będziński et al., 2021). Moreover, these models enable proactive risk mitigation strategies, bolstering the industry's resilience and financial stability.

Automated algorithms that leverage AI can execute trades with superhuman speeds and accuracy in trading. These algorithms enable enhanced decision-making, enabling high-frequency trading and identifying market patterns beyond human cognition. This significantly improves the profitability and efficiency of financial operations (Kim et al., 2021).

AI is also revolutionising customer service in finance. AI-powered chatbots and virtual assistants provide round-the-clock, personalised service, improving customer satisfaction and retention. In addition, they can handle a wide array of customer queries and transactions, reducing operational costs and increasing service efficiency (Pereira et al., 2020).

Moreover, AI is playing a crucial role in fraud detection and prevention. AI systems can learn from historical data, recognise patterns and anomalies, and predict suspicious activities more effectively than traditional systems. This significantly enhances the security of financial transactions and reduces losses due to fraud (Ngai et al., 2011).

Further, AI in finance is enabling the personalisation of financial services. For example, advanced algorithms can analyse customer data to provide personalised financial advice, enhancing customer experience and financial outcomes. This is particularly evident in robo-advisory, where AI-driven platforms provide personalised investment advice to customers based on their financial goals and risk tolerance (Arner et al., 2020).

In summary, AI is paving the way for a new era of efficiency, security, and personalisation in the financial industry. It is crucial, however, to address the associated challenges to optimise its benefits.

**Discussion**

Despite these benefits, the adoption of AI in finance also presents challenges. Ethical issues like data privacy, transparency, and accountability need careful consideration (Mittelstadt et al., 2016). Further, a lack of understanding and trust in AI systems among users and regulatory complexity pose significant hurdles (Scantlebury et al., 2021). It is thus crucial to design AI applications in finance with a strong focus on explainability, fairness, and regulatory compliance. While advantageous, AI's integration into finance also invites complex challenges that demand robust discourse and active solutions. Among these challenges, ethical issues stand at the forefront. Adopting AI could inadvertently encourage biases within financial decision-making processes due to the inherent biases in the training data used. As AI systems learn from historical data, any embedded prejudice regarding creditworthiness assessments or investment decisions may perpetuate within AI decision-making. Therefore, It is critical to prioritise bias detection and mitigation in developing AI systems in finance.

Furthermore, data privacy remains a significant concern. With AI systems often reliant on large volumes of personal customer data, appropriate safeguards must be in place to ensure the privacy and security of this sensitive information. Organisations must maintain transparency about how they use and secure customer data and allow customers to control their data, aligning practices with data protection laws and norms.

Another critical concern is the explainability, or lack thereof, in AI decision-making. Often coined as the 'black box' problem, it refers to the challenge that stakeholders often do not understand how AI systems make confident decisions. This opacity can lead to distrust and can cause regulatory issues. Therefore, a focus on developing interpretable and explainable AI models is paramount.

Additionally, while AI provides efficiency, there is a worry about job displacement caused by automation. The financial industry needs to prepare for this change by focusing on reskilling and upskilling employees to work effectively alongside AI tools and focusing on roles that require uniquely human skills.

Overall, it is evident that while AI technology holds great potential for revolutionising the financial industry, its adoption and use must be thoughtfully managed. Stakeholders across the board must engage in active discussion and collaboration to harness the power of AI effectively and ethically, thus ensuring a prosperous and equitable future for the financial industry.

**Conclusion**

AI holds transformative potential for the finance industry. However, to fully realise its benefits, stakeholders should address the ethical, trust, and regulatory issues associated with its application. Therefore, future research should focus on developing ethically aligned, transparent, and robust AI tools that can thrive within the financial industry's regulatory landscape (Ferrario et al., 2020).

Keywords: Artificial Intelligence, Finance Industry, Risk Management, Automated Trading, Customer Service, Fraud Detection, Personalization, Robo-Advisory.

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