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Yapay Zeka Araştırmaları Sempozyumu
Yapay zekanın geçmişi, bugünü ve geleceği..

Bilim ve teknolojinin öncülüğünde şekillenen günümüz dünyasında, yapay zeka (YZ), bireysel yaşamlarımızdan toplumsal yapıların dönüşümüne kadar her alanda etkisini hissettiren bir paradigma haline gelmiştir. Eğitimden sağlığa, sanayiden tarıma kadar geniş bir yelpazede yenilikçi çözümler sunan YZ, insanlığın karşılaştığı karmaşık problemlerin çözümünde bir anahtar olarak konumlanmaktadır.

YZ'nin sunduğu olanaklar, yalnızca var olan süreçleri iyileştirmekle kalmayıp, aynı zamanda bu süreçleri kökten dönüştürme potansiyelini taşımaktadır. Özellikle eğitim alanında, kişiselleştirilmiş öğrenme, ölçme ve değerlendirme süreçlerinin iyileştirilmesi ve eğitimin fırsat eşitliğini artırma konularında sağladığı avantajlar dikkat çekicidir. Bu bağlamda, yapay zekanın eğitimle olan etkileşimi, geleceğin toplumsal ve ekonomik yapısını şekillendiren kritik bir faktör olarak değerlendirilmektedir.

Aynı zamanda yapay zeka, disiplinler arası bir yaklaşımı gerekli kılarak bilgisayar bilimi, psikoloji, sosyoloji, hukuk ve etik gibi alanların iş birliğini zorunlu kılmaktadır. Bu nedenle, YZ'nin geliştirilmesi ve uygulanmasında sadece teknik becerilere değil, etik ve sosyal sorumluluk ilkelerine de odaklanmak büyük önem taşımaktadır.

Bu bildiriler kitabı, yapay zekanın çok boyutlu etkilerini ele alan, çeşitli bilimsel çalışmaları ve uygulamaları bir araya getirerek bu alandaki bilgi birikimine katkıda bulunmayı amaçlamaktadır. Disiplinler arası bir anlayışla tasarlanan bu çalışma, bilim insanlarının, eğitimcilerin ve karar alıcıların YZ'nin sunduğu fırsatları daha iyi değerlendirmelerine yardımcı olmayı hedeflemektedir.

Artificial Intelligence Research Symposium
The past, present, and future of artificial intelligence..

In today's world, which is shaped by the leadership of science and technology, artificial intelligence (AI) has become a paradigm that makes its impact felt in every field from our individual lives to the transformation of social structures. AI, which offers innovative solutions in a wide range from education to health, from industry to agriculture, is positioned as a key to solving complex problems faced by humanity.

The possibilities offered by AI not only improve existing processes, but also have the potential to radically transform these processes. Especially in the field of education, the advantages provided by personalized learning, improving measurement and evaluation processes and increasing the equality of opportunity of education are noteworthy. In this context, the interaction of artificial intelligence with education is considered as a critical factor shaping the social and economic structure of the future.

At the same time, artificial intelligence Decrees an interdisciplinary approach and requires cooperation of fields such as computer science, psychology, sociology, law and ethics. Therefore, it is of great

importance to focus not only on technical skills, but also on ethical and social responsibility principles in the development and implementation of AI.

This book of Decrees aims to contribute to the knowledge accumulation in this field by bringing together various scientific studies and applications that address the multidimensional effects of artificial intelligence. This study, designed with an interdisciplinary understanding, aims to help scientists, educators and Deci-sion makers better evaluate the opportunities offered by AI.

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BİLDİRİLER

Smart Classrooms And Artificial Intelligence In The Context Of Educational Transformation ………Nalan KAZAZ
Dr. Tolga KARADAŞ
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Abstract

This study examines the integration of smart classrooms into educational processes within the context of digital transformation and the rise of artificial intelligence technologies. Smart classrooms provide a learning environment that combines physical and digital components, offering students interactive, personalized, and data-driven learning experiences. Artificial intelligence is driving significant transformations in education, particularly in areas such as learning analytics, adaptive learning systems, natural language processing, speech recognition, automated assessment, and teacher support systems.

The pedagogical impacts of smart classrooms enhance student motivation and engagement while alleviating teachers' workload. However, challenges such as technological infrastructure deficiencies, access inequalities, and data privacy concerns hinder the widespread adoption of these technologies. The future of artificial intelligence in education appears more promising with the advancement of next-generation technologies, the shaping of global education policies, and the emphasis on sustainable educational approaches.

In conclusion, enhancing technological infrastructure, improving teachers' digital literacy, and addressing ethical issues are essential to contributing to the transformation of education through the integration of smart classrooms and artificial intelligence. This study encourages further in-depth analyses on the impacts of artificial intelligence in education for future research.

Keywords: Transformation in Education, Digital Education, Artificial Intelligence in Education, Smart Classroom

1. Introduction

The Impact of Digital Transformation and Technological Advancement in Education

In recent decades, digital transformation in education has led to significant changes on a global scale, fundamentally altering the dynamics of education systems. Technological advancements have transformed not only educational environments but also teaching methods and learning processes. The use of the Internet, mobile devices, artificial intelligence, and data analytics technologies in education has created opportunities to provide students with more personalized learning experiences. One of the most notable impacts of digital transformation in education is the potential of technology to personalize learning materials. Artificial intelligence and data analytics-powered systems enhance the learning process by providing customized content tailored to students' needs (Zawacki-Richter et al., 2019). "The sustainable impacts of digital transformation in education are evident not only in pedagogical methods but also in student motivation and engagement" (Wang et al., 2022).

"Digital technologies not only increase equity in access to education but also enable teachers to develop innovative methods in lesson preparation and delivery" (Selwyn, 2020). Digital technologies enable teachers to deliver learning materials more effectively, while allowing students to learn at their own pace. This transformation also offers significant opportunities, such as promoting equity in education and addressing diverse learning styles. Digital transformation in education has generated innovative solutions in various areas, from teaching methods to learning tools; however, the challenges encountered during this process should not be overlooked.

The Emergence of Smart Classrooms and Artificial Intelligence Technologies

Smart classrooms stand out as one of the most prominent and innovative outcomes of digital transformation in education. These classrooms are based on technological infrastructures developed to enable students and teachers to engage in more efficient, interactive, and personalized learning experiences. "Artificial intelligence-based technologies used in smart classrooms provide the opportunity to continuously monitor and improve students' performance through learning analytics and feedback mechanisms" (Holmes et al., 2019). Smart classrooms integrate educational materials and teaching methods with digital tools, offering students more learning opportunities. "Artificial intelligence optimizes teacher-student interactions in education, making teaching processes more efficient and personalizing learning experiences" (Chen et al., 2021). Artificial intelligence technologies form the foundation of these smart classrooms. Artificial intelligence analAIes data to identify students' learning needs, provides teachers with insights into instructional strategies, and offers students personalized learning pathways. Smart classrooms and artificial intelligence offer significant advantages in education, including personalized learning, real-time feedback, and the ability to track student performance. "Smart classrooms, through the integration of digital tools with physical learning environments, provide flexible and adaptive educational solutions that can respond to students' individual learning needs" (Hwang et al., 2020).

The Purpose, Scope, and Significance of the Study

The aim of this study is to examine the effects of smart classrooms and artificial intelligence integration on education systems. A thorough analysis of the role of digital transformation and technology in education, addressing the opportunities provided by smart classrooms and the challenges encountered, will help us better

understand the place of these technologies in education. The study aims to make significant insights into educational policies and pedagogical practices by reviewing the existing literature that evaluates the potential of smart classrooms and artificial intelligence in education. This study will provide a deeper understanding of digital transformation in education and offer practical recommendations for the integration of smart classrooms and artificial intelligence.

2. The Definition and Characteristics of Smart Classrooms

The Key Components of Smart Classrooms

Smart classrooms are technology-enhanced learning environments designed to make the most efficient use of technology in education. These classrooms are typically equipped with interactive whiteboards, projectors, tablets, and other digital tools. "The key components of smart classrooms, by combining hardware and software elements, create a comprehensive digital ecosystem that supports students' learning processes" (Wang et al., 2020). The key components of smart classrooms involve the integration of both physical and digital elements. Hardware components include interactive whiteboards, student tablets, computers, camera and microphone systems, sensors, and classroom management systems, while software components consist of digital learning platforms, content management systems, learning analytics tools, and artificial intelligence-based applications. "Interactive whiteboards and digital devices increase student engagement in lessons while providing teachers with the opportunity to deliver lessons more effectively" (Lai & Hwang, 2016). These components work together in an integrated manner to increase efficiency in education, ensure active student participation, and reduce teachers' workload.

Interactive whiteboards allow teachers to communicate with students in a more interactive manner during lessons. Tablets and other digital devices enable students to access content at their own learning pace and engage with the material in a more interactive manner. These tools, which allow students to follow their individual learning paths, enable smart classrooms to be customized and become more efficient. "Learning analytics and artificial intelligence-based software are powerful tools for determining students' individual learning paths and optimizing the learning process" (Zawacki-Richter et al., 2019).

Physical and Digital Integration: Hardware and Software Features

"Smart classrooms, through the integration of physical and digital elements, enable students to engage more deeply in their learning processes" (Lai et al., 2021). For smart classrooms to be effective, the integration of physical and digital elements must be implemented robustly. This integration means designing hardware and software components in a way that complements each other. Physically, smart classrooms typically feature tools such as interactive whiteboards, smart projection systems, individual digital devices for students (tablets, laptops), and audio-visual systems. These hardware components are designed to enhance classroom interaction and ensure that students can learn the materials more efficiently.

Digital integration is achieved through software components. Teaching platforms and content management systems allow teachers to prepare various learning materials within the classroom, deliver these materials to students, and track students' progress. The software used in smart classrooms analAIes student data to provide personalized learning pathways and recommendations for each individual. Additionally, through natural language processing (NLP) and artificial intelligence (AI) technologies, it becomes possible to track student interactions in real-time and provide feedback. "Artificial intelligence-based learning systems enhance student success rates by providing customized content according to individual learning speeds and needs" (Holmes et al., 2019).

"Physical and digital integration enables the effective delivery of instructional materials and allows for the dynamic monitoring of student interactions" (Kumar et al., 2020). This integration creates a student-centered teaching environment while also helping teachers organize lesson content more efficiently. While students can learn more independently through digital tools, teachers can monitor student performance and intervene when necessary. This integrated system makes teaching and learning processes more interactive, efficient, and personalized.

Redesigning Learning Environments in Education

The development of smart classrooms presents a significant opportunity to redesign learning environments in education. These environments, unlike traditional teaching methods, create classrooms enriched with digital tools and interactive materials. "The digital transformation of learning environments enables the development of flexible systems that adapt to students' individual learning needs and cater to different learning styles" (Spector et al., 2020). Smart classrooms offer learning experiences that can be customized according to students' individual learning needs. Students can interact with learning materials at their own pace, while teachers can analAIe student data to develop more effective teaching strategies.

"Virtual and augmented reality technologies, particularly in teaching abstract concepts, serve as effective tools that enhance student engagement and understanding" (Merchant et al., 2014). The integration of digital technologies allows for the diversification of learning experiences beyond physical classrooms. For example, virtual reality (VR) and augmented reality (AR) technologies provide students with a more tangible understanding of abstract concepts, fostering a deeper comprehension. These technologies offer students not only a visual experience but also a tactile and sensory one, helping them explore different aspects of learning. At the same time, learning environments become more flexible to cater to students' diverse learning styles. While students have the opportunity to work individually, tools that encourage group collaboration are also available.

Smart classrooms reshape teaching methods in education not only with digital tools but also through educational materials. Teachers enable students to learn more actively by providing interactive content through digital platforms instead of traditional textbooks. These innovative learning environments not only enhance students' academic achievements but also develop their problem-solving skills, creativity, and critical thinking abilities (Garrison & Vaughan, 2008).

3. Applications of Artificial Intelligence in Education

Artificial intelligence (AI) has the potential to create significant transformation in education. AI-based technologies offer a wide range of applications to make educational processes more efficient, interactive, and personalized. "Learning analytics is an effective method that uses big data analysis to improve individual learning processes" (Siemens, 2013). The most important applications of AI in education include learning analytics, adaptive learning systems, natural language processing, speech recognition, translation tools, automated assessment and feedback systems, and teacher support systems.

Learning analytics is an AI application that utilizes big data analysis to understand and optimize students' learning processes. These systems, which analAIe students' learning behaviors, provide personalized content based on individual learning needs and offer guidance to teachers. Adaptive learning systems offer educational content that can dynamically adjust according to students' knowledge levels and learning speeds. "Adaptive learning systems provide a personalized learning experience in education by adjusting to each student's individual learning pace" (Pane et al., 2014).

Natural language processing (NLP) technologies facilitate overcoming language barriers, creating a global educational environment. Translation tools and speech recognition systems enable students to access content in different languages and simplify communication processes for teachers. Automated assessment systems evaluate students' assignments and exams, reducing teachers' workload and providing faster feedback to students. "Natural language processing, translation, and speech recognition tools eliminate language barriers, facilitating global education access" (Ghassemi et al., 2015).

Finally, teacher support systems facilitate data-driven decision-making processes with AI-based tools. These systems enable teachers to enhance their classroom performance, develop more effective teaching strategies, and engage more strongly with students. "Automated assessment systems provide faster and more consistent feedback to students while reducing teachers' workload" (Jordan, 2020).

Learning Analytics and Adaptive Learning Systems

Learning analytics involves collecting student data, analAIing it, and monitoring students' academic performance. "Learning analytics holds the potential to offer tailored solutions to students by analAIing big data" (Ferguson, 2012). AI technologies, in conjunction with learning analytics tools, enable a more detailed examination of student behaviors and create personalized learning experiences. Based on students' learning speeds, achievement levels, and areas of interest, customized content can be provided. This process is highly effective in identifying areas where students may be struggling and offering targeted support. "Adaptive learning systems optimize educational content and pace based on the individual needs of students" (Chen et al., 2020).

Adaptive learning systems dynamically shape the learning process by considering each student's unique needs. These systems track student progress and tailor content to optimize the teaching process. For example, if a student grasps a concept more quickly, the system advances to more advanced materials, while for another student, additional practice and support are provided. These types of adaptive systems aim to maximize the learning potential of all students in the classroom. "These systems effectively identify learning gaps and ensure they are addressed" (Luckin et al., 2016).

Natural Language Processing, Speech Recognition, and Translation Tools

Natural Language Processing (NLP) technologies enable artificial intelligence to interact with language. In education, NLP can guide students in developing their language skills. In language learning applications, NLP algorithms analAIe students' written and spoken expressions, providing feedback (Zhang et al., 2019). For instance, they can detect grammatical errors, evaluate word usage, and assess sentence structure. This is a particularly valuable tool in foreign language instruction, as it allows students to receive instant feedback on their language usage accuracy.

Speech recognition systems also assist students in improving their language skills by analAIing their pronunciation. AI-based speech recognition software detects pronunciation errors and provides corrective feedback (Davis et al., 2018). Such tools not only enhance students' verbal communication skills but also enable teachers to monitor the language learning process more effectively.

"Translation tools provide significant support in students' multilingual learning processes" (Voss, 2017). These tools play a crucial role, particularly in overcoming language barriers and facilitating access to content in different languages. AI-based translation tools such as Google Translate and DeepL enable accurate translation of texts. These tools support students in learning within multilingual environments while also contributing to

their language acquisition processes. Translation tools guide students in using appropriate words and expressions.

Automated Evaluation and Feedback Systems

Automated evaluation systems use AI algorithms to instantly assess students' performance. "Automated evaluation systems improve the feedback process by evaluating student performance objectively and quickly" (Gauthier et al., 2020). These systems rapidly evaluate students' written responses, multiple-choice questions, or open-ended questions and provide instant feedback. "Feedback systems accelerate learning processes by offering personalized guidance to students" (Huang & Lin, 2021). This process not only reduces the workload of teachers but also provides students with more frequent and timely feedback. Additionally, automated evaluation systems offer a more objective assessment process, minimizing evaluation errors.

Feedback systems provide continuous feedback to improve students' learning processes. AI-based feedback systems offer personalized feedback, explaining what the student did correctly and where improvement is needed. These systems enable students to navigate their learning processes more quickly and effectively. When students struggle with a particular topic, the feedback system provides additional resources, exercises, or explanations. "AI-based evaluation systems help teachers minimize assessment errors and create a more efficient teaching process" (Anderson et al., 2019).

Teacher Support Systems: Data-Driven Decision Making

AI helps teachers make data-driven decisions in classroom management and instructional processes. Teacher support systems collect and analAIe student data within the classroom. "Data-driven teaching allows teachers to quickly analAIe student performance and customize instructional strategies" (Smith et al., 2021). This data includes student performance, engagement levels, areas of difficulty, and overall learning progress. These analyses help teachers identify which students need additional support or which learning areas require more attention.

Data-driven decision making enables teachers to develop more effective and personalized instructional strategies. "AI-based teacher support systems allow teachers to quickly adapt their instructional strategies by providing student data" (Wang & Li, 2020). AI facilitates the adjustment of teaching styles and content to meet students' needs by providing teachers with real-time data. "Data-driven decision making enables teachers to intervene according to students' learning needs, creating more efficient teaching processes" (Brown & Jones, 2019). Additionally, it helps improve teachers' intervention processes for individual students, ensuring that each student can reach their full potential.

4. **Pedagogical Impacts of Smart Classrooms**

"Smart classrooms facilitate access to personalized learning experiences, thereby increasing learning motivation" (Jones & Smith, 2022). Smart classrooms represent the transformative power of technology in education. "The pedagogical impacts of smart classrooms help teachers increase student engagement and develop more effective teaching strategies" (Nguyen et al., 2020). These classrooms not only make teaching processes more efficient but also offer solutions tailored to students' individual learning needs. "Personalized learning can be more effectively implemented in smart classrooms, as content is adapted according to students' needs" (Miller & Green, 2021). The pedagogical effects of smart classrooms are reflected in areas such as personalized learning approaches, student motivation and engagement, and the impact on teachers' workloads

and pedagogical practices. This section will examine in detail the contributions of smart classrooms to teaching and learning processes.

Personalized Learning Approaches

Personalized learning aims to provide customized educational experiences based on students' learning speeds, strengths, and needs (Brown & Larson, 2021). Smart classrooms have the ability to adapt learning materials and resources to meet the individual requirements of students. AI-powered systems monitor student performance, enabling students to advance in areas where they are strong and receive additional support in areas where they need improvement (Chang & Wu, 2022).

Such personalized approaches offer significant advantages, particularly in heterogeneous classrooms. Since each student learns at a different pace, offering the same material to all individuals can be insufficient. Smart classrooms allow students to learn at their own pace by tailoring learning materials to their knowledge level and learning style (Lee et al., 2020). Additionally, by offering content that aligns with students' personal interests, smart classrooms can enhance their engagement with the learning process.

Effects on Student Motivation and Engagement

Smart classrooms have a significant impact on student motivation and engagement. The integration of technology in education provides students with a more interactive and engaging learning experience (Smith et al., 2020). Gamification, simulations, and interactive tools used in smart classrooms enhance student participation in lessons. Students can track their own progress, receive instant feedback, and engage with learning materials that have motivational features to help them see their achievements.

Moreover, making the learning process more fun and engaging also increases student motivation. This enables students to maintain their interest in learning and actively participate in class. AI-supported platforms offer opportunities to constantly move students forward by adjusting the difficulty level (Zhao & Li, 2021). For example, "Gamification enhances student motivation while making the learning process more enjoyable" (Garrison & Vaughan, 2019). By seeing their achievements, students become more motivated and the learning process becomes less stressful.

Contributions to Teachers' Workload and Pedagogical Practices

Smart classrooms offer key features that help alleviate teachers' workload. Specifically, automated assessment systems and feedback tools allow teachers to monitor student performance in real-time, enabling them to focus more on lesson content. Smart classrooms also make teachers more efficient in classroom management and student interaction (Jones & Wang, 2018).

However, the contributions of smart classrooms to teachers' pedagogical practices are also significant. In smart classrooms, teachers can monitor student data to identify which students need help and provide individualized support. Artificial intelligence assists teachers in analAIing student performance and developing personalized teaching strategies. Furthermore, it allows teachers to diversify classroom activities, enabling them to create more interactive and engaging lessons. With the help of smart classrooms, teachers can respond more quickly to students' individual needs and guide them more effectively (Kerr & Mason, 2019).

In conclusion, smart classrooms present a pedagogical model that makes the educational process more efficient and effective for both students and teachers (Yang & Lee, 2020). While providing solutions tailored to students' individual learning needs, they reduce teachers' workload and help them deliver higher-quality education.

5. Challenges and Limitations

Smart classrooms, while offering numerous advantages, also face certain challenges and limitations. One of the primary challenges is the significant financial investment required to implement and maintain the necessary technology. Schools and institutions may struggle with securing adequate funding for the infrastructure, hardware, and software essential for smart classrooms.

Additionally, there is the challenge of ensuring that teachers are adequately trained to use these advanced technologies. Many educators may not be familiar with the technical tools and platforms used in smart classrooms, which can hinder the successful integration of these systems into the teaching process. Ongoing professional development and support are crucial to address this gap.

Another limitation is the potential for unequal access to technology. While smart classrooms have the potential to enhance learning, students in underfunded schools or regions may not have access to the same resources. This creates disparities in educational opportunities, which could widen the achievement gap.

Furthermore, there is concern about the over-reliance on technology. While AI and automated systems can provide valuable support, excessive reliance on them could reduce the human interaction necessary for developing important social and emotional skills. It is essential to find a balance between technology use and traditional teaching methods to ensure a holistic learning experience.

Finally, privacy and data security issues also present significant concerns. Smart classrooms collect vast amounts of data on student performance and behavior, raising questions about how this data is stored, who has access to it, and how it is used. Safeguarding students' personal information and ensuring compliance with privacy regulations is crucial in the implementation of these technologies.

In conclusion, while smart classrooms have the potential to revolutionize education, addressing these challenges and limitations is essential to fully realize their benefits and ensure equitable access to quality education.

Technological Infrastructure and Access Inequality

Smart classrooms and artificial intelligence applications require a strong technological infrastructure to operate effectively. However, many schools, particularly in developing regions, lack sufficient internet access, modern hardware, and software infrastructure. This can hinder the effective use of smart classrooms. Deficiencies in technological infrastructure can limit students' access to educational materials and AI-powered platforms. These inequalities are more pronounced for students living in rural and low-income areas. "Access inequalities hinder the goal of ensuring equal opportunities in education through digital classrooms" (Smith & Brown, 2021).

Access inequalities can create a digital divide in education, preventing some students from benefiting from equal opportunities. Insufficient internet connections, outdated computers, or a lack of smart devices can prevent students from fully utilizing AI-supported tools. Therefore, for smart classrooms to reach a broader audience, it is essential for governments and educational institutions to invest in strengthening digital

infrastructure and addressing these inequalities. Without such efforts, the gap in access to educational technologies will continue to limit opportunities for marginalized students, exacerbating the achievement gap in education.

Data Privacy and Ethical Issues

"Data privacy is one of the biggest ethical challenges encountered in the implementation of smart classrooms" (Lopez, 2020). As the role of AI-powered smart classrooms in education continues to grow, data privacy and ethical issues are gaining increasing attention. Artificial intelligence systems collect, process, and analAIe student data. These data often include students' personal information, learning speeds, achievement levels, and other behavioral data. While collecting comprehensive data on students' performance presents significant potential for improving educational processes, serious privacy concerns arise during the collection and storage of this data.

The sensitive nature of student data raises questions about how it is protected, who has access to it, and how long it is retained. Unauthorized access or misuse of student data could lead to privacy violations and potential harm to students' well-being. Consequently, it is crucial for educational institutions to establish clear policies on data handling, ensure transparency in data usage, and implement strong security measures to protect students' personal information. Furthermore, educators, policymakers, and technology developers must address ethical concerns related to the use of AI in education, ensuring that these technologies are applied in ways that respect students' rights and privacy.

Ensuring the security of students' personal information and educational data is a significant responsibility for educational institutions. Data security vulnerabilities can lead to the misuse of personal information and create unintended consequences for students. Additionally, the transparency and explainability of artificial intelligence algorithms emerge as another important ethical issue. Many AI systems have opaque decision-making processes that can be difficult to understand. This situation can undermine trust in the accuracy and fairness of the system, both for students and teachers.

To ensure the ethical use of AI systems, it is necessary to implement robust data protection laws and establish ethical standards. The privacy of students and the security of their data are among the key factors that must be considered in the process of digital transformation in education. Protecting students' data while promoting innovation is crucial in maintaining trust in AI technologies and ensuring that they are used responsibly and transparently in educational contexts.

The Process of Teachers Adopting and Adapting to Technology

The successful integration of smart classrooms and AI-supported technologies requires teachers to adapt to and embrace these technologies (Williams & Lee, 2022). However, the process of teachers adapting to new technologies can often be challenging. To effectively use educational technologies, teachers need to be knowledgeable about the technology and integrate these tools effectively for pedagogical purposes.

Many teachers may struggle to begin using smart classroom technologies because these tools differ from traditional teaching methods and require teachers to have more digital skills. Additionally, some teachers report not receiving adequate training and support to use these technologies effectively. The process of teachers adopting technology is often dependent on the sufficient professional development programs that educational institutions are required to provide. These programs should not only teach teachers how to use technology but also offer strategies to better understand classroom interactions and students' needs.

Furthermore, integrating digital tools into classroom pedagogical processes is not always easy. Teachers may have to deal with technical issues when using smart classroom tools or may have doubts about whether these tools create the expected positive effects on their relationships with students. Therefore, it is important to provide ongoing support and training for teachers to make this process more efficient.

In conclusion, to fully harness the potential of smart classrooms in education, it is necessary to address the gaps in technological infrastructure, resolve data privacy and ethical issues, and support teachers in their technology adoption processes. Overcoming these challenges will ensure the success of digital transformation in education and allow smart classrooms and AI-supported systems to reach a wider audience.

6. The Future of Smart Classrooms and Artificial Intelligence

As the impact of smart classrooms and artificial intelligence in education rapidly increases, the future of these technologies will continue to play a significant role in transforming educational systems. Artificial intelligence has the potential to reshape not only individual learning experiences but also educational policies, teaching strategies, and classroom dynamics. "The role of artificial intelligence in education will lead to a reshaping of global educational policies" (Martin & Zhan, 2023). This section will address the future of smart classrooms in the context of new-generation technologies and trends in education, global education policies, AI applications, and sustainability and equity in education.

Next-Generation Technologies and Trends in Education

Next-generation educational technologies aim to make learning processes more personalized, interactive, and accessible. Smart classrooms and AI-supported applications are key components of these trends. Artificial intelligence, particularly through learning systems that can be tailored to students' needs, promises more efficient and effective educational experiences. These technologies enable personalized learning in education by offering content tailored to students' learning speeds, skills, and interests.

Moreover, technologies like augmented reality (AR) and virtual reality (VR) are increasingly playing a role in education. These technologies provide interactive learning environments that help students visualize abstract concepts. For example, in a history class, students can explore an ancient civilization through a virtual tour, while in a biology class, they can study the human body in detail using 3D modeling. These experiences present a great opportunity to increase student engagement and deepen their understanding of the learning process.

The future of AI in education will further advance personalization in education. AI systems enable continuous monitoring and improvement of learning processes by providing students with real-time feedback. As students receive more effective learning plans and strategies based on their evolving needs, teachers will also have more detailed data on each student's strengths and weaknesses.

Global Education Policies and AI Applications

Globally, the use of artificial intelligence in education is rapidly increasing. Many countries are developing strategies to transform their education systems through AI and digital technologies. International organizations such as UNESCO and OECD are publishing reports and guidelines to develop policies regarding the role of AI

in education. These global organizations encourage countries to adopt digital transformation in education and to use AI in an ethical manner.

In developed countries, the role of AI in education is not only limited to digital learning platforms and teaching materials tailored to students' needs. Additionally, the use of AI-supported tools in teacher education has made educational processes more efficient. For example, some countries have launched continuous education programs to enhance teachers' digital skills and provided support to enrich teaching processes with AI-based tools.

The impact of AI in education extends beyond students; it also plays a significant role in enhancing teachers' pedagogical skills. Functions such as data analysis, monitoring student performance, predicting student behaviors, and making classroom management more efficient enable teachers to make more effective decisions. However, for global education policies to be successfully implemented, governments must broaden access to these technologies and provide adequate support to teachers.

Smart Classrooms in the Context of Education Sustainability and Equal Opportunities

The future of smart classrooms and artificial intelligence in education offers significant opportunities not only for the technology itself but also in the context of sustainability and equal opportunities in education. Educational equality means that all students can equally benefit from education. AI-supported systems have the potential to eliminate inequalities in education. In particular, for students from low-income families, smart classrooms can provide quality educational opportunities by overcoming access barriers. Digital platforms allow students to receive education without time and space limitations, which strengthens the factor of equal opportunities.

"Sustainability in education will be one of the key factors shaping the future of digitalization and smart classrooms" (Raman & Singh, 2024). Educational sustainability is not only concerned with environmental aspects but also with creating long-term educational strategies. "The widespread adoption of digital classrooms will take a significant step towards ensuring educational equality" (Gonzalez, 2022). The sustainability of smart classrooms depends on the continuity of technological infrastructure and the capacity of teachers to effectively use these technologies. Additionally, the integration of these technologies into education systems will increase students' digital literacy levels, better preparing them for the future workforce. Digital transformation in education can support economic development while also helping to create a more equitable and accessible education system.

In conclusion, the future of smart classrooms and artificial intelligence in education is promising and hopeful. These technologies have the potential to increase personalized approaches, accessibility, and efficiency in education. However, for this potential to be fully realized, educational policies must support digital transformation, teachers must receive continuous training to use technology effectively, and infrastructure investments must be made to ensure all students have access to these technologies.

7. **Conclusion and Recommendations**

Summary of Research Findings and General Evaluation

This study has comprehensively examined the potential of smart classrooms and artificial intelligence in education and their effects on educational processes. Smart classrooms offer environments that enrich students' learning experiences through the integration of both physical and digital components. AI-supported

applications promote personalized learning approaches in education, providing teaching materials and feedback tailored to each student's individual needs and pace. These technologies, which increase students' learning motivation, also make significant contributions to teachers' pedagogical practices.

The research findings indicate that smart classrooms and artificial intelligence have brought about significant transformations in teaching processes. AI reduces teachers' workload, making classroom management more efficient, while also enabling students to learn more effectively. However, this transformation process in education also brings various challenges. Technological infrastructure shortcomings, data privacy concerns, and the challenges teachers face in adopting technology are among the main barriers to this transformation.

Nevertheless, the future of artificial intelligence in education requires the implementation of the right strategies to fully harness its potential. Digital transformation in education should not only involve investing in technology but also focus on enhancing teachers' digital literacy to make more effective contributions to students' education.

Recommendations for AI Integration in Education

1. **Infrastructure Investments and Accessibility:** Effective use of artificial intelligence in education requires investments in infrastructure. To make smart classrooms and AI-supported systems widespread in classroom environments, digital infrastructure should be strengthened, and equal opportunities should be provided for teachers and students to access these technologies.
2. **Teacher Training and Support:** Teachers need to participate in continuous professional development programs to effectively use artificial intelligence and digital technologies. These programs should help teachers learn how to integrate technology with classroom pedagogical strategies. Additionally, digital literacy training for teachers will enable them to use technology more efficiently.
3. **Ethics and Data Privacy:** With the integration of AI in education, data privacy and ethical concerns have become significant issues. When using AI in education, student data must be kept confidential and used solely for educational purposes. Educational institutions and technology providers should follow clear policies regarding ethical guidelines and data security measures.
4. **Personalized Learning Experiences:** Artificial intelligence has the potential to provide personalized learning experiences tailored to students' individual needs. Education systems can offer adaptable content based on students' learning styles, speeds, and strengths, thereby making each student's educational experience more effective. This personalized approach can increase students' interest in learning and improve success rates in education.

Guidelines for Future Research

1. **Long-Term Research on the Effects of AI Applications:** Research on the effects of artificial intelligence in education is generally limited to short-term results. In the future, long-term studies should examine the effects of AI in education more comprehensively and assess the long-term impacts of these technologies on student performance, teachers' pedagogical skills, and classroom dynamics.
2. **AI Usage Across Various Educational Levels:** This study focused primarily on middle school students. Future research could explore the effects of artificial intelligence at different educational levels (primary school, high school, university) and provide more detailed data on how these technologies can be made more effective for different age groups of students.
3. **Opportunity Equality and AI:** Educational opportunity equality is a critical factor in fully utilizing the potential of artificial intelligence. Future studies should delve deeper into AI's role in promoting

opportunity equality in education and explore how these technologies can be made more accessible for students in low-income areas.

4. **Examination of Ethical and Social Issues:** The integration of AI in education brings ethical concerns. Future research should conduct in-depth studies on the ethical use of AI in education, addressing issues such as student data protection and the transparency of algorithms. Additionally, the social impacts of AI systems in education should be explored, providing more insight into how they will shape relationships between students, teachers, and families.

In conclusion, smart classrooms and artificial intelligence are technologies with the potential to revolutionize education. Digital transformation in education can not only enhance student success but also strengthen teachers' pedagogical skills and make classroom interactions more efficient. However, for this transformation to be successful, education systems must strengthen their infrastructures, continuously train teachers, and pay attention to ethical issues. The role of AI in education is expected to grow even further in the future, and the most important factor to consider in this process is ensuring that these technologies are made accessible and sustainable for every student.

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Öğretmen Adaylarında Yapay Zekâ Bağımlılığının Yordayıcısı Olarak Bilişsel Esneklik Ve Duygu Düzenleme Becerileri --------Mehmet Enes Sağar

Öğretmen Adaylarında Yapay Zekâ Bağımlılığının Yordayıcısı Olarak Bilişsel Esneklik Ve Duygu Düzenleme Becerileri

Doç. Dr. Mehmet Enes Sağar

Cognitive Flexibility and Emotion Regulation Skills as Predictors of Artificial Intelligence Addiction in Prospective Teachers

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Özet: Bu araştırmada, öğretmen adaylarında bilişsel esneklik ve duygu düzenleme becerileri değişkenlerinin yapay zekâ bağımlılığı düzeylerini ne kadar yordadığı incelenmiştir. Araştırma ilişkisel tarama modelinde dayalı olarak yürütülmüştür. Çalışmanın araştırma grubunu 2024-2025 eğitim-öğretim yılında Türkiye'deki farklı üniversitelerde öğrenim gören 193

(%46.8) erkek, 219 (%53.2) kız olmak üzere toplam 412 öğretmen adayı oluşturmuştur. Araştırma grubunun yaş ortalaması 20.47'dir. Araştırmada veri toplama araçları olarak "Yapay Zekâ Bağımlılık Ölçeği", "Bilişsel Esneklik Envanteri", "Duygu Düzenleme Becerileri Ölçeği" ve "Kişisel Bilgi Formu" kullanılmıştır. Araştırmada elde edilen veriler çoklu doğrusal regresyon analiz (adımsal) yöntemi ile analiz edilmiştir. Araştırma sonucunda; yapay zekâ bağımlılığını birinci sırada "bilişsel esneklik", ikinci sırada "duygu düzenleme becerileri" değişkenlerinin anlamlı düzeyde yordadığı belirlenmiştir.

Anahtar Kelimeler: Öğretmen adayı, Yapay zeka, Bilişsel esneklik, Duygu düzenleme becerileri.

Abstract: This study examined how much the variables of cognitive flexibility and emotion regulation skills of teacher candidates predicted the levels of artificial intelligence addiction. The study was conducted based on the relational screening model. The research group of the study consisted of a total of 412 teacher candidates, 193 (46.8%) male and 219 (53.2%) female, studying at different universities in Turkey in the 2024-2025 academic year. The average age of the research group was 20.47. The "Artificial Intelligence Addiction Scale", "Cognitive Flexibility Inventory", "Emotion Regulation Skills Scale" and "Personal Information Form" were used as data collection tools in the study. The data obtained in the study were analyzed with the multiple linear regression analysis (stepwise) method. As a result of the study; It was determined that the variables of "cognitive flexibility" and "emotion regulation skills" significantly predicted artificial intelligence addiction in the first place.

Keywords: Teacher candidate, Artificial intelligence, Cognitive flexibility, Emotion regulation skills.

Giriş

Sürekli gelişen teknoloji, hayatımızı birçok açıdan kolaylaştırırken aynı zamanda bazı olumsuz sonuçları da beraberinde getirmektedir. Teknolojinin hızla ilerlemesi, yeni imkânların ve fırsatların doğmasına olanak tanırken, eğitim alanından sağlığa kadar birçok kurum tarafından ve bilgi aramadan eğlenceye kadar birçok amaç için kullanılmaktadır. Aynı zamanda bu gelişmelerin getirdiği sorunlar da göz ardı edilemez. Özellikle dijital cihazların, internetin ve sosyal medyanın yaygınlaşması, teknolojiye olan bağımlılığın artmasına neden olabilmektedir. Bu teknolojik ilerlemeye bağlı bağımlılıklardan bir tanesi de yapay zekâ bağımlılığı olarak dikkat çekmektedir (Ateş ve Sağar, 2021; Morales-García, Sairitupa-Sanchez, Morales-García ve Morales-García, 2024; Sağar ve Sağar, 2022).

Literatür Taraması

Yapay zekâ, yaşanan yüzyılda dünyanın şekillenmesinde kritik bir rol oynamaktadır. Geçmişte, yalnızca bilim kurgu eserlerinde gördüğümüz hayal gücüne dayalı teknolojiler, günümüzde hayatımıza dahil olmuş ve büyük bir değişimi beraberinde getirmiştir. Bu değişimlerin kökenine bakıldığında, 1921 yılında Çek yazar Karel Čapek'in yazdığı R.U.R. (Rossum's Universal Robots) adlı oyunu, robot kavramının ilk kez geniş bir kitleye tanıtıldığı yer olarak öne çıkmaktadır. Çapek'in kullandığı "robot" terimi, günümüzün yapay zekâ ve robotik uygulamaları için bir temel oluşturmuştur. Yapay zekâ, sadece endüstriyel alanda değil, sağlık, tarım, enerji, otomotiv, eğitim gibi pek çok alanda etkisini göstermektedir. 1986 yılında Groover ve arkadaşları tarafından yapılan çalışmalarda, endüstride robotların, belirli görevleri gerçekleştirmek için programlanan ve hareket eden sistemler olarak tanımlandığı belirtilmiştir. Bu tanım, bugünün robotlarının ve yapay zekâ uygulamalarının temellerini atmaktadır. Bu bağlamda, yapay zekâ sadece teknoloji dünyasında değil, toplumların her alanında devrim yaratacak potansiyele sahiptir (Becker, Brown, Dahlstrom, Davis, DePaul, Diaz ve Pomerantz, 2018). Birçok farklı alanda kendine yer bulan ve teknolojinin önemli bir parçası haline gelen yapay zekâ problemli kullanıldığı durumlarda bağımlılık sorunlarına yol açabilmektedir. Bu çerçevede yapay zekâ bağımlılığından söz edilebilmektedir. Teknoloji bağımlılıkları kapsamında değerlendirilen (problemli internet kullanımı, problemli akıllı telefon kullanımı gibi), yapay zekâ bağımlılığı; olumsuz sonuçlar meydana getirebilecek bağımlılık ve bağımlılık eğilimine sebep olan yapay zekâ teknolojilerinin aşırı kullanımı şeklinde tanımlanmaktadır (Savaş, 2024). Alanyazın incelendiğinde bu bağımlılığa ilişkin tanımlamaların ve araştırmaların oldukça sınırlı olduğu görülmekte bu sebeple yapay zekâ bağımlılığı ile farklı değişkenlerin bir arada incelendiği çalışmaların literatüre katkı sunacağı düşünülmektedir. Dolayısıyla bu araştırmada yapay zekâ bağımlılığı, bilişsel esneklik ve duygu düzenleme becerileri ile birlikte incelenmiştir.

Bilişsel esneklik, bireylerin değişen koşullara, yeni bilgilere veya farklı durumlara uyum sağlama kapasitesini ifade etmektedir. Bu kavram, kişinin bir probleme farklı açılardan yaklaşabilmesi ve çözüm üretme sürecinde esnek davranabilmesi ile ilgili önemli bir psikolojik özelliktir. Bilişsel esneklik, sadece mevcut durumu anlamakla kalmaz, aynı zamanda alternatif düşünme, yeni stratejiler geliştirme ve çeşitli çözümleri değerlendirme yeteneğini de içermektedir (Martin ve Anderson, 1996, 1998; Martin, Anderson ve Thweatt, 1998; Martin ve Rubin, 1995). Bilişsel esneklik bakımından güçlü olan kişi, karşılaştığı yeni ya da beklenmedik durumlar karşısında yalnızca birkaç seçenekle sınırlı kalmamaktadır. Aksine, farklı perspektiflerden düşünebilmekte, birden fazla çözüm önerisi geliştirebilmekte ve duruma uygun çeşitli stratejiler oluşturabilmektedir. Bu, bireyin hem kişisel hem de profesyonel yaşamında daha etkin bir şekilde problem çözmesine olanak tanımaktadır. Bunun yanında, bilişsel esneklik, kişilerin yeniliklere açık olmalarını, öğrenmeye devam etmelerini ve değişen çevreye uyum

sağlamalarını desteklemektedir (Ateş ve Sağar, 2021; Sağar, 2022). Bir başka ifade ile bilişsel esneklik, bir kişinin çevreden gelen değişen uyaranlara uyum sağlayarak, gerektiğinde düşünsel süreçlerini ve davranışlarını esnek bir şekilde değiştirebilme yeteneğidir. Bu, kişinin yeni bilgileri öğrenebilmesi, önceki düşünce ve davranış biçimlerini değiştirebilmesi ve farklı durumlar için uygun yanıtlar verebilmesi anlamına gelmektedir (Scott, 1962). Bilişsel esneklik, bireylerin çeşitli durumlar ve değişen koşullar karşısında düşünsel süreçlerini esnek bir şekilde uyarlama yeteneğini ifade etmektedir. Bu yetenek, kişilerin yeni bilgiler edindiklerinde, önceki deneyimlerinden farklı çözümler üretebilmelerini sağlamaktadır. Bilişsel esneklik, bireylerin karşılaştıkları zorluklarla başa çıkabilmelerine, problemlere farklı açılardan yaklaşabilmelerine ve alternatif çözümler geliştirmelerine yardımcı olmaktadır (Canas, Fajardo ve Salmeron, 2006). Bu bilgiler bağlamında yüksek düzeyde bilişsel esnekliğe sahip kişilerin alternatif seçeneklerle problemleri değerlendirebildikleri ve farklı çözüm yolları bulabildikleri ve sorunlara işlevsel biçimde çözümler üretebildikleri söylenebilir. Bunun aksine düşük düzeyde bilişsel esnekliğe sahip bireyler ise problemlere karşı alternatif seçenekler üretememekte ve bu bağlamda bu bireylerin yapay zekâ bağımlılık düzeylerinin de yüksek olabileceği ifade edilebilir. Dolayısıyla bu bireyler yapay zekâ bağımlılığıyla etkili biçimde başa çıkamayacakları ve alternatif çözüm yolu yolları üretmekte güçlük yaşayabilecekleri düşünülmektedir.

Bilişsel esneklik değişkenin yanında yapay zekâ bağımlılığı ile ilişkili olduğu düşünülen diğer bir kavram ise duygu düzenleme becerileridir. Duygu düzenleme, bireylerin duygusal tepkilerini tanıma, izleme, değerlendirme ve gerektiğinde değiştirme süreçlerini içeren bir yetenek olarak tanımlanabilmektedir. Bu süreç, duygusal deneyimlerin yoğunluğunu ve zamansal özelliklerini yönetmeyi kapsamaktadır (Thompson, 1994). Duygu düzenleme, bireylerin farklı durumlar içinde amaçlarına yönelik olarak duygularının şiddetini belirleme ve yönetme esnekliğine sahip olmalarını sağlamaktadır. Bu da, duyguların kontrol edilmesi ve gerektiğinde adaptif bir şekilde değiştirilmesiyle amaçlara ulaşmayı mümkün kılmaktadır (Bonanno ve Burton, 2013). Bunların yanı sıra duygu düzenleme, kişinin duygusal deneyimlerini bilinçli ya da bilinçdışı bir şekilde kontrol etme, yönlendirme veya değiştirme sürecidir. Bu, bireyin duygusal durumları üzerinde müdahalede bulunarak, duygularını hem kendi yararına hem de çevresiyle olan ilişkilerinde uygun şekilde ifade etmesini sağlamaktadır (Gross, 1998). Gross (2001), duygusal düzenleme süreçlerini iki ana boyutta incelemiştir. Bunlar dışavurumcu bastırma ve bilişsel yeniden değerlendirmedir. Dışavurumcu bastırma boyutu, bireylerin duygusal ifadelerini kontrol altına alarak gizlemeleri ya da engellemeleri ile ilgilidir. Yani, kişi duygusal bir tepki hissetse de bunu dışa vurmaz ve duygusal ifadesini bastırır. Bu tür bir düzenleme, genellikle kişinin çevresine duygusal tepki göstermemek ya da sosyal durumlarda uygun olabilmek amacıyla kullanılmaktadır. Bilişsel Yeniden değerlendirme boyutu ise bireylerin bir olayla ilgili duygusal deneyimlerini değiştirebilmek için o olayı yeniden değerlendirmeleri ya da anlamlandırmalarıdır. Yeniden değerlendirme, duygusal tepkiyi değiştirme amacını taşımakta ve kişilerin daha pozitif ya da daha az olumsuz duygular yaşamasını sağlayabilmektedir. Stresli bir durum karşısında kişinin bu durumu "bir fırsat" olarak görmesi buna bir örnek teşkil etmektedir. Gross'un modeline göre, dışavurumcu bastırma daha çok duyguların gizlenmesi veya baskılanması ile ilişkiliyken, bilişsel yeniden değerlendirme daha çok düşünsel ve anlamlandırma süreçleri üzerinden duygusal düzenlemeyi içermektedir (Gross, 2001). Duygu düzenleme becerileri, bireylerin duygusal durumlarını etkili bir şekilde yönetme, anlamlandırma ve gerektiğinde değiştirme yeteneğidir. Bu beceriler, kişilerin stres, kaygı, öfke, üzüntü gibi güçlü duyguları kontrol etmelerine yardımcı olmaktadır. Duygusal düzenleme becerilerinin eksikliği, bireylerin duygusal tepkilerini aşırı şekilde ya da sağlıksız bir biçimde ifade etmelerine yol açabilmektedir (Berking ve Lukas, 2015). Bu bağlamda duygularını etkin şekilde düzenleme becerileri bakımından yoksun olan, bir başka deyişle duygu düzenleme beceri düzeyleri düşük olan öğretmen adaylarının yapay zekâ bağımlılığı düzeylerinin

yüksek olabileceği söylenebilir. Bu çerçevede yapay zekâ bağımlılığının duygu düzenleme becerileri ile ilişkili olabileceği düşünülmektedir.

Her yaştan ya da her kesimden bireyi etkileyerek bağımlılık oluşturabilecek bir sorun olan yapay zekâ bağımlılığı bireylerin farklı alanlarda işlev kayıpları yaşamasına sebep olarak ruh sağlığına zarar verebilir. Bu bağlamda öğretmen adayları açısından da yapay zekâ bağımlılığının önemle incelenmesi gereken bir sorun olduğu ifade edilebilir. Bu noktada öğretmen adaylarında yapay zekâ bağımlılığıyla ilişkili olabilecek değişkenlerin ortaya koyulmasının yapay zekâ bağımlılığının daha iyi bir biçimde anlaşılmasının yanında bu çerçevede yapılacak olan iyileştirici, koruyucu ruh sağlığı çalışmalarına yardımcı olacağı düşünülmektedir. Yapay zekâ bağımlılığı konusuna yönelik olarak yürütülen alan yazın taramasında yapay zeka bağımlılığının çeşitli değişkenlerle bir arada incelendiği araştırmaların olduğu görülmüştür. Ancak alanyazında yapay zekâ bağımlılığının bilişsel esneklik ve duygu düzenleme becerileri değişkenleriyle bir arada incelendiği herhangi bir çalışmaya ulaşılmamıştır. Bu sebeple yapılan bu araştırma alan açısından çok önemli ve değerli görülmektedir. Bu bağlamda yürütülen bu araştırmada, bilişsel esneklik ve duygu düzenleme becerileri değişkenlerinin öğretmen adaylarının yapay zekâ bağımlılığı düzeylerini ne kadar yordadığını incelemek amaçlanmıştır.

Yöntem

Araştırma Modeli

Yapılan bu araştırma ilişkisel tarama modelinde dayalı olarak yürütülmüştür. Bu model iki ya da daha fazla sayıdaki değişken arasında birlikte değişimin varlığını ya da derecesini belirlemeye yönelik bir araştırma modelidir (Karasar, 2016).

Araştırma Grubu

Bu çalışmanın araştırma grubunu 2024-2025 eğitim-öğretim yılında Türkiye'deki farklı üniversitelerde öğrenim gören 193 (%46.8) erkek, 219 (%53.2) kız olmak üzere toplam 412 öğretmen adayı oluşturmuştur. Araştırma grubunun cinsiyet açısından dağılımı Tablo 1'de verilmiştir. Araştırma grubunun yaş aralığı 18-25 arasında olup; yaş ortalaması 20.47'dur.

Tablo 1. Araştırma grubunun cinsiyete göre dağılımı

Cinsiyet	N	%
Erkek	193	46.8
Kız	219	53.2
Toplam	412	100

Veri Toplama Araçları

Yapay Zekâ Bağımlılık Ölçeği

Morales-García, Sairitupa-Sanchez, Morales-García ve Morales-García (2024) tarafından geliştirilen bu ölçeğin Türkçe'ye uyarlanmasını Savaş (2024) yapmıştır. Bu ölçek 5'li likert tipinde ve 5 maddeden oluşmaktadır. Ölçekten alınan puanların yüksek olması yapay zekâ bağımlılığının yüksek olduğunu göstermektedir. Ölçeğin Türkçe uyarlamasında Cronbach alfa güvenirlik katsayısı ölçeğin tamamında .82 olarak saptanmıştır (Savaş, 2024). Bu araştırmada ise ölçeğin tamamı için Cronbach alfa güvenilirlik katsayısının .79 olduğu belirlenmiştir.

Bilişsel Esneklik Envanteri

Dennis ve Vander Wal (2010) tarafından geliştirilen Bilişsel Esneklik Envanterinin Türkçe'ye uyarlanmasını Sapmaz ve Doğan (2013) yapmıştır. Bilişsel Esneklik Envanteri, 5'li likert tipinde ve 20 maddeden oluşmakta ve ölçeğin 2, 4, 7, 9, 11, 17. maddeleri tersten puanlanmaktadır. Ölçekten alınan puanların yüksek olması bilişsel esnekliğin yüksek olduğunu göstermektedir. Ölçeğin Türkçe uyarlamasında Cronbach alfa güvenirlik katsayısı ölçeğin tamamında .90 olarak saptanmıştır. (Sapmaz ve Doğan, 2013). Bu araştırmada ise ölçeğin tamamı için Cronbach alfa güvenilirlik katsayısının .89 olduğu belirlenmiştir.

Duygu Düzenleme Becerileri Ölçeği

Berking ve Znoj (2008) tarafından duygu düzenleme becerilerini değerlendirme yapmak amacı ile geliştirilen bu ölçeğin Türkçe uyarlamasını Vatan ve Kahya (2018) yapmıştır. 27 maddeden oluşmakta ve beşli likert tipindedir. Toplam puan ortalaması ile değerlendirme yapılabilen bu ölçekten alınan yüksek puanlar duygu düzenleme becerilerinin daha yüksek olduğunu ifade etmektedir. Ölçeğin Türkçe uyarlamasında, güvenilirlik çalışmasında tüm test için Cronbach alfa iç tutarlılık katsayısı 0.89 olduğu tespit edilmiştir (Vatan ve Kahya, 2018). Bu araştırmada ise ölçeğin tamamı için Cronbach alfa güvenilirlik katsayısının .94 olduğu belirlenmiştir.

Kişisel Bilgi Formu

Araştırma grubunda bulunan öğretmen adaylarının cinsiyet ve yaşı hakkında bilgi alabilmek amacıyla bu araştırma kapsamında oluşturulmuştur.

Verilerin Toplanması

Araştırma verileri Google Form aracılığıyla online (çevrimiçi) yöntemle toplanmıştır. Bu doğrultuda Google Form aracılığıyla hazırlanan veri toplama araçları e-posta yoluyla öğretmen adaylarına gönderilerek araştırmaya davet edilmiştir. Araştırmaya gönüllü öğretmen adaylarının katılması esas alınmış olup araştırmaya katılmadan önce öğretmen adaylarından aydınlatılmış onam alınmıştır. Ayrıca veri toplama sürecinde gizlilik ilkesi dikkate alınmış ve bu konuda öğretmen adayları bilgilendirilmiştir. Çevrimiçi veri toplama süreci yaklaşık olarak on beş gün sürmüştür.

Verilerin Analizi

Araştırmada ilk olarak verilerin çoklu doğrusal regresyon analizi için uygun olup olmadığına belirlemek için veri setlerinin normalliği ve doğrusallığı değerlendirilmiştir. Normallik (çok değişkenli) ve doğrusallık varsayımlarını güçleştiren uç değerlerin olup olmadığı mahalanobis uzaklık (13.82), cook's (Cook'<1) ve leverage values (.000 - .020) değerlerine göre incelenmiştir. Ayrıca veri setleri basıklık, çarpıklık değerleri (+1/-1), saçılım ve histogram grafikleri bakımından da incelenmiştir. Bu incelemeler sonucunda 12 kişiye ait veriler veri analizini etkileyecek düzeyde uç değerlere sahip

olmalarından dolayı veri setinden çıkarılmıştır. Veri setlerinin doğrusallık ve normallik koşullarını sağlamanın yanı sıra yordayan değişken sayısı esas alındığında örneklem büyüklüğünün de uygun olduğu görülmüştür. Çoklu doğrusal regrasyon analizinin diğer bir varsayımı olan yordayıcı değişkenler arasında yüksek bağıntı katsayısının bulunmaması noktasında yapılan incelemelerde yordayıcı değişkenler arasında çoklu bağlantılık olarak tanımlanabilecek .80 üzerinde bir korelasyon değerinin olmadığı (Tablo 3), tolerans değerlerinin .20'den yüksek, VIF değerlerinin 10'dan küçük ve CI değerlerinin ise 30'dan küçük olduğu belirlenmiştir. Hataların bağımsız olması şartını incelemek için ise Durbin-Watson değerine bakılmış; değerin 1-3 arasında (DW=1.80) olduğu ve sorun teşkil etmediği görülmüştür. Yapılan incelemelere bağlı olarak elde edilen verilerin çoklu doğrusal regresyon analizi için uygun olduğu belirlenmiştir. Araştırmada elde edilen veriler çoklu doğrusal regresyon analiz (adımsal) yöntemi ile analiz edilmiştir. Araştırmada .05 anlamlılık düzeyi esas alınmıştır (Akbulut, 2010; Büyüköztürk, 2011).

Bulgular

Araştırmada bulgular kısmında; ilk olarak araştırma grubunun yapay zekâ bağımlılığı, bilişsel esneklik ve duygu düzenleme becerileri puanlarına ilişkin aritmetik ortalama ve standart sapma değerleri, daha sonra değişkenlere ilişkin basit korelasyon analiz katsayıları ve son olarak da yapay zekâ bağımlılığının yordanmasına ilişkin çoklu doğrusal regresyon analiz (adımsal) sonuçları verilmiştir.

Araştırma grubunun yapay zekâ bağımlılığı, bilişsel esneklik ve duygu düzenleme becerileri puanlarına ilişkin aritmetik ortalama ve standart sapma değerleri Tablo 2'de verilmiştir.

Tablo 2. Aritmetik ortalama ve standart sapma değerleri

Değişken	N	$\bar{X}$	SS
Yapay Zekâ Bağımlılığı (Y.Z.B.)	412	12.36	3.72
Bilişsel Esneklik (B.E.)	412	75.89	11.22
Duygu Düzenleme Becerileri (D.D.B.)	412	23.36	6.54

Tablo 2 incelendiğinde araştırma grubunun aritmetik ortalama ve standart sapma değerleri; yapay zekâ bağımlılığı ($\bar{X}$=12.36; SS= 3.72), bilişsel esneklik ($\bar{X}$=75.89; SS=11.22) ve duygu düzenleme becerileri ($\bar{X}$=23.36; SS=6.54) olarak belirlenmiştir. Öğretmen adaylarının yapay zekâ bağımlılığı, bilişsel esneklik ve duygu düzenleme becerileri arasındaki ilişkilere basit korelasyon analiz yöntemi ile bakılmış ve elde edilen sonuçlar Tablo 3'de verilmiştir.

Tablo 3. Değişkenlere ilişkin basit korelasyon analiz katsayıları

Değişken	İ.B.	B.E.	D.D.B.
Yapay Zekâ Bağımlılığı (Y.Z.B.)	1		
Bilişsel Esneklik (B.E.)	-.292[**]	1	
Duygu Düzenleme Becerileri (D.D.B.)	-.235[**]	.526[**]	1

**P<.01

Tablo 3 incelendiğinde yapay zekâ bağımlılığı ile bilişsel esneklik (r=-.292, p<.01) ve duygu düzenleme becerileri (r=-.235, p<.01) arasında negatif yönde anlamlı düzeyde birer ilişkinin olduğu belirlenmiştir. Bu bulgudan hareketle öğretmen

adaylarında bilişsel esneklik ve duygu düzenleme beceri düzeyleri arttıkça yapay zekâ bağımlılığı düzeyinin azaldığı söylenebilir. Ayrıca tablo 3 incelendiğinde yordayıcı değişkenler arasında çoklu bağlantılık olarak tanımlanabilecek .80 üzerinde bir korelasyon değerinin olmadığı da görülmüştür.

Bir sonraki adımda çoklu doğrusal regresyon analizine ilişkin yordayıcı değişkenlerin yordanan değişkenle ilişkisini ve dolayısı ile yordanan değişkendeki değişimi açıklama derecesinin anlamlılığını test eden ANOVA tablosu incelendiğinde, açıklanan varyansın ya da regresyon modelinin istatistiksel olarak anlamlı olduğu tespit edilmiştir ($F_{1/410}$=38.174; $F_{2/409}$=21.283, p<.01). Buna göre yordayan değişkenler model üzerinde yordama işlemini başarı ile yerine getirmişlerdir.

Tablo 4. Yapay zekâ bağımlılığının yordanmasına ilişkin çoklu doğrusal regresyon analiz (adımsal) sonuçları

	B	SH	ß	t	İkili r	Kıs. r	R	R^2	F	Sd
1.(Sabit)	19.72	1.20		16.39**						
B.E.	-.097	.016	-.292	-6.17**	-.292	-.292	.292[a]	.085	38.174**	1/410
2.(Sabit)	19.72	1.19		16.46**						
B.E.	-.077	.018	-.233	-4.20**	-.292	-.204	.307[b]	.094	21.283**	2/409
D.D.B.	-0.64	.032	-.112	-2.02*	-.235	-.100				

**P<.01; *P<.05

Tablo 4 incelendiğinde çoklu doğrusal regresyon analizinin birinci adımında incelenen bilişsel esneklik değişkeninin yapay zekâ bağımlılığını yordamada beta katsayısı -.292'dir. Beta katsayısının anlamlılığına ilişkin t testi sonucunun anlamlı düzeyde olduğu belirlenmiştir (t=-6.17, p<.01). Tek başına bilişsel esneklik değişkeni yapay zekâ bağımlılığının %8'ini açıklamaktadır (R=.292; R^2=.085).

Çoklu doğrusal regresyon analizinin ikinci adımında modele bilişsel esneklik değişkeninin yanı sıra duygu düzenleme becerileri değişkeni de girmiştir. Bilişsel esneklik ve duygu düzenleme becerileri değişkenleri birlikte yapay zekâ bağımlılığının yaklaşık olarak %9'unu açıklamaktadır (R=.307; R^2=.094). Bilişsel esneklik değişkeninin beta katsayısı -.233; duygu düzenleme becerileri değişkeninin beta katsayısı -.112'dir. Beta katsayısının anlamlılığına ilişkin t testi sonuçlarının anlamlı düzeyde olduğu belirlenmiştir (t_{BE}=-4.20, p<.01; t_{DDB}=-2.02, p<.05). Yapılan çoklu doğrusal regresyon analiz sonucunda bilişsel esneklik ve duygu düzenleme becerileri değişkenlerinin yapay zekâ bağımlılığını anlamlı düzeyde yordadığı görülmüştür. Modeldeki değişkenlere ilişkin beta değerleri dikkate alındığında öğretmen adaylarının yapay zekâ bağımlılıklarını ilk sırada "bilişsel esneklik", ikinci sırada "duygu düzenleme becerileri" değişkenlerinin anlamlı düzeyde yordadığı belirlenmiştir.

Tartışma, Sonuç ve Öneriler

Araştırma sonucunda yapay zekâ bağımlılığı ile bilişsel esneklik ve duygu düzenleme becerileri arasında negatif yönde anlamlı düzeyde birer ilişkinin olduğu belirlenmiştir. Ayrıca yapılan bu çalışma sonucunda bilişsel esneklik ve duygu düzenleme becerileri değişkenlerinin yapay zekâ bağımlılığı değişkeninin anlamlı düzeyde yordayıcıları olduğu görülmüştür. Bilişsel esneklik ve duygu düzenleme becerileri değişkenleri birlikte yapay zekâ bağımlılığının yaklaşık olarak %9'unu açıklamıştır.

Öğretmen adaylarının yapay zekâ bağımlılıklarını birinci sırada "bilişsel esneklik", ikinci sırada "duygu düzenleme becerileri" değişkenlerinin anlamlı düzeyde yordadığı belirlenmiştir.

-Bu çalışmada araştırma grubu öğretmen adayları grubu ile sınırlıdır. Bu noktada bir araştırmada farklı araştırma grupları (yetişkinler, lise öğrencileri, farklı meslek adayı grupları vb.) ile çalışılabilir.

-Bu çalışma bilişsel esneklik ve duygu düzenleme beceri değişkenlerinin öğretmen adaylarının yapay zekâ bağımlılığı düzeylerini ne kadar yordadığının incelenmesiyle sınırlıdır. Bu noktada yapılacak başka bir çalışmada yapay zekâ bağımlılığı ile farklı değişkenler incelenebilir.

-Bu çalışma sonucunda öğretmen adaylarında bilişsel esneklik ve duygu düzenleme becerileri düzeyi arttıkça yapay zekâ bağımlılığı düzeyinin azaldığı sonucu elde edilmiştir. Bu bağlamda yapay zekâ bağımlılığına önlem almak ya da azaltmak amacıyla öğretmen adaylarının bilişsel esneklik ve duygu düzenleme beceri düzeylerini artırılmasına yönelik çalışmalara yapılabilir.

<div align="center">Kaynakça</div>

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Eğitimde Yapay Zeka Kullanımının Öğrenci Başarısına Etkisi The Effect Of Using Artifical Intellegence In Education On Student Success ---------- Şeymanur Tunahan

Eğitimde Yapay Zeka Kullanımının Öğrenci Başarısına Etkisi The Effect Of Using Artifical Intellegence In Education On Student Success

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Özet

Yapay zekanın dijitalleşen dünyada önemli bir konumu vardır. Yapay zeka, insan davranışlarını taklit eden bilgisayara işlemcileri olarak tanımlanmaktadır. Yapay zeka, her alanda olduğu gibi eğitim alanında kendini göstermektedir. Bu çalışmanın amacı eğitimde yapay zeka kullanımının öğrenci başarısına etkisini incelemektir. Bu amaç doğrultusunda çeşitli dergilerde yayınlanan makalelerden ve Ulusal Tez Merkezi'nden alınan doktora tezi olmak üzere 8 çalışma sistematik derleme ile incelenmiştir. İncelemeler sonucunda yapay zekanın öğrenci başarısında olumlu etkide bulunduğu bununla birlikte yapay zekanın öğrenci başarısına etkisini inceleyen daha fazla çalışma yapılması önerilmiştir.

Anahtar Kelimeler: Yapay Zeka, Eğitimde Yapay Zeka, Öğrenci Başarısı

Summary

Artificial intelligence has an important position in the digitalizing world. Artificial intelligence manifests itself in the field of education, as in every field. The purpose of this study is to examine the effect of using artificial intelligence in education on student success. For this purpose, 8 studies, including articles published in various journals and doctoral theses taken from the National Thesis Center, were examined by systematic review. As a result of the investigations, it has been shown that artificial intelligence is effective in student success, and more studies are recommended to examine the effect of artificial intelligence on student success.

Keywords: Artificial Intelligence, Artificial Intelligence in Education, Student Success

Giriş

Modern dünyanın inşa edilmesi ile birlikte temel bilişim ağları ve makineler, yaşamın vazgeçilmez parçası haline gelmiştir. Makineler önceleri yalnızca verilere ulaşma amacıyla kullanılırken ilerleyen süreçte veriler hakkında yorum yapma seviyesine ulaşmıştır. Günümüze gelindiğinde ise insan yapımı bu makinelerin insanlar adına kararlar aldığı ve olaylar arasında bağlantılar kurabildiği görülmektedir. Makine ve bilişim ağlarının bu yetilerinin gelişmesini amaçlayan çalışmalar 'yapay zeka' olarak adlandırılmaktadır. İlk kez 1950'li yıllarda ortaya atılan yapay zeka kavramı zamanla hayatımızın vazgeçilmez parçası haline gelmiş, son yirmi yılda ise eğitim sistemleri içerisinde yer almaya başlamıştır (Öztemel, 2003; Sarıoğlu, 2023). Bu dönemde bilgisayarlar yalnızca işlenen komutu uygulamaktaydı. Yapay zekanın doğuşu 1943'de bilgisayarın icadı ile olmuştur (Bekleriç, 2003). Yapay zekanın gelişimi bilgisayarların gelişimiyle paralel ilerlese de yapay zeka, bilgisayar teknolojileriyle sınırlı kalmayarak pek çok alanda etkinliğini sürdürerek hayatla doğrudan ilişki kurmaktadır (Doğan, 2002). Alan Turing, 1950 yılında Turing adı verilen test ile yapay zeka teknolojisinin temellerini atmıştır. Turing testi, makinenin insanca kararlar verebilme yeteneğini ölçen ve bu ölçüm sonucunda insan kararıyla makine kararı arasındaki farkı değerlendiren bir testtir. Eğer test makine ile insan kararını birbirinden ayırt edemezse, bu durum makinenin insanla aynı zihinsel faaliyeti gösterebildiği anlamına gelmektedir (Sarıoğlu, 2023). Bilgisayarların zeka ile birleşeceği bilgiyi saklama özelliği 1950'nin ortasında bulunmuştur. İlk defa 1956 yılında Dortmund'da düzenlenen bir konferansta John McCarthy tarafından dile getirilen yapay zeka kavramı, günümüze kadar sayısız değişim ve dönüşümden geçerek bugün mühendislikten eğitim alanına kadar pek çok sektörün vazgeçilmez parçası haline gelmiştir (Arslan, 2017). Günümüzde yapay zeka, tek bir alanla sınırlı kalmayarak kendine çeşitli uygulama alanları oluşturmuştur. Özellikle siber güvenlik, bankacılık ve eğlence alanlarında yapay zeka uygulamaları etkin bir şekilde kullanılmaktadır (Elmas, 2007).

Yapay zeka; otomotiv, sanayi, savunma, sağlık, oyun, tarım, gibi farklı sektörlerde olduğu gibi eğitim alanında da faaliyet göstermektedir (Bayram ve Çelik, 2023). Yapay zeka, çağdaş eğitimde her zaman destekleyici bir rol oynamıştır. Sidney L. Pressey'nin 1920'de yaptığı çalışmalar yapay zekanın eğitimdeki ilk uygulama örnekleri arasında gösterilebilmektedir (Arslan, 2017). Pressey, çoktan seçmeli testleri sadece öğrenciyi değerlendirme aracı olarak görmemekte, aynı zamanda bu testlerin öğrenciye pekiştireç verebileceğini de savunmaktaydı. Pressey, öğrencilere çoktan seçmeli testlerin sonuçlarını hemen görebilecekleri ardından gerekli dönüt ve düzeltmeler ile doğru bilgiye ulaşabilecekleri makinelerden bahsederek yapay zekânın eğitim alanında uygulanmasına öncelik etmiştir (Holmes ve diğ., 2019). 1980'lerden bu yana yapay zeka, eğitim sürecinde öğretmenlere destek olarak öğrencinin öğrenme sürecine katkı sağlamak amacıyla kullanılmaktadır (How ve Hung, 2019). Yapay zekâ, öğrenme sürecinin akışını değiştirerek devrim yaratma potansiyeline sahiptir. Yapay zekâ, öğrencinin bilgileri nereden, hangi yoldan ve kim(ler) aracılığıyla edindiğiyle ilgili köklü değişiklikler yaparak eğitimde yeni kapılar açmaktadır (Sarıoğlu, 2023). Yapay zeka, eğitim materyallerine aktive edilerek materyaller algılama, düşünme ve uygulama gibi zeki canlılara özgü özelliklere sahip olmuştur. Yapay zekâ bu yönüyle başta aktif öğrenme olmak üzere pek çok öğrenme yöntemiyle harmanlanarak eğitim alanında kendini göstermektedir (Akdeniz ve Özdinç, 2021). Yapay zeka teknolojisinin eğitimde kullanıldığı yeni nesil öğretim materyalleri; eğitim yazılımları, müzeler, web materyalleri, dijital kitaplar, öğretici robotlar, arayüz ajanları ve sanal asistanlardır (Bayram ve Çelik, 2023). Yapay zekâ, öğrenciye geri bildirim sağlayarak öğrencinin güçlü ve zayıf yönlerini görmesine, onları gidermesine yardımcı olmaktadır. Ayrıca, yapay zekayı kullanan öğretmenler, öğrenciye rehberlik desteği sunarak öğrencinin zamandan bağımsız gelişimine destek olmaktadır (Sarıoğlu,

2023). Yapay zeka aracılığıyla hazırlanan rehberlik planlamalarıyla öğrenci verileri analiz edilerek öğrenciye özgü ders planları geliştirilebilmektedir (Yıldız, 2014). Bu yöntemle öğrencilerin eksikliklerini daha hızlı fark edip gidererek kendi potansiyellerini ortaya koymaları amaçlanmaktadır (Sarıoğlu, 2023).

Yapay zeka teknolojilerinin eğitimde kullanımı, öğrencinin akademik başarısını etkileyen önemli bir faktördür. Yapılan çalışmalar eğitimde teknoloji kullanımının öğrenci başarısını olumlu yönde etkilediğini göstermektedir. Teknolojinin öğrenci başarısına etkisi öğrenci ihtiyaçları, teknolojik altyapı, teknolojinin kullanılma durumuna göre değişiklik göstermektedir. Teknolojinin öğrenme sürecine dahil olması, öğrencinin bilgiyle bağ kurma hızını artırmaktadır. Teknoloji, öğrencilerin kendi öğrenme türlerine bağlı olarak eğitim alma imkanı sunmaktadır. Örneğin, görsel zekası baskın olan öğrencilerin görsel medya ve interaktif simülasyonlar, öğrencinin öğrenme deneyimini hızlandırmaktadır. Ayrıca, teknoloji, öğrencilerin öğrenme süreçlerini takip etme ve öğretmenlere daha hızlı geri bildirim sağlama yeteneğiyle öğrenme sürecini iyileştirebilmektedir (Akbulut vd., 2024).

Çalışmanın Amacı

Bu çalışma, günümüzün yaygın öğrenme araçlarından biri olan yapay zekanın öğrenci başarısına etkisini saptamak amacıyla yapılmıştır. Bu amaç doğrultusunda yayınlanan yüksek lisans tezleri, eğitim dergilerinde yayınlanan makaleler ve uluslararası dergilerde yayınlanan makaleler sistematik derleme ile incelenmiştir.

Yöntem

Bu çalışmada eğitimde kullanılan yapay zekanın öğrenci başarısına etkisini saptamak amacıyla sistematik derleme yöntemi kullanılmıştır. Sistematik derleme, bir soruna çözüm bulmak amacıyla o alanda yapılan bütün çalışmaların detaylı bir şekilde incelenerek, belli kriterler ölçüsünde değerlendirmeye alınacak çalışmaların belirlenmesiyle birlikte derlemeye dâhil edilen çalışmalarda yer alan bulguların sentez edilmesidir (Karaçam, 2013).

Verilerin Toplanması

Araştırma kapsamında Ulusal Tez Merkezinde yayınlanmış yüksek lisans ve doktora tezlerinden, dergilerde yayınlanmış makalelerden ve uluslararası hakemli dergilerden yararlanılmıştır. Bu kapsamda 8 adet çalışmaya ulaşılmıştır.

Araştırma kapsamında 8 çalışma belirlenmiştir ve bu çalışmalar Tablo 1'de gösterilmiştir.

Tablo 1. Makale ve tezlerin dağılımı

Sıra	Kaynak	Yayınlandığı Yer	Tür
1	Karagöz ve Korkmaz (2015)	TURKISH STUDIES -International Periodical for the Languages, Literature and History of Turkish or Turkic	Makale
2	Özbey, Karaköse ve Uçar (2016)	In 2016 15th International Conference on Information Technology Based Higher Education and Training (ITHET) (pp. 1-6)	Makale
3	İncekara ve Taşdemir (2019)	Gazi Mühendislik Bilimleri Dergisi	Makale
4	Huber, Schufeld ve Rhudes (1990)	Social Science Computer Review	Makale
5	Akbulut vd. (2024)	International QMX Journal	Makale
6	Erdemir ve İngenç (2014)	Eğitim ve Öğretim Araştırmaları Dergisi	Makale
7	Sarıoğlu (2023)	Ulusal Tez Merkezi	Makale
8	Kazu ve Özdemir (2010)	Doğu Anadolu Bölgesi Araştırmaları	Doktora Tezi

Bulgular

Yapılan çalışmalar, eğitimde yapay zekâ uygulamalarının öğrenci başarısına olumlu katkı sağladığını göstermektedir. Bununla birlikte yapay zekâ destekli materyaller kullanılırken öğrencinin hazırbulunuşluğu, kazanımlar, mekan gibi etkenler yapay zekânın kullanılma biçimi hakkında önemli ipucları vermektedir. Eğitsel alanda yapay zekâ kullanımının, öğretmene zaman kazandırmasının yanı sıra öğrencinin ilgi ve dikkat süresinin artmasına imkan sağlamaktadır. Özellikle bilgisayar destekli oyun öğretimleri öğrencinin ders ve okul ile olumlu bağ kurmasına yardımcı olarak okula ilişkin kaygılarını en aza indirmektedir.

Tartışma, Sonuç ve Öneriler

Bulgular sonucunda yapay zekânın eğitimin her alanında ortaya çıktığı görülmektedir. Yapay zekâ materyalleri öğrencinin eğitim seviyesi ve hazırbulunuşluğuna göre hazırlanmaktadır. Bu çalışmalar hem öğretmen hem de öğrenci adına zamandan ve enerjiden tasarruf sağlamasına olanak sağlayarak ekonomiklik ilkesi ile özdeşleşmektedir. Öğrenciler, yapay zekânın desteklediği eğitsel oyunlar sayesinde öğrenmeye daha istekli hale gelerek öğrenme sürecini daha hızlı tamamlamaktadır. Yapay zekâ destekli öğrenme ortamlarında öğrencilere oyun ortamı sağlanarak akranlarıyla rekabet ederek öğrenmeyi sağlamaları bireysel öğrenme yetilerinin gelişmesine neden olmaktadır. Bu sayede öğrenci, bireysel farklılıklarını erken yaşta fark ederek süreç içerisinde öğretmen desteği ile birlikte eksikliklerini daha hızlı düzeltme ve ilerleme şansı bulmaktadır. Yapay zekânın eğitimde kullanımı öğrenci ve öğretmen açısından işlevsel olsa da bazı sorunları da beraberinde getirmektedir. Öğrencilerin dijital öğrenime alışması öğrenim hayatlarının ilerleyen süreçlerinde dikkat eksikliği ve odaklanma gibi problemleri beraberinde getirebilmektedir. Öğrencilerin bireysel eğitimle rekabet halinde olmaları akranları ile olumlu ve dostane ilişkiler kurmalarına engel olabilmektedir. Bununla birlikte hızla değişen dijital süreçte okulların ve diğer eğitim kurumlarının değişime ayak uyduramaması altyapı sorunlarını beraberinde getirebilmektedir. Bu sorunlara ilişkin çözüm önerileri aşağıda sıralanmıştır:

- Teknolojik altyapı yetersizliğini gidermek amacıyla kurumlar belli aralıklarla uzman yardımı almalıdır.

- Öğrenciye sunulan yapay zekâ hizmetinin güncel ve uygulanabilir olmasına dikkat edilmelidir.

- Öğretmenin, yapay zekâ uygulamalarını öğrencinin bireysel farklılıklarını dikkate alarak kullanması gerekmektedir.

- Öğretmenin çağın yeniliklerine ayak uyduracak donanıma sahip olması gerekmektedir. Bunun için öğretmenlere lisans düzeyinden itibaren yapay zekâ, robotik ve kodlama vb. alanlarda eğitimler verilmesi gerekmektedir.

- Öğrenciyi okulun doğal ortamından uzaklaştıracak öğretme biçimlerinden ziyade akranlarıyla kaynaşık öğrenmeler gerçekleştireceği, hayatla iç içe olacağı eğitimler verilmeldiir.

- Yapay zekâ destekli öğrenme gerçekleştiren öğrencilere yeterince dönüt ve düzeltme imkanı sağlayarak yapay zekânın öğrenme alanının her aşamasında uygulanabilir olmasına dikkat edilmelidir.

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Merkeziyetsiz Otonom Organizasyonlar: Örgüt Yapıları Ve Yapay Zekâ Kapsamında Bir Değerlendirme-------------
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Günümüz dünyasında, çalışanların beklentileri, iş yapış biçimleri ve örgüt yapıları hızlı bir değişim içerisindedir. Geleneksel yönetim ve organizasyon yapılarının geçerliliğinin giderek azaldığı, bunun yerine şeffaflık, esneklik ve çalışan katılımı gibi kavramların ön plana çıktığı görülmektedir. Bu kavramların günümüzün hız kesmeyen dijitalleşme akımından da etkilenmesiyle karşımıza "Merkeziyetsiz Otonom Organizasyonlar (Decentralized Autonomous Organizations- DAO)" kavramı çıkmaktadır. Ortak bir amaç için bir araya gelen, merkezi bir otoriteye bağlı olmayan, işlemlerin önceden belirlenerek otomatik bir biçimde gerçekleştirildiği, şeffaf ve yalın yapıdaki DAO'lar gerek teoride gerekse uygulamada artan bir öneme sahiptir. Bu sebeple DAO'ların detaylıca ele alınması ve kavramın çeşitli bakış açılarından incelenmesi gerekmektedir. Bu kapsamda çalışmada, DAO mekanizmalarının nasıl işlediği, avantaj ve dezavantajlarının neler olduğu, yönetim ve organizasyon alanında nasıl bir dönüşüme sebebiyet verdiği, potansiyel uygulama alanlarının neler olduğu gibi konular mevcut yönetim teorileri ve pratikleri kapsamında ele alınmıştır. DAO'lar, yapay zekâ (Artificial Intelligence - AI) ve blockchain teknolojilerini bir araya getirerek, geleneksel organizasyon modellerine kıyasla önemli bir dönüşüm potansiyeli sunmaktadır. Bu organizasyonlar, kodlanmış akıllı sözleşmeler aracılığıyla işlemlerini otomatik olarak gerçekleştiren, şeffaf ve merkezi bir otoriteden bağımsız yapılar olarak tanımlanmaktadır. Geleneksel hiyerarşik yapılardan uzaklaşarak, dinamik çevrelere uyum sağlayabilen esnek ve organik yapılara dönüşme potansiyeline sahiptirler. Ayrıca, dijitalleşme süreçlerini entegre etme becerileriyle, geleceğin organizasyonlarına dair yenilikçi ve sürdürülebilir bir perspektif sunmaktadırlar. DAO'ların temel avantajları arasında, şeffaflık, güvenlik ve maliyetlerin azalması yer almaktadır. Blockchain teknolojisi sayesinde, tüm işlemler izlenebilir bir şekilde kayıt altına alınmaktadır. Bu durum, organizasyon içindeki güvenin artırılmasına katkı sağlarken, insan müdahalesini minimuma indirerek önyargı, yolsuzluk ve nepotizm gibi örgüt içi olumsuzlukların önlenmesinde etkili bir çözüm sunmaktadır. Aynı zamanda, AI araçlarının kullanımıyla, karmaşık veri analizleri gerçekleştirerek hızlı ve doğru kararlar alınmasına olanak tanımaktadır. Bununla birlikte, DAO'ların bazı dezavantajları da bulunmaktadır. Teknolojiye olan yüksek bağımlılık siber güvenlik risklerini artırabilirken; hukuki çerçevelerin henüz tam anlamıyla oturmamış olması, bu organizasyonların ulusal ve uluslararası düzeyde faaliyetlerini sınırlandırabilmektedir. Ayrıca, katılımcıların yeterli teknik bilgiye sahip olmaması, karar alma süreçlerinde zorluklara yol açabilmektedir. Henüz bir olgunlaşma sürecine ihtiyacı olsa da DAO'ların yönetim ve organizasyon alanında önemli bir dönüşüme öncülük ettiği açıktır. Geleneksel hiyerarşik yapılardan uzaklaşarak, dinamik çevrelere uyum sağlayabilen, esnek ve organik bir yapıya evrilmişlerdir. Bu sayede, sadece günümüz iş

dünyasının gereksinimlerine değil, aynı zamanda geleceğin organizasyonlarına da ışık tutan bir model sunmaktadırlar. Potansiyel uygulama alanları arasında finans, sağlık, eğitim ve tedarik zinciri yönetimi gibi sektörler yer almakta, her geçen gün bu alanlara yenileri eklenmektedir. DAO'lar akademik çevrelerce giderek artan bir ilgi görmekle birlikte potansiyelinin tam anlamıyla gerçekleşmesi için hem teknolojik altyapısının hem de yönetişim modellerinin daha olgun bir seviyeye ulaşması gerekmektedir. Gelecekte, DAO'ların mevcut örgütsel yapıları tamamlayıcı ya da tamamen dönüştürücü bir rol üstlenmesi, iş dünyasında rekabetin ve sürdürülebilirliğin yeniden tanımlanmasını sağlayabilir. Bu doğrultuda, DAO'ların gelişimi, yalnızca teknoloji odaklı bir dönüşüm değil, aynı zamanda toplumsal ve organizasyonel paradigmaların yeniden şekillenmesi anlamına gelebilir.

Anahtar kelimeler: Merkeziyetsiz Otonom Organizasyonlar, DAO, Örgüt Yapıları, Otonom Sistemler, Yapay Zekâ Destekli Organizasyonlar

Decentralized Autonomous Organizations: An Evaluation within the Scope of Organizational Structures and Artificial Intelligence

In today's world, the expectations of employees, ways of doing business, and organizational structures are undergoing rapid changes. Traditional management and organizational structures are becoming increasingly obsolete, while concepts such as transparency, flexibility, and employee participation are gaining prominence. Influenced by the relentless wave of digitalization, these changes have introduced the concept of "Decentralized Autonomous Organizations (DAO)." DAOs are transparent and lean structures where individuals come together for a common purpose, operate without a central authority, and execute pre-defined processes automatically. They are gaining significant importance both in theory and practice, underscoring the need for a detailed examination of DAOs and their evaluation from various perspectives. This study addresses how DAO mechanisms function, their advantages and disadvantages, the transformations they bring to management and organization, and their potential application areas within the framework of current management theories and practices. DAOs combine artificial intelligence (AI) and blockchain technologies, offering significant potential for transformation compared to traditional organizational models. These organizations are defined as transparent and independent entities that carry out transactions automatically through coded smart contracts. Moving away from traditional hierarchical structures, they possess the potential to evolve into flexible and organic entities that can adapt to dynamic environments. Moreover, their ability to integrate digitalization processes provides innovative and sustainable perspectives for the organizations of the future. The primary advantages of DAOs include transparency, security, and cost reduction. Thanks to blockchain technology, all transactions are recorded in a traceable manner, enhancing trust within the organization. This minimizes human intervention, effectively addressing issues such as bias, corruption, and nepotism in organizational settings. Additionally, the use of AI tools enables complex data analysis, allowing for quick and accurate decision-making. However, DAOs also present certain disadvantages. Their high reliance on technology increases cybersecurity risks, while the lack of well-established legal frameworks limits their operations at both national and international levels. Furthermore, insufficient technical knowledge among participants can create challenges in decision-making processes. Although still in need of maturation, DAOs clearly lead to a significant transformation in management and organization. By moving away from traditional hierarchical structures,

they have transitioned into flexible and organic models capable of adapting to dynamic environments. As a result, DAOs offer a framework that not only addresses the needs of today's business world but also provides a model for future organizations. Potential application areas include sectors such as finance, healthcare, education, and supply chain management, with new sectors being added to this list continuously. While DAOs are attracting increasing interest from academic circles, their full potential can only be realized once their technological infrastructure and governance models reach a more advanced stage. In the future, DAOs may play a complementary or even transformative role in existing organizational structures, leading to a redefinition of competition and sustainability in the business world. Accordingly, the development of DAOs signifies not only a technology-driven transformation but also the reshaping of societal and organizational paradigms.

Sağlık Yönetiminde Yapay Zekanın Kullanım Alanları ve Önemi ----- Mustafa Burak Karagöz

Sağlık Yönetiminde Yapay Zekanın Kullanım Alanları ve Önemi

Mustafa Burak Karagöz

Özet

Dünyadaki nüfus giderek yaşlanmaktadır. Bununla beraber sağlık sistemindeki yoğunlukta giderek artmaktadır. Buna ek olarak Covid-19 pandemisi örneğinde olduğu gibi sağlık sistemi özel durumlarda çökme riski göstermektedir. Günümüzde sağlık sistemindeki artan maliyetlerin geleneksel yöntemlerle önüne geçmek pek mümkün değildir. Bu geleneksel yöntemlerin dışında yapay zeka kullanımıyla sağlık sistemindeki maliyetleri minimize etmek mümkünken, sağlık sistemindeki kaliteyi korumak veya artırmak olasıdır. Sağlık sisteminde mevcut durumdan dolayı ciddi bir talep oluşmaktadır. Bu talebi karşılamak için yeterli sağlık çalışanı ve imkanlar bulunmamaktadır. Bu durumda sağlık yönetiminde yapay zeka kullanımıyla ciddi anlamda maliyetler düşürülebilir ve artan sağlık hizmeti talebi ise daha akılcı bir şekilde karşılanabilmektedir.

Anahtar Kelimeler: Sağlık Yönetimi, Yapay Zeka, Sağlık Yönetiminde Yapay Zeka

Abstract

The world's population is aging. At the same time, the density in the health system is increasing. In addition, as in the case of the Covid-19 pandemic, the health system is at risk of collapse in special cases. Today, it is not possible to prevent the increasing costs in the health system with traditional methods. Apart from these traditional methods, it is possible to minimize the costs in the health system with the use of artificial intelligence, while it is possible to maintain or increase the quality in the health system. There is a serious demand in the health system due to the current situation. There are not enough health workers and facilities to meet this demand. In this case, costs can be seriously reduced with the use of artificial intelligence in health management, and the increasing demand for health services can be met more rationally.

Key Words: Health Management, Artificial Intelligence, Artificial Intelligence in Health Management

1.GİRİŞ

Sağlık yönetimi diğer disiplinlerle bir arada çalışarak verimli bir sonuca varmaktadır. Sağlık yönetiminde sadece sağlık profesyonelleri değil, diğer disiplinlerden profesyonellerin katılımıyla koordineli ve doğru bir oluşuma varılmaktadır (Rosenfield,1992:1343). Dünya genelinde yaşlanan nüfus ve özellikle gelişmiş ve gelişmekte olan ülkelerdeki sağlık talebi artışına karşın bu talebi karşılayacak personel bulunamamaktadır. Bu duruma binaen özellikle gelişmiş ülkelerde olmak üzere sağlık yönetimi alanında yapay zeka kullanımına başlanmıştır.

Yapay zekanın sağlık yönetiminde uygulama alanlarını başlıca sıralayacak olursak bunlar; Genel olarak sağlık yönetiminde uygulanması, sağlık yönetiminde dokümantasyon alanında yapay zekanın uygulanması, Sağlık yönetiminde maliyet minimizasyonu ve kalite maksimizasyonunda uygulanması, Sağlık yönetiminde kurum kapasitelerinin yapay zeka sayesinde doğru kullanımı, sağlık yönetiminde yapay zeka sayesinde hizmetteki aksaklıkların giderilmesi, Sağlık yönetiminde

uzaktan hastalar konusunda önleyici ve tamamlayıcı hizmetlerin yapay zeka ile verilmesi şeklinde sıralayabiliriz (Akalın ve Veranyurt, 2021:234).

2. Yapay Zekanın Sağlık Yönetiminde Uygulama Alanları Hakkında

Yapay zeka, genel olarak sağlık yönetimindeki uygulamaların kullanım sıklığına bakılarak hastaneye müracaat durumu kontrol edilebilir. Bu sayede yoğunluk durumu kontrol altına alınabilir. Ayrıca çocukluk yaşı aşılamaları yapay zeka yardımıyla takip edilebilir (Klumpp vd.,2021:961).

Sağlık yönetiminde dokümantasyon alanında yapay zeka kullanımıyla Sağlık çalışanlarının bilgilerinin kayıt, saklanma ve ihtiyaca binaen tekrarlı kullanımı sağlanabilir. NLP (Doğal dil işleme) sayesinde sağlık çalışanlarının yazış olduğu raporlar kayıt altına alınabilir ve ihtiyaca binaen yapay zeka tarafından tekrar kullanılabilir (Bongurala vd., 2024:342).

Sağlık yönetiminde maliyet minimizasyonu ve kalite maksimizasyonu yapay zeka kullanımıyla hastalara tanı ve hastalıkların teşhisi geleneksel doktor muayenesine göre hastane maliyetlerini daha düşük seviyelere indirmektedir (Jiao vd., 2023: 123455). Sağlık hizmetlerinde kaliteden ödün vererek hastane maliyetlerini düşürmek mümkün değildir. Hastaların hastalıklarını teşhiste yapay zeka uygulamaları kullanılarak daha önceden hastalığın tespiti mümkündür. Düzenli olarak yapay zeka uygulamaları hastanın faaliyetlerini sisteme aktarır ve hem önlem alınabilir hem daha kaliteli ve maliyeti düşük şekilde tanılar konulabilmektedir.

Sağlık yönetiminde kurum kapasitelerinin yapay zeka sayesinde doğru kullanımına hastanedeki boş yatakların yapay zeka sayesinde anlık kontrolünü belirtebiliriz. Bu sayede hastanenin atıl durumda kalma riskinin önüne geçilmiş olunmaktadır. Ayrıca taburcu olan hastaların daha sonra hangi sıklıkla hastanede yatarak tedavi edileceğine dair yapay zeka sayesinde bilgi akışı sağlanabilir. Bir diğer önemli husus ise acil servislerdeki yoğunluğun giderilmesi gerekliliğidir. Yapılan yapay zeka uygulamaları sayesinde acil servis yükü düzenlenebilmektedir (Born vd.,2024; 1706).

Sağlık yönetiminde yapay zeka sayesinde hizmetteki aksaklıkların giderilmesinin en belirgin yönü insanların günlük hayatta giyilebilir kişisel aksesuarlar sayesinde oluşan sağlık verilerinin doğru ve düşük maliyetli bir şekilde kullanılması gerekliliğidir. Bilindiği üzere artık kişilerin sağlık verileri büyük bir veri havuzunu oluşturmaktadır (Morley vd., 2022:9). Bu veri uzmanlar tarafından analiz edildiğinde hem maliyetler artmaktadır hem yanlışlıklar yapılabilmektedir. İnsan faktörünün azaltıldığı yapay zeka kullanımı sayesinde bu veri daha düşük maliyette işlenirken, daha doğru sonuçlar alınmaktadır. Bu sayede gereksiz ilaç kullanımında ciddi düşüşler olurken daha doğru reçeteler verilebilmektedir. Bu veri havuzu efektif bir şekilde yapay zeka tarafından kullanımı, sağlıkta artan maliyet durumunun önüne geçebilmeyi sağlayabilir.

Sağlık yönetiminde uzaktan hastalar konusunda önleyici ve tamamlayıcı hizmetlerin yapay zeka ile verilmesi sağlık alanındaki kıt kaynaklarda ciddi anlamda tasarruf sağlamaktadır. Kişilerin makine öğrenmesine sahip yapay zeka uygulamalarıyla takip edilmesi sayesinde potansiyel hastalıklara karşın önceden önlem alınabilmektedir (Shaheen ve Yousef, 2021: 3). Bu sayede ciddi anlamda maliyetten vazgeçilmiş olunur. Ayrıca kişinin ağır hastalıkları yaşamaması durumuyla birlikte topluma olan yükü azalacak ve ekonomiye olan katkısı artacaktır.

3. Sonuç

Gelişen teknolojiyle birlikte yapay zeka sadece sağlık alanında değil, birçok farklı alanda kullanılmaktadır. Sağlık sektöründeki kıt kaynaklardan ötürü sağlık hizmetlerinin arzı ciddi anlamda kısıtlıdır. Yapay zekanın sağlık yönetiminde kullanımıyla bu arzın artırılma şansının olduğu belirtildiği gibi buna ek olarak sağlığın sunumundaki maliyetlerin düşüşü de söz konusudur. Tabiki kalitenin korunması ve artırılması da önemli bir kazanım olacaktır. Bu bağlamda yapay zekanın sağlık yönetimine uyumlanması, birçok yönden gereklilik icap etmektedir.

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Üstün Zekalı Öğrencilerin Eğitiminde Güncel Teknolojilerin Kullanılma Amaçlarının İncelenmesi------- Hasibe Kuzu, Mustafa Ersoy

Üstün Zekalı Öğrencilerin Eğitiminde Güncel Teknolojilerin Kullanılma Amaçlarının İncelenmesi[1] ------------Hasibe Kuzu[2], Mustafa Ersoy

ÖZET

Bu çalışma, üstün zekalı öğrencilerin eğitiminde güncel teknolojilerin kullanım amaçlarını incelemektedir. Araştırma, bireyselleştirilmiş öğrenme deneyimleri, karmaşık kavramların görselleştirilmesi, problem çözme ve eleştirel düşünme becerilerinin geliştirilmesi gibi alanlarda teknolojinin sunduğu katkılara odaklanmaktadır. Çalışma sonucunda, yapay zeka destekli eğitim programlarının öğrencilerin öğrenme süreçlerini zenginleştirdiği, çevrim içi platformların bireysel öğrenme hızlarına uygun içerik sunduğu ve STEM temelli teknolojik araçların yaratıcı projelerin geliştirilmesinde etkili olduğu belirlenmiştir. Ayrıca, teknolojinin öğrencilerin sosyal ve duygusal becerilerini geliştirme ve toplumsal farkındalık kazandırmada önemli bir araç olduğu vurgulanmıştır.

ABSTRACT

This study examines the purposes of using current technologies in the education of gifted students. The research focuses on the contributions of technology in areas such as personalized learning experiences, visualization of complex concepts, and the development of problem-solving and critical thinking skills. The findings reveal that AI-supported educational programs enrich learning processes, online platforms provide content tailored to individual learning paces, and STEM-based technological tools are effective in fostering creative projects. Additionally, the study emphasizes the role of technology in enhancing students' social and emotional skills and raising societal awareness.

Üstün Zekalı Öğrencilerin Eğitiminde Güncel Teknolojilerin Kullanım Amaçları

Giriş

Üstün zekalı öğrenciler, çoğu zaman eğitim sisteminin standart yaklaşımlarının ötesinde bireyselleştirilmiş ve özel öğretim yöntemlerine ihtiyaç duyan bireylerdir. Günümüz teknolojisi, bu öğrencilerin özel yeteneklerini ortaya çıkarma ve geliştirme konusunda çeşitli olanaklar sunmaktadır. Teknolojik aracılar, bireyselleştirilmiş öğrenme deneyimleri, karmaşık kavramların görselleştirilmesi, problem çözme ve eleştirel düşünme becerilerinin desteklenmesi gibi çok yönlü yaklaşımlar sunarak öğrencilerin potansiyellerini maksimize etmeye yönelik çözümler sunar. Ancak, bu teknolojilerin etkin kullanımının önümdeki engellerin ve fırsatların kapsamını anlamak önemlidir.

Problem Durumu

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[1] Sivas Cumhuriyet Üniversitesi, Eğitim Bilimleri Enstitüsü, Eğitim Programları ve Öğretim alanında yapılan yüksek lisans tezinden üretilmiştir.
[2] Yüksek lisans öğrencisi

Üstün zekalı öğrencilerin geleneksel eğitim modelleri içerisindeki potansiyellerini tam anlamıyla ortaya koyamadıkları yaygın bir gerçektir. Bu öğrenciler, bireysel öğrenme hızları ve öğrenme ihtiyaçlarına uygun çözümler sunulmaması durumunda, ilgi kaybı ya da yetersiz uyarımla karşı karşıya kalabilirler. Teknolojinin sunduğu bireyselleştirilmiş öğrenme deneyimleri ve yenilikçi çözümler, bu öğrencilerin karmaşık kavramları anlamalarına, yaratıcı projeler geliştirmelerine ve sosyal-duygusal becerilerini geliştirmelerine katkıda bulunabilir. Ancak, bu teknolojilerin eğitimde hangi amaçlarla ve ne kadar etkili kullanıldığı konusunda akademik bilgi sınırlıdır. Dolayısıyla, üstün zekalı öğrencilerin eğitiminde teknolojinin rolünü detaylı bir şekilde incelemek önem taşımaktadır.

Amaç

Bu çalışmanın temel amacı, üstün zekalı öğrencilerin eğitiminde güncel teknolojilerin kullanım amaçlarını incelemek ve bu teknolojilerin öğrenci başarısına ve gelişimlerine olan etkilerini değerlendirmektir. Araştırmada, bireyselleştirilmiş öğrenme deneyimleri, karmaşık kavramların görselleştirilmesi, problem çözme becerilerinin geliştirilmesi, yaratıcılık ve inovasyonun teşviki gibi alanlarda teknolojinin katkıları ele alınacaktır.

Yöntem

Bu araştırmada nitel bir yaklaşım benimsenmiş ve dokümantasyon analizi yöntemi kullanılmıştır. Öncelikle özellikle son on yılda bu alanda yayımlanmış bilimsel makaleler, raporlar ve çalışmalar derlenmiş ve kapsamı belirlenmiştir. Veriler tematik analiz yöntemiyle incelenerek, teknolojinin öğrenci eğitiminde hangi boyutlarda kullanıldığı ve hangi önemli etkilerinin bulunduğu ortaya konmuştur. Ayrıca, çalışma sırasında uzman görüşlerinden de yararlanılarak bulguların akademik ve uygulamalık anlamda geçerliliği sağlanmıştır.

Bulgular

Bu araştırmada, teknolojinin üstün zekâlı öğrencilerin eğitim süreçlerindeki kullanım amaçları ve bu kullanımlara yönelik yaklaşımlar incelenmiştir. Bulgular, teknolojinin eğitimde bireyselleştirilmiş öğrenme deneyimlerinden karmaşık kavramların görselleştirilmesine, problem çözme becerilerinin geliştirilmesinden yaratıcılık ve inovasyonun teşvik edilmesine kadar geniş bir yelpazede etkili bir araç olduğunu göstermektedir. Ayrıca, üstün zekâlı öğrencilerin özel eğitim ihtiyaçlarına yönelik hızlandırılmış eğitim programları ve potansiyel analizi gibi süreçlerde teknolojinin kritik bir rol oynadığı belirlenmiştir. Araştırma sonuçları, teknolojinin sadece bilişsel gelişimi değil, aynı zamanda sosyal, duygusal ve kültürel farkındalık gibi çeşitli alanlardaki gelişimi de desteklediğini ortaya koymaktadır. Aşağıda, elde edilen bulgular tematik olarak detaylandırılmıştır.

Teknolojinin Eğitimde Kullanım Amaçları ve Yaklaşımları

1. Öğretim Sürecinin Zenginleştirilmesi

Alt Temalar:

a. Bireyselleştirilmiş Öğrenme Deneyimleri

b. Karmaşık Kavramların Görselleştirilmesi

c. Problem Çözme ve Eleştirel Düşünme Gelişimi

1.a. Bireyselleştirilmiş Öğrenme Deneyimleri

Teknolojinin üstün zekâlı öğrencilerin bireysel öğrenme hızlarına uyum sağlayan araçlar sunduğu, bu sayede öğrencilerin bağımsız öğrenme süreçlerini desteklediği belirtilmektedir (Hayat & Alrayes, 2019). Özellikle yapay zekâ destekli programlar, öğrenme içeriklerini öğrencilerin bilgi düzeyine, ilgi alanlarına ve hızlarına göre özelleştirmekte, bu da öğrencilerin aktif katılımını teşvik etmektedir (Siegle, 2023; Housand & Housand, 2012). Web tabanlı öğrenme platformları ise öğrencilere bireysel hedeflerine uygun materyallerle çalışma ve bağımsız öğrenme alışkanlıkları geliştirme fırsatı sunmaktadır (Periathiruvadi & Rinn, 2012; Alawamreh & Elias, 2015).

1.b. Karmaşık Kavramların Görselleştirilmesi

Görselleştirme teknolojileri, üstün zekâlı öğrencilerin soyut kavramları daha somut bir şekilde anlamalarına yardımcı olmakta ve öğrenme sürecini derinleştirmektedir. Multimedya araçları, simülasyonlar ve sanal gerçeklik uygulamaları bu süreçte önemli rol oynamaktadır (Yang, 2022; Ali & Alrayes, 2019). Özellikle STEM odaklı teknolojik uygulamalar, fen bilimlerinde soyut kavramların somutlaştırılması için kullanılmaktadır (Eraslan vd., 2013; Şahin vd., 2024).

1.c. Problem Çözme ve Eleştirel Düşünme Gelişimi

Teknolojik araçlar, üstün zekâlı öğrencilerin analitik düşünme ve problem çözme becerilerini geliştirmek için güçlü bir araçtır. Strateji oyunları ve robotik projeler, öğrencilere farklı senaryolar sunarak yaratıcı çözümler geliştirmelerini teşvik eder (Ogurlu vd., 2021; Galitskaya vd., 2022). Yapay zekâ destekli araçlar ise öğrencilerin karmaşık problemleri çözme ve farklı perspektifleri değerlendirme yetilerini artırmaktadır (Siegle, 2023).

2. Yaratıcılık ve İnovasyonun Teşviki

Alt Temalar:

a. Yaratıcı Projeler ve Tasarım Süreçleri

b. Sanal Laboratuvar ve Deney Ortamları

c. Yeni Fikirlerin Test Edilmesi ve Prototipleme

2.a. Yaratıcı Projeler ve Tasarım Süreçleri

Dijital araçlar ve STEM tabanlı platformlar, üstün zekâlı öğrencilerin yaratıcılıklarını geliştirmesine olanak sağlamaktadır. Robotik setler, dijital hikâye anlatımı araçları ve yapay zekâ tabanlı yazılımlar, öğrencilerin yaratıcı fikirler geliştirmesini ve bu fikirleri hayata geçirmesini desteklemektedir (Ogurlu vd., 2021; Eraslan vd., 2013; Siegle, 2023).

2.b. Sanal Laboratuvar ve Deney Ortamları

Sanal laboratuvarlar ve simülasyon araçları, öğrencilerin risk almadan deney yapmalarına, hipotezler geliştirmelerine ve bilimsel düşünce süreçlerini deneyimlemelerine olanak tanımaktadır (Alawamreh & Elias, 2015; Ali & Alrayes, 2019). Özellikle STEM odaklı yazılımlar, öğrencilerin bilimsel ve inovatif becerilerini geliştirmektedir (Çubukçu & Tosuntaş, 2018).

2.c. Yeni Fikirlerin Test Edilmesi ve Prototipleme

Teknolojik araçlar, öğrencilerin yenilikçi fikirler geliştirmesine ve bu fikirleri prototiplere dönüştürmesine olanak tanır. Dijital ekosistemler, öğrencilerin yaratıcılıklarını geliştirmeleri ve fikirlerini test etmeleri için güçlü bir altyapı sunmaktadır (Şahin vd., 2024; Besnoy vd., 2012).

Üstün Zekalı Çocukların Eğitimi için Teknolojik Yaklaşımlar

Kullanım Amacı	Teknolojik Yaklaşım
Öğretim Sürecinin Zenginleştirilmesi	Bireyselleştirilmiş Öğrenme Deneyimleri, Karmaşık Kavramların Görselleştirilmesi, Problem Çözme ve Eleştirel Düşünme Gelişimi
Yaratıcılık ve İnovasyonun Teşviki	Yaratıcı Projeler ve Tasarım Süreçleri, Sanal Laboratuvar ve Deney Ortamları, Yeni Fikirlerin Test Edilmesi ve Prototipleme
Sosyal ve Duygusal Gelişim	Sanal Takımlar ve İş birliği Becerileri, Duygusal Zeka Eğitimi, Toplumsal Bilinç ve Kültürel Farkındalık
Üstün Zekalı Çocukların Özel Eğitim İhtiyaçları	Hızlandırılmış Eğitim Programları, Potansiyel Analizi ve Yetenek Gelişimi, Üstün Yetenek Haritalama ve İzleme
Etik ve Güvenlik Perspektifleri	Dijital Ortamlarda Güvenlik, Teknoloji Kullanımının Riskleri ve Faydaları, Dijital Dünyada Etik Davranış
Geleceğe Hazırlık ve 21. Yüzyıl Becerileri	Kodlama ve Programlama Eğitimi, Eleştirel Düşünme ve Problem Çözme, Dijital Vatandaşlık Eğitimi

Sonuç

Bu araştırma, teknolojinin üstün zekâlı öğrencilerin eğitim süreçlerinde sunduğu çok boyutlu katkıları ortaya koymuştur. Bulgular, teknolojinin bireyselleştirilmiş öğrenme, karmaşık kavramların görselleştirilmesi, problem çözme ve eleştirel düşünme becerilerinin geliştirilmesi gibi alanlarda öğrencilere benzersiz fırsatlar sunduğunu göstermektedir. Ayrıca, yaratıcılık ve inovasyonun teşvik edilmesi, sanal laboratuvarlar aracılığıyla deney yapma olanaklarının artırılması ve yeni fikirlerin test edilmesi gibi süreçlerde teknolojinin önemli bir araç olduğu belirlenmiştir.

Teknolojinin sadece bireysel öğrenme süreçlerini değil, aynı zamanda öğrencilerin sosyal ve duygusal gelişimlerini desteklediği de tespit edilmiştir. Özellikle sanal takımlar aracılığıyla iş birliği becerilerinin geliştirilmesi, toplumsal bilinç ve kültürel farkındalık oluşturma noktasında dijital araçların etkili olduğu görülmüştür. Bunun yanında, üstün zekâlı öğrencilerin

hızlandırılmış eğitim ihtiyaçlarının karşılanması, potansiyellerinin analizi ve yetenek geliştirme süreçlerinde teknolojinin kritik bir rol oynadığı vurgulanmıştır.

Sonuç olarak, teknolojinin üstün zekâlı öğrencilerin eğitimine entegre edilmesi hem bireysel hem de toplumsal gelişimlerini destekleyen kapsamlı bir yaklaşım sunmaktadır. Bu nedenle, eğitim politikalarının ve öğretim stratejilerinin teknoloji tabanlı uygulamalarla zenginleştirilmesi, öğrencilerin öğrenme deneyimlerini daha etkili ve sürdürülebilir bir hale getirecektir. Gelecek araştırmaların, teknolojinin etkilerini daha derinlemesine inceleyerek uygulamalı sonuçlar sunması, bu alandaki literatüre değerli katkılar sağlayacaktır.

Tartışma ve Öneriler

Bu araştırmanın bulguları, teknolojinin üstün zekâlı öğrencilerin eğitim süreçlerine sunduğu katkıları ve bu katkıların eğitimdeki potansiyel etkilerini kapsamlı bir şekilde ele almaktadır. Öncelikle, teknolojinin bireyselleştirilmiş öğrenme fırsatları sunarak öğrencilerin kendi hızlarında ve ilgi alanlarında ilerlemelerine olanak tanıdığı görülmektedir. Bu durum, öğrencilerin öğrenme motivasyonlarını ve akademik başarılarını artırabilecek bir fırsat sunmaktadır. Ancak, bireyselleştirilmiş öğrenme süreçlerinde teknolojinin etkili bir şekilde kullanılabilmesi için öğretmenlerin teknolojiye ilişkin yeterliliklerinin artırılması gerektiği tartışılabilir (Ogurlu vd., 2021; Siegle, 2023).

Karmaşık kavramların görselleştirilmesi ve problem çözme becerilerinin geliştirilmesinde teknolojinin etkisi, STEM odaklı eğitim uygulamalarında daha fazla vurgulanmaktadır. Ancak, teknolojik araçların öğrenme süreçlerine entegrasyonunda pedagojik uyumun sağlanması gerekmektedir. Teknolojik uygulamaların yalnızca araç olarak kullanılması yerine, öğrencilerin eleştirel ve yaratıcı düşünme süreçlerini destekleyecek şekilde planlanması önemlidir (Çubukçu & Tosuntaş, 2018; Şahin vd., 2024).

Teknolojinin yaratıcılık ve inovasyon süreçlerine katkısı, üstün zekâlı öğrencilerin yaratıcı projeler geliştirmesine olanak tanıyan robotik setler, sanal laboratuvarlar ve dijital araçlarla desteklenmiştir. Ancak, bu tür araçların erişilebilirliği ve okulların altyapı yeterliliği bu katkının etkisini sınırlayabilir. Bu noktada, eğitim kurumlarının teknolojiye erişim imkanlarının artırılması ve öğretmenlerin bu araçları etkin bir şekilde kullanmalarını sağlayacak eğitim programlarının geliştirilmesi gereklidir (Ali & Alrayes, 2019; Besnoy vd., 2022).

Öneriler

1. Öğretmen Yeterliliklerinin Geliştirilmesi: Öğretmenlerin, teknolojiyi bireyselleştirilmiş öğrenme ve problem çözme süreçlerinde etkin bir şekilde kullanabilmesi için mesleki gelişim programları düzenlenmelidir. Bu programlar, özellikle STEM eğitimi, yapay zekâ ve dijital platformlar üzerinde yoğunlaşmalıdır.

2. Teknolojik Altyapının Güçlendirilmesi: Eğitim kurumlarının teknolojik altyapıları, öğrencilerin sanal laboratuvarlar ve dijital öğrenme araçlarına erişimini kolaylaştıracak şekilde güçlendirilmelidir.

3. Pedagojik ve Teknolojik Uyumun Sağlanması: Teknolojinin eğitim süreçlerine entegrasyonunda pedagojik yaklaşımlar öncelikli hale getirilmeli, teknolojik araçlar yalnızca içerik sunumu için değil, öğrencilerin yaratıcı düşünme ve eleştirel becerilerini geliştirmek için kullanılmalıdır.

4. Kültürel ve Toplumsal Etkileşimlerin Artırılması: Web tabanlı platformlar ve sanal iş birliği araçları, öğrencilerin farklı kültürlerden bireylerle etkileşim kurmasına olanak sağlayacak şekilde tasarlanmalı ve toplumsal bilinç kazandıracak etkinlikler desteklenmelidir.

5. Araştırma ve Geliştirme Çalışmalarının Desteklenmesi: Teknolojinin eğitim süreçlerindeki etkilerinin daha kapsamlı bir şekilde incelenmesi için disiplinler arası araştırmalar teşvik edilmeli, bu araştırmaların sonuçları uygulamaya yönelik stratejiler geliştirmek için kullanılmalıdır.

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Hemşirelikte Yönetim Açısından Yapay Zeka ve Kullanımı----------Nuriye Sarıakçalı

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Özet

Sağlık hizmetlerindeki artan karmaşıklık ve hasta bakımına yönelik artan talepler, yapay zekanın birçok alanda olduğu gibi bu alanda da önemini artırmıştır.Yapay zeka kullanımının, karar verme hızını ve doğruluğunu artırma, maliyetleri düşürme, hasta memnuniyetini artırma gibi birçok avantajının bulunmasına rağmen, etik, güvenlik, veri gizliliği ve eğitim alanında yaşanabilecek güçlükler gibi bir çok olumsuz tarafı da bulunmaktadır. Gelişebilecek olumsuz durumlara yönelik yapılacak planlı ve etkili eğitim programları, etik araştırmalar ve güvenlik çözümleri hemşirelik yönetiminde yapay zekanın etkili ve doğru kullanımını destekleyecektir. Hemşirelik yönetimindeki avantajları, karşılaşılan zorluklara rağmen bu teknolojinin gelecekteki sağlık hizmetlerinde önemli bir araç olabileceğini göstermektedir. Bu çalışmada, yapay zekanın hemşirelik yönetimindeki rolü, kullanım alanları, avantajları ve zorlukları ele alınmıştır.

Anahtar Kelimeler: Sağlık Hizmetleri, Yapay Zeka, Hemşirelikte Yönetim

Abstract

Increasing complexity in healthcare services and increasing demands for patient care have increased the importance of artificial intelligence in this field as in many other fields. Although the use of artificial intelligence has many advantages such as increasing the speed and accuracy of decision-making, reducing costs, increasing patient satisfaction, it also has many negative aspects such as ethics, security, data privacy and difficulties in the field of education. Planned and effective training programs, ethical researches and security solutions will support the effective and correct use of artificial intelligence in nursing management. Its advantages in nursing management show that this technology can be an important tool in future health services despite the difficulties encountered. In this study, the role, usage areas, advantages and challenges of artificial intelligence in nursing management are discussed.

Key Words: Healthcare, Artificial Intelligence, Nursing Management

1. Giriş

Hasta bakım hizmetlerine yönelik taleplerin artması beklentilerin yükselmesi, sağlık hizmetlerinin kompleks yapısı gibi bir çok neden modern yönetim yaklaşımlarının yeniden değerlendirilmesini zorunlu hale getirmiştir. Yapay Zeka teknolojileri, bu ve buna benzer zorluklarla başa çıkmada önemli bir araç olarak ortaya çıkmıştır. Yapay Zekanın kullanımı, karar destek sistemlerini daha güçlü hale getirmek, hasta bakım hizmetlerini iyileştirmek ve verimliliği artırabilme noktasında geniş ve önemli bir potansiyele sahiptir (Topal, 2019).

2. Yapay Zeka ve Hemşirelik Yönetimi

Yapay Zeka, hemşirelik yönetiminde farklı alanlarda kullanılabilmektedir. Bunlardan ilki, yapay zeka uygulamalarının hasta bakım hizmetlerinde karar destek sistemleri olarak, hemşirelerin daha doğru ve hızlı kararlar almasında yardımcı

olabilmesidir (Shaban & Considine, 2021). Örnek verilecek olursa, hasta verilerinin analiz edilerek risk değerlendirmelerinin yapılması sağlanarak, gelişebilecek olası komplikasyonların erken teşhisi mümkün olabilir. Aynı zamanda yapay zeka personel yönetimi ve planlamada da kullanılabilir. Yapay zeka algoritmaları, hemşirelerin çalışma saatlerinin (vardiyaların) en iyi şekilde planlamasının yapılmasını ve iş yükünün dengelenmesini de sağlayabilir (McDonald & Kelley, 2020). Simülasyonlar ve kişiye özel eğitim programları gibi yapay zeka tabanlı uygulamalar, eğitim ve gelişim süreçlerinde kullanılarak fayda sağlayabilir. Hasta güvenliği ve hizmet kalitesinin artırılması noktasında da yapay zeka, klinik yönetişim ve kalite kontrol alanında da kullanılarak fayda sağlayabilir (Rajkomar, Dean, & Kohane, 2019).

3. Yapay Zeka Kullanımının Avantajları

Hemşirelik yönetiminde yapay zeka kullanımı karar verme süreçlerinin daha hızlı ve doğru olabilmesi açısından avantaj sağlayabilmektedir. Acil durumlarda, yapay zekanın sağlamış olduğu hızlı analizler, özellikle hayati önem taşıyan kararların daha etkili ve verimli bir şekilde alınmasına olanak tanıyabilir (Krittanawong et al., 2021). Aynı zamanda veriye dayalı yönetimsel yaklaşımlar, personel ve kaynak yönetiminde verimliliğin artmasını sağlayarak maliyetlerin azaltılmasında avantaj sağlayabilir. Yine bir diğer avantaj olarak da yapay zeka kullanımı, hasta ihtiyaçlarına hızlı ve etkili yanıt verilmesini sağlayarak, hasta memnuniyetini artmasında olumlu katkı sağlayabileceği gösterilebilir (Burke, 2019).

4. Yapay Zeka Kullanımında Karşılaşılan Zorluklar

Yapay zeka kullanımının hemşirelik yönetiminde bir çok avantajı bulunmasının yanı sıra farklı olumsuzluk ve zorlukları da bulunmaktadır. Bunların en başında da etik ve güvenlik endişeleri gelmektedir. Hasta güvenliği ve etik açıdan tartışmalara neden olabilecek en büyük problemin, yapay zekaya ait sistemlerin bağımsız olarak kararlar alabilecek olması gelmektedir (Topol, 2019). Aynı zamanda hemşirelerin yapay zeka sitemlerine adapte olabilmesi ve bunları etkili, verimli bir şekilde kullanabilmesi için bir eğitim sürecine ihtiyaç olması bir diğer zorluk olarak gösterilmektedir (McDonald & Kelley, 2020). Yine teknoloji maliyetleri ve mevcutta bulunan sistemlerle entegrasyon zorlukları, yapay zekanın yaygın olarak benimsenmesini ve kullanımını sınırlayan etkenlerdir (Rajkomar, Dean, & Kohane, 2019). Sağlık sektöründe yapay zeka kullanımı, veri gizliliği ve güvenliği hususlarında önemli bir endişe kaynağı olarak görülmektedir (Shaban & Considine, 2021).

5. Örnek Vaka Çalışmaları

Yapay zekanın hemşirelik yönetimindeki rolünün, ilerleyen zamanlarda daha fazla önem kazanacağına yönelik vurgulamalar yapılmaktadır. Örnek olarak, Amerika Birleşik Devletleri'nde bulunan bazı hastanelerin, hasta bakımında yapay zeka destekli karar verme sistemlerini kullanarak komplikasyon oranlarını düşürmeyi başarmış olması gösterilmektedir (Burke, 2019). Yine benzer şekilde, Avrupa'da birçok sağlık kuruluşunun, personel yönetiminde yapay zeka algoritmalarını kullandığı ve iş gücü verimliliğini artırdığı belirtilmektedir (Krittanawong et al., 2021). Belirtilen örneklerle de yapay zekanın, hemşirelik yönetiminde sağlamış olduğu faydalar gösterilmektedir.

6. Gelecekteki Yönelimler ve Öneriler

Teknolojinin sağlık hizmetlerine entegrasyonu arttıkça, hemşirelerin sağlık hizmetleri alanında yapay zekayı daha doğru ve etkin bir şekilde kullanabilmesi için sürekli eğitim ve gelişim programlarının düzenlenmesinin önemli olduğu ifade edilmektedir (Shaban & Considine, 2021). Aynı zamanda yapay zeka kullanımının etik ve güvenlik konusunda oluşturabileceği olumsuz durumlara yönelik daha fazla araştırma yapılması ve çözümler üretilmesi de gereklidir (Rajkomar, Dean, & Kohane,

2019). Yapay zekanın gelecekte hemşirelik yönetiminde daha fazla kullanılacağı, doğru ve etkin kullanımın kaliteyi artıracağı öngörülmektedir (Topol, 2019). Sürekli değişen ve gelişen dinamik dijital çağda yenilikler zorunludur. Öyleki ilerleyen teknolojiler, değer yaratan fikirleri uygulamak ve birleştirmek için birincil araçlar olmaktadır ve bu nedenledir ki yapay zeka ve ilgili teknolojilerin kullanılması bir tercihten ziyade kuruluşların rekabet avantajı elde edebilmesi için kabul etmesi ve kullanması gereken bir eğilim olarak ifade edilmektedir (Lee & Yoon 2021).

7. Sonuç

Teknolojinin sağlık hizmetleri de dahil her alana girmesi bir çok alanda dönüşüm ve değişimler oluşmasını zorunlu hale getirmiştir. Yapay zeka da hemşirelik yönetiminde önemli bir dönüşüm sağlamaktadır. Kullanılan bu teknolojinin, karar verme süreçlerini daha hızlı hale getirip personel yönetimini optimize ederek sağlık hizmetlerinde verimliliği artırması beklenmektedir. Yapay zekanın sağlayacağı faydalar düşünülürken beraberinde oluşabilecek etik ve güvenlik alanındaki zorluklar göz önünde bulundurulmalıdır. Aynı zamanda yapay zekayı etkin, doğru ve verimli bir şekilde kullanabilmek için sürekli eğitim ve gelişimin olması önemlidir. Sonuç olarak yapay zekanın hemşirelik yönetiminde getirmiş olduğu avantajlara ve zorluklara rağmen, sağlık hizmetlerinde önemli bir araç olarak kullanılacağı öngörülmektedir.

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Case Study Data Generator for DJF51082: A Teaching Innovation for Quality Control Education------Yoong Chow, Ho, Alexandria George Ak Empam, Jane Daniela Anak Mugan, Zainal Abiddin Bin Ahmad

Abstract

This study presents the development and application of the "Case Study Data Generator" designed for the DJF51082-Quality Control module under the Diploma in Mechanical Engineering (Manufacturing) at Politeknik Kuching Sarawak, Malaysia. The generator provides randomized, realistic, and pedagogically tailored datasets for student case studies. It aims to enhance learning outcomes by offering diverse problem scenarios while streamlining case study preparation for instructors. This paper details the generator's development, its implementation in a classroom setting, and its impact on student engagement and performance.

Bu çalışma, Politeknik Kuching Sarawak, Malezya'da Makine Mühendisliği (İmalat) Diploması kapsamında DJF51082-Kalite Kontrol modülü için tasarlanan "Vaka Çalışması Veri Oluşturucu"nun geliştirilmesini ve uygulamasını sunmaktadır. Oluşturucu, öğrenci vaka çalışmaları için rastgele, gerçekçi ve pedagojik olarak uyarlanmış veri kümeleri sağlar. Eğitmenler için örnek olay hazırlığını kolaylaştırırken çeşitli problem senaryoları sunarak öğrenme çıktılarını geliştirmeyi amaçlamaktadır. Bu belge, oluşturucunun gelişimini, sınıf ortamında uygulanmasını ve öğrenci katılımı ve performansı üzerindeki etkisini ayrıntılarıyla anlatmaktadır.

Keywords: Case Study, data generator

INTRODUCTION

Teaching of quality control principles in manufacturing education requires hands-on problem-solving with real-world scenarios. Case studies are an effective pedagogical tool but pose challenges due to the time-intensive process of creating varied and realistic datasets. Research highlights that leveraging data-driven approaches can improve quality control processes and integrate effectively within educational and industrial frameworks (Mahmoudi, & Laboratory, I. 2024) (Pozzi, Cannas, & Rossi, 2024).

The DJF51082-Quality Control course for Diploma in Mechanical Engineering (Manufacturing), Politeknik Kuching Sarawak's students emphasizes fundamental quality control principles, statistical methods, and improvement techniques. Case studies, constituting 20% of the course grade, require datasets that align with real-world scenarios to evaluate students effectively.

Currently, generating these datasets involves time-intensive manual efforts, often leading to inconsistent data quality and limited accessibility. This paper introduces a digital system designed to automate dataset generation, ensuring alignment with case study requirements while enhancing efficiency and accessibility.

1.   Background

Ulanoff, Fingon, and Beltrán (2005), discusses using case studies as a method of assessing students' knowledge and skills. The quote you mentioned can be connected to the notion of case studies helping students to simulate real-world problems, thereby

facilitating the practical application of theoretical knowledge. Based on their findings, it is highlighted how case studies are a valuable pedagogical tool for bridging the gap between classroom learning and professional practice in education, healthcare and business.

Conrad and Openo (2018) discussed various online assessment strategies, including the use of case studies in Assessment Strategies for Online Learning: Engagement and Authenticity. The authors emphasize that case studies can encouraged deeper learning and engagement by requiring students to analyze scenarios and propose solutions based on real-world environments.

Case study approach is an effective assessment to enhance critical thinking, problem-solving skills, and practical knowledge among students. The key insights:

- Pedagogical Value: Case studies simulate real-world problems, helping students to connect theoretical knowledge to practical applications. This approach ensures that students perform deeper learning, analyze scenarios, identify challenges, and propose solutions which is relevant in fields like education, business, and (Ulanoff, Fingon, and Beltrán, 2005).

- Implementation Strategies: Case study assessments require structured guidelines and rubrics. These assessments involve iterative feedback to refine students' understanding and output on the issues. To study on literacy education emphasized creating comprehensive rubrics that account for both analytical depth and presentation quality, such as adherence to citation standards and grammar. (Ulanoff, S. H., Fingon, J. C., & Beltrán, D., 2009).

- Student Engagement: The approach requires active learning as students must engage in discussions and debates with others. Practically, peer and self-assessment practices are integrated to build reflective and evaluative skills, which are essential for continuous professional growth (Conrad and Openo, 2018).

- Challenges and Solutions: The implementation of case studies presents several challenges, primarily related to ensuring fairness in evaluation and maintaining academic rigor. The utilization of digital tools, such as plagiarism detection software and detailed rubrics, can mitigate these concerns. Furthermore, the integration of technology for online assessments has proven to be an effective strategy for expanding access and standardizing evaluation processes, particularly for large cohorts (Ulanoff, S. H., Fingon, J. C., & Beltrán, D., 2009).

By using these strategies, teachers can create case study assessments that are effective and easy to manage. These assessments can help students learn and meet the needs of both the school and the students themselves.

The article "Using Case Studies to Assess Candidates' Knowledge and Skills in a Graduate Reading Program" by Ulanoff, Fingon, and Beltrán (2009) explores how case studies can be used to evaluate graduate students in a Reading and Language Arts Specialist Credential Program. The authors highlight how case-based learning can connect theory to real-life teaching situations, especially for working with diverse learners. In this program, case studies serve as a final assessment, where students demonstrate their understanding of educational concepts and their ability to apply them in diverse urban classrooms. Not only do case studies help students learn, but they also provide an effective way to assess their knowledge and skills in a practical setting.

2.   The Importance of Case Studies in Quality Control Education

The "Case Study Data Generator" addresses this issue by automating dataset generation tailored to the DJF51082 module. Case studies simulate real-world challenges, enabling students to:

- Apply theoretical knowledge.
- Develop critical thinking and problem-solving skills.
- Understand statistical and quality control tools like SPC (Statistical Process Control) and process capability analysis.

This paper explores:

1. The conceptualization and development of the data generator.
2. Its application in an academic setting.
3. The observed impact on teaching efficiency and student learning outcomes.

3.   Challenges in Preparing Case Study Data

Instructors often face difficulties in:

- Generating diverse and realistic datasets.
- Customizing problems to cater to different student abilities.
- Balancing dataset complexity with pedagogical goals.

4.   Existing Tools for Teaching Quality Control

While generic quality control tools like Minitab or Excel are available, the ability to generate custom datasets for educational purposes varies and requires skills and knowledge in programming languages. Thus, it may also lead to repetitive or overly generic scenarios.

LITERATURE REVIEW

Case study assessment has become a cornerstone of coursework, particularly in fields that require problem-solving and critical thinking. Its integration into academic curricula is supported by its ability to simulate real-world scenarios, fostering both theoretical understanding and practical application.

1.   Importance of Case Study Assessment

Case studies serve as an effective pedagogical tool to bridge the gap between theory and practice. They provide students with the opportunity to analyze complex situations, make decisions, and justify their reasoning. Research highlights that case study methods enhance critical thinking, collaborative learning, and knowledge retention (Herreid, 2007). Additionally, case studies are adaptable across various disciplines, from engineering to business and healthcare, making them versatile for educational use (Prince & Felder, 2006).

2.   Design and Implementation

Effective case study assessments are characterized by their realism, relevance, and the depth of inquiry they promote. The design process involves selecting or creating cases that align with learning objectives and challenging students to apply their knowledge in context (Dunne & Brooks, 2004). Educators often include reflective components to help students connect theoretical concepts with practical experiences.

3.   Challenges in Case Study Assessment

One of the biggest hurdles in using case study assessments is creating realistic and high-quality cases, which can be quite time-consuming. Another challenge is grading student responses, as analyzing qualitative work can be subjective. To ensure fair and consistent grading, clear rubrics and guidelines are essential (Biggs & Tang, 2011).

4.	Technology and Automation

Using technology, like case study generators, can make it easier to create and customize cases for coursework. These tools can help us work more efficiently while still ensuring the quality and variety of cases, especially in specialized fields like quality control in manufacturing.

Creating value automatically in case studies is becoming more and more important in education and work. With advancements in computers, data analysis, and AI, we can automate this process to make it more efficient, flexible, and able to create specific scenarios for different learning or analysis goals.

i.	Automation and Case Study Creation

Automation in case study creation mostly involves using algorithms to put together data, stories, and problem scenarios. Tools like data simulators, AI content generators, and special software have been developed to quickly create a variety of realistic scenarios. These systems can use randomness, rules, and limitations to make sure the cases are diverse and useful (Vanderbilt University Center for Teaching, 2021).

ii.	Data-Driven Approaches

To create valuable case studies, we need to base them on real-world data. Automated systems use large datasets, often from real-life situations or simulations, to fill case scenarios with realistic and relevant details. Techniques like machine learning and predictive analytics help identify patterns and create datasets that match real-world trends (Bishop, 2017).

iii.	Scalability and Personalization

Automated systems can create customized case studies for different people, fitting specific learning goals or real-world problems. For example, in business schools, AI tools can create financial models or market scenarios tailored to students' learning, making sure the cases are relevant and interesting (Kolb, 2014).

iv.	Challenges and Considerations

While automation has transformed case study creation, there are still challenges, like making sure the cases are relevant, ethical, and accurate. It's important to balance technology with human expertise to get the most out of these tools.

v.	Future Trends

New technologies like generative AI and digital twins are set to take automation to the next level. These tools can simulate entire systems, creating dynamic, multi-layered case studies that change based on user choices, just like real-life situations (Foss, Pedersen, & Pyndt, 2015).

DEVELOPMENT OF THE CASE STUDY DATA GENERATOR

1.	Objectives

The generator was designed with the following goals:

	i.	Automate the creation of diverse datasets tailored to DJF51082 learning outcomes.
	ii.	Ensure datasets align with real-world quality control challenges.
	iii.	Provide customization options for varying levels of student difficulty.

2.	Design and Features

The generator was developed as a user-friendly software tool with the following features:

- Randomized Data Generation: Produces realistic datasets for processes like defect analysis, SPC charts, and tolerance analysis.

- Case Selection Options: Allows instructors to specify case file for the individual student or group to avoid duplication of answers.
- Export Capabilities: Generates data in formats compatible with Minitab, Excel, and other analysis tools.

3.   Technical Architecture

The technical setup for this study is as follows:

- Programming Language: Python for system development, statistical analysis and data manipulation libraries.
- Backend Logic: Incorporates algorithms to ensure data realism, such as data based on the case.
- Processing Tools: Processor for generating the solutions is a 64-bit operating system, x64-based processor, 12th Gen Intel(R) Core(TM) i5-12500, 3.00 GHz, running at 16 GB ram.

i.   Problem Identification and Definition:

- o   Literature Review: Thoroughly research existing studies, tools, and methods related to creating, organizing, and managing datasets.
- o   Stakeholder Interviews: Talk to researchers, students, and experts to understand their specific needs and challenges when working with datasets.
- o   Problem Statement Formulation: Clearly define the problem the system aims to solve, including its specific goals and objectives.

ii.   System Design and Architecture:

- o   Requirements Gathering: Identify the system's needs, such as the data sources, criteria for creating datasets, data quality standards, and user interface specifications.
- o   System Architecture: Design the overall structure and parts of the system, including the data pipeline, algorithms for creating datasets, and user interface elements.
- o   Technology Selection: Choose the right technologies and tools based on the system's needs and structure, including programming languages, hardware requirements, and operating platforms.

iii.   Dataset Generation Algorithm Development:

- o   Algorithm Design: Create algorithms or rules to select and combine data from different sources based on specific criteria.
- o   Data Quality Assessment: Include ways to check the quality of the generated datasets, including their accuracy, completeness, and consistency.
- o   Customization: Allow for customizing the dataset generation process to meet different research needs and preferences.

iv.   Data Integration and Curation:

- o   Data Sources: Find and connect to relevant data sources based on the course content and class notes.
- o   Data Extraction: Extract data from the chosen sources using appropriate methods, making sure the data is accurate and consistent.

- o Data Cleaning and Preprocessing: Clean and prepare the extracted data to fix issues like missing values, outliers, and inconsistencies.
- o Data Transformation: Change the data into a suitable format for creating datasets, if needed.

v. System Development and Implementation:

- o Coding and Implementation: Write the system's code based on the design plans, using the chosen technologies and tools.
- o Testing and Debugging: Thoroughly test the system to find and fix any bugs or errors.
- o User Interface Development: Create a user-friendly interface that allows users to input criteria, view generated datasets, and access case files.
- o Deployment: Deploy the system on a suitable platform to ensure users can consistently and accurately transfer data to local infrastructure.

vi. Evaluation and Refinement:

- o User Testing: Test the system with users to get feedback on its usability, functionality, and effectiveness.
- o Performance Evaluation: Assess the system's performance in terms of speed, efficiency, and scalability.
- o Iterative Refinement: Based on the evaluation results, make necessary improvements and refinements to the system.

vii. Integration with CIDOS Platform:

- o API Development: Develop APIs to allow the system to work seamlessly with the CIDOS platform.
- o Data Sharing: Implement ways to share generated datasets and case files with users through the CIDOS platform.
- o Security and Access Control: Make sure that data sharing complies with relevant privacy and security regulations.

By following this approach, the team can create a digital system that solves the problem of dataset generation and provides a useful tool for researchers and students.

5. Application Method and Evaluation of Effectiveness
i. Application Method

- o User Access: Users, including researchers, students, and experts, can access the platform to use the dataset generation system.
- o Criteria Input: Users provide specific details for dataset generation, such as the desired user ID, and case files.
- o Dataset Generation: The system processes the input details and automatically creates the requested dataset based on the defined rules and data sources. The data is randomized based on the grading criteria set by the programmers, referring to the specific case file.

- Dataset Access and Download: Students can view, analyze, and download the generated dataset for their case file.
- Case File Association: The system connects the generated dataset with relevant case files, providing additional context and information.
- Sharing and Collaboration: Students can share generated datasets and case files with teammates or lecturers through the CIDOS platform.
- Guideline File: Students are given a PDF guideline on how to use and understand the generated data to ensure consistent understanding.

ii.   Evaluation of Effectiveness

To evaluate the effectiveness of the innovation, the following metrics can be used:

(a)   User Satisfaction:

 i.   Conduct surveys with other lecturer teaching the same course and students who used the system to gather feedback on their satisfaction with the system's usability, functionality, and ease of use.

 ii.   Measure user engagement to assess the system's value and appeal.

(b)   Time and Resource Savings:

- Compare the time and effort required to generate datasets using the system with traditional manual methods.
- Measure the cost savings associated with reduced labour and resource requirements.

(c)   Data Quality and Consistency:

- Evaluate the quality of the generated datasets using predefined metrics, such as accuracy, completeness, and consistency.
- Compare the data quality to that of datasets generated using traditional methods.

(d)   Knowledge Sharing and Collaboration:

 i.   Measure the number and frequency of dataset and case file sharing activities on the CIDOS platform.

 ii.   Analyze the level of collaboration and knowledge exchange facilitated by the system.

 iii.   Sharing of the system thru relevant platform such as exhibitions and innovation competition to evaluate the acceptance of the system.

(e)   System Performance and Scalability:

 i.   Evaluate the system's performance in terms of speed, efficiency, and scalability.

 ii.   Assess the system's ability to handle increasing user demand and data volumes.

By evaluating these metrics, it will be possible to assess the effectiveness of the innovation.

4.   Statistical Analysis Approach

As the new approach is implemented for one semester, the statistical analysis will only based on descriptive statistics to identify any differences in the average marks on case study reports. Comparison of Mann-Whitney U-Test and T-test are not conducted as the number of students registered for the course is incomparable for the 2 consecutive semesters in terms of background and numbers. Statistics are rated based on student's performance and qualitative feedback from educators.

Responses of the applicability of the new approach is conducted using Google form for ease of distribution. Responses of the student focus on the ease of use on the generator to complete the assignment. Responses from other instructors teaching the same course focuses on relevancy of the generator for the assessment and applicability at other institutions.

IMPLEMENTATION, RESULTS AND DISCUSSION

1.   Classroom Integration

The generator was deployed in the DJF51082-Quality Control module for a cohort of 20 students. Case study exercises included:

- Identifying process trends using SPC charts.
- Calculating process capability indices.
- Performing defect rate analysis.

2.   Impact on Teaching and Learning

i.   Instructor Efficiency

1.   Before: Case study preparation required an average of 2 hours per dataset.
2.   After: The generator reduced this to <1 minutes per dataset.
3.   Result: 99% time savings for instructors.

ii.   Student Engagement

A survey showed:

i.   100% of students responded that the system can be used on their personal computers.
ii.   100% of students responded that data generated can be easily match with the guide and easily understood.
iii.   100% of students found the datasets realistic and engaging.
iv.   100% reported an increased understanding of quality control concepts.
v.   100% of students finds that the data generated helps to understand the case given by the instructor better.

iii.   Learning Outcomes

The Course Learning Outcome (CL)) set for this course stated that the second CLO requires students to determine the related quality tools and techniques to control the quality of products or services based on case studies. Based on the statement, the case study provided to the students must evaluate whether students can apply relevant tools and techniques to solve quality control issues based on the given case.

Comparison of exam scores before and after implementation revealed a significant improvement in students' ability to interpret SPC charts and perform defect analysis.

2. Statistical Analysis

i.   Student Performance and Engagement

(a)   Descriptive Statistics

The descriptive test have been conducted to identify the average case study report marks for 2 groups of students. Due to the constraint in the number of students, which varies every semester, only descriptive statistics are conducted.

Table 1 Descriptive Analysis of Report score for 2 cohort

No.	Group	Count	Mean	Standard Deviation	Minimum	Median	Maximum
1.	1 2024/2025	20	10.38	2.77	7.2	9.6	15.0
2.	2 2023/2024	14	10.36	1.37	8.7	10.75	12.4

Referring to Table 1, Group 1 represents student of cohort Session 1, 2024/2025, using the new data generator and Group 2 represents student of cohort Session 2, 2023/2024, not using the latest data generator. Findings show slight improvements in the average scores for the session that uses the new approach.

(b)   Boxplot

The paired dataset excludes rows with missing values, preparing for statistical testing. Therefore Boxplot was conducted and return the following finding.

    i.   Session 1 (2425) has a wider range of scores with some outliers at the higher end.

    ii.   Session 2 (2324) exhibits a more compact distribution, with scores clustered closer to the median.
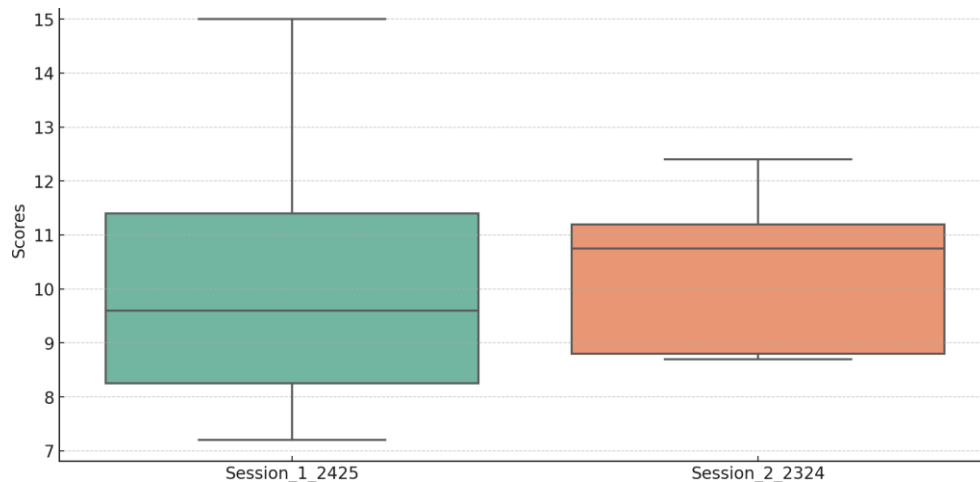

Figure 1 Score distribution for Sessions 1 2025 and 2 2324

(c)   Histogram

Conducting a Histogram plot show that the density of scores for Session 1 (2425) is more spread out compared to Session 2 (2324), which shows peaks around 10-12.
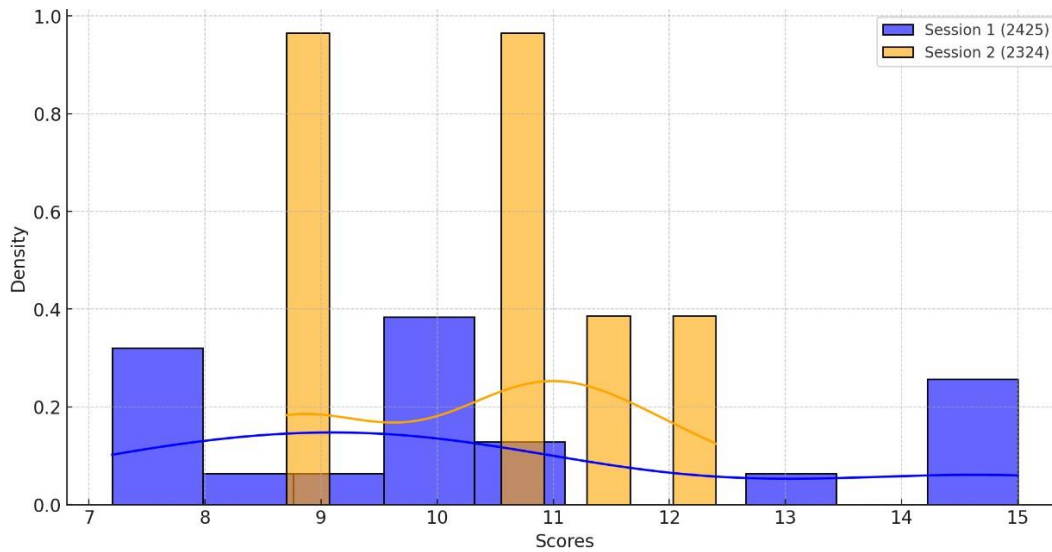
Figure 2 Score distribution comparison of Session 1 2425 and 2 2324

(d)   Hypothesis Testing

To test the hypothesis, a Paired t-test was conducted and found:

    a.   Test Statistic (ttt) = 1.008
    b.   p-value = 0.332

    At a significance level of 0.05, the p-value suggests there is no statistically significant difference between the scores of the two sessions.

ii.   Qualitative Feedback from Educators

A survey form was distributed among lecturers from Politeknik in Malaysia to collect responses on the applicability of the new application. 6 Politeknik responded to the survey. The collected data was as below.

Table 2 Survey responses on the applicability of the new application.

Politeknik	The new application suits the requirement of CLO2	The new application is easy to use	The guide is easy to follow	The new application can be run on all PC	The data generated is suitable to the respective case	Comment (if any)
PNS	Yes	Yes	Yes	Yes	Yes	Suitable to be used
PBS	Yes	Yes	Yes	Yes	Yes	Can improve on interface
PPD	Yes	Yes	Yes	Yes	Yes	Good

PKK	Yes	Yes	Yes	Yes	Yes	Relevant to CLO2, good
PMS	Yes	Yes	Yes	Yes	Yes	Useful to the case study
PTSS	Yes	Yes	Yes	Yes	Yes	Guide is very clear

iii.   Knowledge Sharing and Collaboration

The new innovative approach to address case study assessment was shared in "POLIKU Research and Innovation Exhibition Session 1 2024/2025" dated 1 November 2024 in Politeknik Kuching Sarawak, Malaysia, an Innovation Competition that allows the participant to showcase their ideas in various fields including educational approaches. The innovation was awarded Silver Award during the exhibition.

3.   Discussion

i.   Strengths of the Innovation

The innovation has several key strengths. First, it can be customized to fit different datasets, making it relevant and effective for various case studies in quality control. Second, it saves instructors time by automating dataset creation while maintaining high quality that meets educational standards. Finally, it's flexible enough to be used in other modules and institutions, expanding its potential impact on education.

ii.   Limitations

The tool's development wasn't without challenges. Initially, it required significant technical knowledge, which could limit its use by non-technical users. Also, the current version is limited to generating statistical datasets. Future versions could overcome this by including textual case studies or multimedia elements, making it more versatile and appealing for wider educational use.

iii.   Opportunities for Future Development

The tool has potential for future development. Machine learning algorithms could be used to dynamically adjust datasets based on student performance, making them more personalized and relevant. The tool could also be used in other engineering modules, making it more widely applicable. Developing a web-based version would make it more accessible to students and educators from different places and devices.

CONCLUSION

1.   Conclusion

The "Case Study Data Generator" is a major innovation in teaching quality control to mechanical engineering students. By automating dataset creation, it makes teaching more efficient and learning more effective. The results from its use show its potential as a scalable tool to improve education in quality control and other related fields.

2.   Recommendations

Based on the findings, it is recommended:

- Pilot testing on a larger scale will further identify its usability and scalability for future improvements.

- Interface for the data generator should be improved with easier display instead of running under command prompt display.
- Data generated should be based on the actual table format to avoid misleading interpretation if guidelines are not provided.
- The system should be tested for usability and scalability to ensure it's easy to use and can handle complex or large-scale case studies. Indicator of test may include usability testing scores, processing time and system response under varying loads.
- Case Study Platforms could be Benchmarked using tools like Coursera Labs or EdTech solutions

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Azərbaycanın Qarabağdakı uğurlarının beynəlxalq mətbuatda işıqlandırılması--------Aytekin Zeynalova, Nəzəri Aynurə

Azərbaycanın Qarabağdakı uğurlarının beynəlxalq mətbuatda işıqlandırılması

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Özet

Seçilmiş mövzunun yazılmasında əsas məqsəd ölkəmizin əzəli torpaqlarının düşmən tapdağından azad edilməsi, dövlətimizin qazandığı uğurların, bir sözlə, Qarabağ qələbəsinin bütün dünyaya çatdırılması, beynəlxalq mətbuatda əks olunması, bu uğruların qeyd olunan kontekstdə qərəzli və yaxud qərəzsiz mövqedən işıqlandırılmasına, hər iki mövqenin təhlilinə əsaslanır. Bu məqsədlə sadalanan vəzifələrin həlli zəruri əhəmiyyət daşıyır:

• ilk əvvəl müharibənin hər iki cəbhədən aparılması üzrə məlumatların dəqiqləşdirilməsi, informasiya müharibəsinin əsas xüsusiyyətləri aydınlaşdırılması;

• Azərbaycan dövlətinin haqlı mövqeynin mətbuatda işıqlandırılmasına dair məlumatların dəyərləndirilməsi;

• əsasən də, Rusiya, Türkiyə və İran kimi qonşu dövlətlərin Qarabağ müharibəsinə və ölkəmizin qələbəsinə dair mövqelərinin araşdırılması;

• qeyd olunan mövqelərin qərəzli və yaxud qərəzsiz, doğru və ya yalnış olduğunun müəyyənləşdirilməsi və bunun dərin təhlilinin aparılması.

Açar sözlər: Qarabağ, Azərbaycan, Vətən müharibəsi

Coverage of Azerbaijan's successes in Karabakh in the international press

Abstract

The main goal of writing the selected topic is to liberate the ancient lands of our country from the enemy, to convey the successes of our state, in short, the victory of Karabakh to the whole world, to reflect them in the international press, to cover these successes from a biased or impartial position in the mentioned context, and to analyze both positions. For this purpose, the solution of the listed tasks is essential:

• First of all, clarification of information on the conduct of the war from both fronts, clarification of the main features of the information war;

• Evaluation of information on coverage of the rightful position of the Azerbaijan state in the press;

• mainly, the investigation of the positions of neighboring countries such as Russia, Turkey and Iran regarding the Karabakh war and the victory of our country;

• Determining whether the stated positions are biased or neutral, true or false, and conducting an in-depth analysis of this.

Keywords: Karabakh, Azerbaijan, Patriotic War

Qarabağ müharibəsi beynəlxalq mətbuatda geniş əks olunmuşdur. Bu münaqişə ilə bağlı müxtəlif məqalələr, analizlər, müsahibələr və xəbərlər bir çox beynəlxalq mətbuat orqanlarında yayımlanmışdır. Mövcud məqalələr, müsahibələr və analizlər, fərqli ölkələrin media nümayəndələri, siyasətçiləri, müstəqil ekspertlər və digər mütəxəssislər tərəfindən tərtib edilmişdir.

Ümumiyyətlə, İkinci Qarabağ müharibəsi zamanı Ermənistan istər döyüş xəttində, istərsə də informasiya müharibəsi sahəsində məğlub olmuş, ölkəmizə qarşı başlatdırdığı qara piar layiqincə cavabını almışdır. Bunu Prezidentimizin hazırcavablığı, azərbaycanlı nümayəndələrin operativliyi və s. bu kimi müsbət faktorlarla əlaqələndirmək olar. Ermənilərin uydurduğu məlumatların yalan olması təsdiqlənmiş, vaxtında qarşısı alınmış və bütün bunlar faktlarla beynəlxalq ictimaiyyətə çatdırılmışdır (https://www.virtualkarabakh.az/az/post-item/52/2871/ikinci-qarabag-muharibesi.html).

Azərbaycan Prezidentinin böyük səs gətirən müsahibələri arasında Almaniyanın ARD telekanalına verdiyi müsahibəni xüsusilə qeyd etmək olar. Burada Prezidentimiz öz çevikliyini, intellektini bir daha hər kəsə sübut etmişdir. Müsahibə yenə də Dağlıq Qarabağa muxtariyyət verilməsi ilə bağlı idi. İlham Əliyev isə artıq qəti şəkildə bu məsələnin mzakirəyə qapalı olduğunu, artıq reallıqların diqqətə çatdırılmasını qeyd etdi. Əvvəlki təkliflərin və şərtlərin olmaması, yeni reallıqların formalaşması nəticəsində sadəcə Ermənistan tərəfinin hərbi əməliyyatları dayandırması nəticəsində sülhün bərqərar ola biləcəyi diqqətə çatdırılmışdır (https://dergipark.org.tr/en/download/article-file/2742121).

Eləcə də bu dövr ərzində qarşı tərəfin törədə biləcəyi təxribatların qarşısının alınması üçün Nəqliyyat, Rabitə və Yüksək Texnologiyalar Nazirliyi yanında yaradılmış Elektron Təhlükəsizlik Xidməti əhalidən sosial şəbəkələrdə maksimal şəkildə diqqətli olmağı, düşmənə əsgərlərimizin yerini bildirəcək məlumatların ötürülməsinə şəraitin yaradılmamasını, heç bir naməlum keçidə araşdırmadan daxil olmamağı, mənşəyi bilinməyən, qeyri-adi nömrələrdən gələn materialları yükləməməyi tövsiyə etmişdir. Təbii ki, bu, səbəbsiz deyildi. Belə ki, müharibənin başlamasından sonra ermənilər dəfələrlə Azərbaycana məxsus sistemlərə daxil olmağa cəhd etmişdir (http://sabunchu-ih.gov.az/az/page/442.html).

II Qarabağ müharibəsinin işıqlandırılmasına xüsusi diqqət yetirən ölkələrdən biri də Böyük Britaniyadır. Dəfələrlə bu ölkənin mətbuatında etibarlı və obyektiv formada yazılar dərc olunmuşdur. İndependent saytının səhifələrində 44 gün ərzində Dağlıq Qarabağda baş verən hadisələrlə bağlı dəfələrlə məqalələr dərc olunmuşdur. Ermənistan və Azərbaycan arasında hərbi əməliyyatların dayandırılmasından bəhs edən "Rusiya sülhməramlıları barışığı möhkəmləndirmək üçün Dağlıq Qarabağa gedir" başlıqlı məqalə xüsusilə diqqətəlayiqdir. Məqalədə Azərbaycan qüvvələrinin əhəmiyyətli irəliləyişlərindən sonra ermənıləri hərəkətə davam etmək imkanından məhrum edən atəşkəsin bağlanmasından bəhs edilir.

Ukrayna mətbuatında, xəbər portallarında da Ermənistanın Azərbaycan ərazilərində işğalçılıq siyasəti aparması, terror aktları təşkil etməsi, heç bir öhdəliklərə əməl etməyərək mina terrorunu davam etdirməsi xəbərləri verilmişdir. Bu kütləvi informasiya vasitələri arasında xüsusilə Korrespondent, Ukrinform kimi xəbər portallarını qeyd etmək olar. Təqdim edilən

digər xəbərlər arasında isə əraziyə yerləşdirilmiş minalar nəticəsində polis əməkdaşlarının həlak olması ilə bağlı məlumatlar yer alır.

(http://anl.az/down/meqale/azerbaycan/2023/sentyabr/866438(meqale).pdf).

Azərbaycan Prezidentinin neytral mövqe daşıyan kütləvi informasiya vasitələrində yer alan müsahibələrini də qeyd etmək lazımdır. Bu kimi müsahiblər arasında Yaponiyanın Nikkei qəzetində təqdim olunan müsahibəni nümunə göstərmək olar. Müsahibədə müxbir Ermənistan tərəflə danışıqlara gedilməsi barədə müəyyən şərtləri müzakirə etməyə çalışmış, İlham Əliyev isə hər hansı əlavə şərtlərin qəbul edilməyəciyini, Ermənistanın bütün ərazimizdən tamamilə çıxmalı olduğunu vurğulamışdır. Sadəcə rayonların mərhələli şəkildə boşaldılması təklifi ilə razılaşmaq mümkündür (https://president.az/az/articles/view/43836).

İlham Əliyev 2020-ci il 4 noyabrın tarixində isə böyük səs gətirən videomüsahibə ilə çıxış etmişdir. İspaniyanın EFE agentliyinə verilən bu müsahibədə Qarabağa muxtariyyət verilməsi ilə bağlı mövzular yer almışdır. İlham Əliyev isə bunun artıq keçmişdə qaldığını, bu kimi təkliflərin qəbul edilməyəcəyini qeyd etmişdir. Əgər əvvəllər danışıqlar vasitəsilə Qarabağa muxtariyyətin verilməsi məsələsi aktual sayıla bilərdisə, artıq bundan söhbət belə gedə bilməz.

Azərbaycanın Qarabağda həyata keçirdiyi əks hücum tədbirləri barədə İran mətbuatından da geniş məlumat əldə etmək olar. Mehr, Ecoiran, Fardanews kimi aparıcı İran kanallarında, əksər informasiya agentliklərində ordumuzun erməni hücumuna qarşı cavab tədbirlərinə başlaması xəbərləri yer almışdır. Sadalanan kütləvi informasiya vasitələrində yer alan məlumatlar əsasında əsasən Prezidentimizin çıxışını, onun ərazi bütövlüyümüzü bərpa etməsini, Azərbaycan ordusunun bütün məqsədlərinə nail olmasını, suvereniyini bərpa etməsini və s. qeyd etmək olar. O cümlədən yer alan materiallar arasında ölkə Prezidentininbaş verənlər fonunda yenə də tolerantlı göstərərək Qarabağdakı erməni əhaliyə heç bir xətər yetirməyəcəyi, onların hüquqlarını pozmayacağı vurğulanmışdır.

Ordumuzun antiterror əməliyyatının bütün periodlarında qazandığı nailiyyətlər nəticə olaraq Ermənistan rəhbərliyini işğalçılıq nəticəsində məskunlşdıqları torpaqlardan qovulmasına və Üçtərəfli Bəyənnamə hazırlamağa vadar etmişdir.

Diqqətlə baxsaq görərik ki, Prezident İlham Əliyev hakimiyyətdə olduğu müddətdə Dağlıq Qarabağ məsələsini gündəlik gündəmdə saxlamaq üçün bütün qüvvələrini səfərbər edib və səsimizi bütün dünyaya çatdırmağa çalışıb. Onun bütün çıxış və çıxışlarında, beynəlxalq görüşlərində, müsahibələrində, başqa dövlətlərin rəhbərləri ilə görüşlərində Qarabağ sevgisi daim hiss olunur. Bu, Vətən Müharibəsinin uğurunu şərtləndirən əsas amillərdən biridir. Bəlkə də bir çoxumuz bu yerlərdə heç vaxt olmamışıq və yaşamamışıq. Bununla belə, hər birimiz Qarabağ torpaqlarını dərindən sevir, burada yaşayan insanların öz torpaqlarını tərk etmək məcburiyyətində qalmasından həmişə təəssüflənir, öz torpaqlarına qayıtmaq, onları düşmən işğalından azad etmək həmişə arzulamışıq. Azərbaycanın döyüş meydanındakı qələbəsi isə sadəcə möhtəşəm idi. Bir tərəfdə qalib ordu və onun Ali Baş Komandanı, digər tərəfdə isə rüsvayçılığa məruz qalmış Ermənistan. Xalqımız bu qələbənin yaşandığı an küçələrə çıxmış, bütün binaların üzərində bayraqlar qaldırılmış, ən əsası isə Şəhidlərimiz yad edilmiş, onların portretləri meydanda daşınaraq nisgilli, bir o qədər də məğrur görünüş yaratmışdır.

Nəticə etibarilə, hazırki dövrdə də Qarabağla bağlı yazılanların, məqalələrin, nəşrlərin, internet resurslarının (xüsusilə, xarici mətbuatın) dərindən təhlili zəruri əhəmiyyət daşıyır. Bu, post-konflikt dövründə digər dövlətlərin, eləcə də müxtəlif təşkilatların ölkəmizə qarşı hansı mövqedən yanaşmasını, bizə qarşı olan münasibəti öyrənməyə və növbəti mərhələlərdə də bunu bilməyə imkan verir.

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EXPLORING TECHNOLOGY ACCEPTANCE OF GENERATIVE AI IN HIGHER EDUCATION: INSIGHTS FROM MALAYSIAN POLYTECHNICS

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ABSTRACT

This study examines how Malaysian polytechnic students use Generative Artificial Intelligence (GAI) systems in the context of technological changes in education. GAI's capacity to produce original, contextually relevant information may personalize learning, boost engagement, and automate training. In Malaysia, usability, ethical, and infrastructural issues hinder its inclusion into education. This study uses the Technology Acceptance Model (TAM) to examine the links between GAI tool PEOU, PU, BI, and AU. The study analyses student survey data from three Malaysian polytechnics using SEM. Results show that PEOU improves PU and BI, suggesting that user-friendly interfaces and low learning curves are key to adoption. PU also affects BI, emphasizing the relevance of perceived educational value in GAI system adoption. BI and AU are positively correlated, although the connection is weaker, suggesting that institutional backing, infrastructure, and accessibility determine utilization. Findings show that easy on boarding, error recovery, and adaptable interfaces reduce adoption obstacles and build user confidence. To bridge the gap between intention and practice, institutions must provide solid infrastructure, such as reliable internet connectivity and device access, and targeted training and support programs, according to the report. The study identifies Malaysian barriers and enablers of GAI implementation in education, expanding our understanding. GAI may reinvent education by aligning with individual learning styles and boosting academic achievements. Policymakers and

educators should promote digital literacy, GAI technologies in curriculum, and peer-assisted learning. Future study should examine how cultural, ethical, and trust-related issues affect GAI user views and adoption behavior over time. This holistic strategy will enable fairer and more meaningful GAI technology deployment in higher education, guaranteeing equal access and learning gains.

INTRODUCTION

During a time when applications like ChatGPT experience significant expansion in their user base by demonstrating exceptional domain-independent expertise (Hu, 2023), the concept of "Generative Artificial Intelligence" (GAI) emerges as a revolutionary influence in the digital landscape (Dwivedi et al., 2023; Teubner et al., 2023; Wessel et al., 2023). The capacity of this technology to develop high-quality, contextually pertinent content that closely mimics human-produced work prompts discussions over its potential early signs of artificial general intelligence (Bubeck et al., 2023). Regardless of discussions about AI's sentience, current advancements in machine learning (ML) and deep learning (DL) have broadened traditional, data-driven AI capabilities such as predictions, classifications, and recommendations to include the generation of unique, realistic, and inventive material. Extensive collaborations between humans and intelligent systems in commercial and personal domains have been shaped by the incorporation of AI, especially in process optimisation and decision-making (Burström et al., 2021; Moussawi et al., 2021). Generative Artificial Intelligence addresses this advancement by providing novel augmentation and automation prospects via innovative services and business models (Mondal et al., 2023), including assisting customer support staff with recommendations for appropriate conversational responses (Brynjolfsson et al., 2024). The swiftly evolving and increasingly vast domain of Generative Artificial Intelligence requires a thorough comprehension of its characteristics and capabilities to grasp the phenomena (Dwivedi et al., 2023; Strobel et al., 2023).

Education is a dynamic field significantly influenced by technological advancement. Technology has persistently served as a vital catalyst for transformation in educational development (Dwivedi et al., 2023; Murugesan & Cherukuri, 2023). In the realm of technical progress, Artificial Intelligence (AI) has emerged as a revolutionary force, reshaping educational experiences and teaching methods. Recent advancements have resulted in the advent of Generative AI, a form of artificial intelligence that autonomously produces content and data, distinguishing itself from earlier AI models that primarily focus on data analysis or interpretation. This type of AI has the unique capability to generate original, tailored content, therefore offering significant potential to revolutionise educational methodologies and learning experiences (Cooper, 2023; Dai et al., 2023; Zawacki-Richter et al., 2019). Nonetheless, the integration of Generative AI into the educational sector poses some challenges. This necessitates a comprehensive plan to ensure sustainable development, inclusivity, and equity in AI applications within education (Ahmad et al., 2021; Dai et al., 2023). Furthermore, there is an immediate necessity for comprehensive data systems and adequate training for educators and students within an AI-integrated educational framework (Hutson et al., 2022; Rasul et al., 2023). The potential of Generative AI in education is particularly notable for creating tailored and unique instructional materials. It understands and adapts to the unique learning patterns and needs of individual students, offering customised educational experiences that can significantly enhance engagement and learning outcomes (Celik et al., 2022). Personalised approaches can improve learning by catering to individual preferences and learning styles, hence potentially enhancing the overall quality of education. Nevertheless, the incorporation of Generative AI in higher education, especially in Thailand, is

still in its nascent stages. Various challenges impede its widespread implementation, including concerns about its ability to understand and analyse complex educational content, ethical issues, plagiarism concerns, and the maintenance of academic integrity (Akinwalere & Ivanov, 2022; Chan & Hu, 2023; Su & Yang, 2023; Wang et al., 2023).

This study examines the factors affecting the adoption of Generative-AI technologies among Malaysian Polytechnic students. The objective is to gain insight into the perceptions of Generative AI among Malaysian Polytechnic students, as well as to identify the key factors influencing its acceptance and incorporation into educational procedures. The project aims to elucidate these characteristics to formulate effective solutions for enhancing learning outcomes, providing fair access to the advantages of AI, and preserving academic integrity within a more AI-integrated educational environment (Song, 2024). This study identifies the factors affecting the Technology Acceptance Model (TAM) among Malaysian Polytechnic students, employing Structural Equation Modelling to elucidate the relationships that represent the actual implementation of Generative-AI. This study analyses pertinent literature to identify components in the development of a research framework and hypotheses concerning TAM and Generative AI. Outlines encompass the study methodology, sampling procedures, instruments, and data analysis. The results, discussion, and conclusions are subsequently presented, highlighting the principal findings of the relationships among TAM components. This paper concludes with recommendations for the application of Generative AI in higher education, alongside suggestions for further research and an analysis of the study's limitations.

LITERITURE REVIEW

Technology Acceptance Theory (TAM)

The adoption of new technologies by people and organizations in various systems, particularly information systems, has been the interest of the researchers. Various models have been established to understand the elements that influence the usage of information technology (Gupta et al., 2008) namely Technology acceptance theory (TAM) (Davis, 1989; Davis et al., 1989), reasoning theory (TRA) (Ajzen & Fishbein, 1980), planned behavior theory (TPB) (Ajzen, 1991), innovation and diffusion theory (IDT) (Rogers et al., 2019) and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003). For study into technology adoption, TAM is a standard paradigm.

The Technology Acceptance Model (TAM), proposed by Davis (1989), identifies Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) as fundamental factors influencing Behavioural Intention (BI) to adopt technology. PEOU denotes the simplicity of utilising a system, whereas PU highlights its perceived significance in improving performance. Behavioural intention (BI), a significant predictor of actual usage, is shaped by expectations, desires, and intentions. It can be evaluated through enquiries that investigate what individuals anticipate, desire, or aim to accomplish with the technology (Chuenphitthayavut et al., 2020). TAM's simplicity has established it as a foundational model; however, it has been criticised for neglecting other factors that affect user attitudes, including cost, trust, and cultural influences. Researchers have broadened the Technology Acceptance Model (TAM) to incorporate factors such as user experience, security concerns, and product involvement, particularly in the context of technological advancements (Jaradat, 2013; Koufaris, 2002). Concerns regarding privacy and security can adversely affect business intelligence, as evidenced by the adoption of artificial intelligence (Cao et al., 2021). The extensions enhance the adaptability of TAM, allowing for improved predictions of user adoption in various contexts.

Recent studies have delved into the adoption of Generative AI systems, focusing on the influence of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) on user engagement with platforms like ChatGPT and Copilot. Singh (2024) highlight that PU significantly impacts users' intention to adopt AI-based writing tools, while PEOU is critical in lowering adoption barriers, particularly for non-technical users. Similarly, Ma et al., (2024) examined the application of the Technology Acceptance Model (TAM) in relation to large language models, finding that PU and PEOU mediate the relationship between user interaction and overall satisfaction. Building on this foundation, this study explores the role of TAM in the context of Generative AI platforms, aiming to provide insights that assist organisations and developers in enhancing user engagement, improving training strategies, and optimizing deployment methods for broader adoption and impactful usage.

Perceived Ease of Use (PEOU)

The extent to which one feels that utilizing the technology would be enjoyable is referred to as perceived ease of use (PEOU) (Davis et al., 1989). It is further described as the amount of work that must be put into a technology in order for it to be simple to use (Venkatesh & Davis, 2000). Aside from that, the TAM claims that perceived ease of use is the most important element explaining the variability in perceived usefulness. In the long term, this has an impact on consumers' willingness to accept technology services. Additionally, it has been hypothesized that perceived ease of use has a favorable influence on perceived usefulness (Davis et al., 1989; Venkatesh et al., 2003). Users are more inclined to view a system as useful when they find it easy to use, as diminished effort enhances their ability to recognise the system's practical advantages. Gefen and Straub (2000) and Venkatesh and Davis (2000) conducted research that supports the notion that systems demanding less cognitive effort allow users to concentrate on task completion, thereby increasing perceived usefulness. Research in various fields, including Shih (2004) indicates that ease of use enhances users' perceptions of a system's benefits, facilitating rapid learning and the realisation of its full potential. Ma et al. (2024) and Singh (2024) illustrate that generative AI platforms such as ChatGPT and DALL·E lower adoption barriers and enhance perceived usefulness by enabling users to engage with the system's complete functionality with minimal effort. This research underscores the necessity of creating user-friendly AI systems that minimise the learning curve and enhance users' recognition of their value, ultimately promoting increased engagement and sustained adoption.

In light of the above considerations, the current investigation hypothesizes that:

H1 : Perceived ease of use will positively affect perceived usefulness to adopt generative AI system among polytechnic students.

Perceived Ease of Use (PEOU) significantly influences user adoption and engagement with generative AI systems, as evidenced by various studies. Singh (2024) highlight that intuitive designs and simplified interfaces effectively reduce barriers to entry, especially for non-technical users. Yu et al. (2024) demonstrated that perceived ease of use (PEOU) mediates the relationship between user interaction and satisfaction, highlighting its significance in enhancing positive experiences with AI tools such as ChatGPT and Copilot. Huang & Oteng, (2023) identify PEOU as a crucial element for improving accessibility and usability in creative fields, whereas Choung et al. (2023) associate it with heightened trust in AI systems through the mitigation of perceived complexity. Implementations aimed at enhancing perceived ease of use (PEOU) encompass seamless

on boarding, error recovery mechanisms, and adaptive interfaces, as outlined by Kari & Kosa (2023). As a consequence, ease of use directly affects the willingness to utilize technological services (Amin & Hamid, 2018; Venkatesh & Davis, 1996, 2000).

In light of the above considerations, the current investigation hypothesizes that:

H3 : Perceived ease of use will positively affect intention to adopt generative AI system among polytechnic students.

Perceived Usefulness (PU)

In accordance with the TAM's definition, perceived usefulness refers to the extent to which one feels that employing a technology would improve his or her overall performance (Davis et al., 1989). Several studies show that perceived usefulness influences behavior intention (Davis 1993; Venkatesh et al. 2003; Venkatesh & Davis 1996). For technology to be embraced, views about its utility must be considered (Chen & Barnes, 2007; Venkatesh & Morris, 2000). According to existing research, perceived usefulness influences the motivation to adopt technological advances, which influences the actual use of such technology (Adams et al., 1992; Gefen & Straub, 2003; Laukkanen, 2017). Using an experimental methodology, we examine the favorable influence of perceived usefulness on behavior intention (Tan & Lau 2016).

Thus, the goal of generative artificial intelligence systems has been to reduce the amount of technical knowledge that end-users need to possess. According to Singh (2024), the integration of systems such as Copilot into coding platforms brings about a reduction in the learning curve by offering contextual suggestions and explanations. This makes it simpler for those who are not specialists to utilise sophisticated technologies.

In light of the above considerations, the current investigation hypothesizes that:

H2 : Perceived usefulness will positively affect the intention to adopt generative AI system among polytechnic students.

Behavioral Intention (BI)

A person's perceived likelihood of completing an activity is defined by Fishbein and Ajzen (1975). Intention is also influenced by the person's attitude toward the activity and the subjective norm in which it is conducted. As a key indicator of effective technology adoption, strong behavioral intention shows a person's high likelihood to embrace technology. It was confirmed by Gerpott & Thomas, (2014) that intention was the most significant predictor of technology adoption. According to Jaradat & Faqih, (2014), Febrianto et al. (2018), and Rattanaburi & Vongurai (2021), behavioral intention influences the use of technological advancements. Therefore, the fundamental purpose of this study is to better understand the link between behavior intention and actual use of generative AI platforms among students in Malaysian Polytechnic.

In light of the above considerations, the current investigation hypothesizes that:

H4 : Intention will positively affect actual usage of generative AI system among polytechnic students.

This study aims to enhance the TAM model by investigating whether these variables influence Malaysian Polytechnic students to adopt and utilize generative AI systems as tools to support and enhance their learning experiences within the polytechnic context. The proposed model is illustrated in Figure 1.
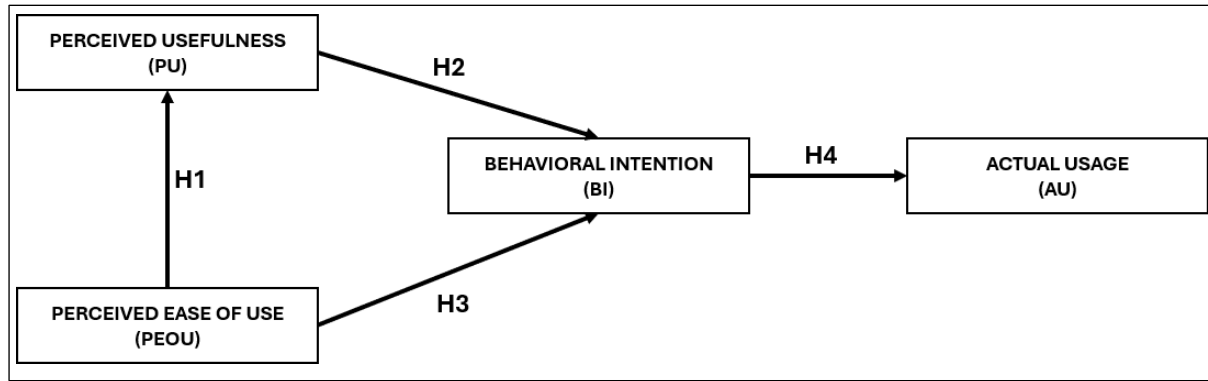
Figure 1: Proposed Model

METHODOLOGY

An empirical investigation was carried out to determine the link between the constructs, and a questionnaire was created specifically for this purpose as well. To gather the information, researchers used survey methods. The survey employed in this research consisted of three sections: first, a description of the respondent's demographic characteristics such as age, gender, education and income. Second, the respondent's experience with using an e-wallet was elicited, and finally, 16 items with 4 latent variables were utilized to assess the variables examined in this research. The questionnaire used a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). 7 factors were examined in the research: perceived ease of use (PEOU), perceived usefulness (PU), behavioral intention (BI), and actual use (AU).

The survey is conducted online by sending questionnaires to participants. This study comprised students from 3 different polytechnics in Malaysia, which is Politeknik Tuanku Sultanah Bahiyah, Politeknik Sultan Idris Shah dan Politeknik Seberang Perai. The data collection period lasted four months, from July 2024 to October 2024. The data collection approach used for this study was random sampling (Wu & Wang, 2005). Throughout the data collection process, respondents were promised that their information would be kept fully confidential.

The Structural Equation Model (SEM) is a statistical tool for evaluating the validity of a hypothesis (Ringle et al., 2005). The two most common techniques are covariance and variance. Therefore, the variance-based technique, namely PLS-SEM, is chosen to analyze the hypothetical model in this study. The PLS-SEM analysis was performed using SmartPLS 3.3.5 software (Hair et al. 2021), and a bootstrap resampling of 5,000 subsamples was utilized (Hair et al., 2011; Raza et al., 2017, 2018) to get the results. PLS-SEM is suitable for a wide range of research settings (Henseler et al., 2009) and complex models (Chin, 1998b, 1998a). Compared to other covariance-based techniques, this method has the least restrictions on sample size and residual distributions, which makes it appealing. To evaluate the measuring instrument and test hypotheses, (Bagozzi & Yi, 2012) claim that SEM is a very effective statistical technique in cross-sectional data surveys. The estimate was done in two parts, based on (Anderson & Gerbing, 1988) two-step approach. Step one established the model's reliability and validity; step two determined the structured model's validity and hypotheses. The proposed research model was evaluated experimentally using SEM in this work.

FINDINGS

Assessment of Measurement Model

The reliability and validity of the concept were evaluated using outer factor loading, composite reliability, and average variance extracted (AVE), as indicated in Table 4. Loadings below 0.7 should be eliminated (Churchill 1979). All components exhibit loadings exceeding 0.7. AVE scores exceeded 0.5, ranging from 0.813 to 0.836, so affirming the study's convergent validity (Fornell & Lacker 1981). Composite reliability (CR) was ultimately assessed for internal consistency (Werts et al. 1974), with all components exceeding 0.7, ranging from 0.911 to 0.964. This signifies that the investigation was internally coherent and dependable. A final assessment of the variables' reliability was conducted utilizing Cronbach's alpha coefficients. All exceeded the requisite threshold of 0.7 (Nunnally and Bernstein, 1994). The model's convergent validity was evaluated by the average variance extracted (AVE). To satisfy Fornell and Lacker's (1981) criterion, all variables were at least 0.50. Following the establishment of convergent validity, we employed Average Variance Extracted (AVE) to assess discriminant validity. The square root of AVE exceeds the correlation between variables, so satisfying Fornell & Lacker's (1981) criterion as presented in Table 5.

The measurement approach also verifies the variable uniqueness by validating convergent and discriminant validity.

Table 4: Measurement Results

Construct	Item	Loadings (>0.7)	Cronbach α (>0.7)	Composite Reliability (>0.7)	AVE (> 0.5)
Perceived Ease Of Use (PEOU)	PEOU1	0.881	0.954	0.963	0.813
	PEOU2	0.886			
	PEOU3	0.913			
	PEOU4	0.916			
	PEOU5	0.914			
	PEOU6	0.898			
Perceived Usefulness (PU)	PU1	0.868	0.955	0.964	0.815
	PU2	0.906			
	PU3	0.913			

Construct	Item				
	PU4	0.923			
	PU5	0.890			
	PU6	0.914			
Behavioral Intentions (BI)	BI1	0.905	0.804	0.911	0.836
	BI2	0.923			
Actual Usage (AU)	AU1	0.913	0.804	0.911	0.836
	AU2	0.916			

Source(s): SmartPLS Model Analysis

Table 5: Correlation Matrix

	AU	BI	PEOU	PU
AU	0.915			
BI	1.000	0.914		
PEOU	0.697	0.702	0.902	
PU	0.609	0.610	0.755	0.903

Notes: AU = Actual Usage; BI = Behavioral Intention; PEOU = Perceived Ease of Use; PU = Perceived Usefulness.

The diagonal elements (italic) represent the square root of AVE (average variance extracted).

Assessment of Structural Model

Before evaluating the structural model, it is important to check that there are no problems with lateral collinearity (Hair et al. 2017"). Results for the Variance Inflation Factor (VIF) are presented in Table 6. There is no evidence of collinearity in this inquiry, as evidenced by the fact that the VIF values for all the constructs are lower than 5, as shown in the table (Hair et al. 2017). It is therefore appropriate to move forward with the testing of the hypothesis.

Table 6: Variance Inflation Factor (VIF)

	AU	BI	PEOU	PU
AU				
BI	1.000			
PEOU		2.322		1.000
PU		2.322		

Notes: AU = Actual Usage; BI = Behavioral Intention; PEOU = Perceived Ease of Use; PU = Perceived Usefulness.

Hypothesis Testing

The structural model was analyzed utilizing standardized routes. Each route signifies a unique hypothesis. The sign, size, and statistical significance of each latent variable (LV) and dependent variable are employed to evaluate the hypothesis. A larger coefficient indicates a greater influence of the independent variable on the dependent variable. The alpha threshold for the hypotheses is 0.05. Table V presents the findings of the investigation. All factors (PU and PEOU) exert a statistically significant positive influence on behavioral intention, hence corroborating hypotheses 1, 2, and 3. Furthermore, the significant influence of behavioral intention on actual usage substantiates hypothesis H4. All four theories were validated.

Table 7: Path Analysis

Hypothesis		β	Standard Deviation	t-statistics	p-value	Decisions
H1	PEOU → PU	1.000	0.000	8066.467	0.000	Supported
H2	PU → BI	0.191	0.061	3.049	0.002	Supported
H3	PEOU → BI	0.558	0.069	8.115	0.000	Supported
H4	BI → AU	0.153	0.078	1.972	0.049	Supported

Notes: AU = Actual Usage; BI = Behavioral Intention; PEOU = Perceived Ease of Use; PU = Perceived Usefulness.
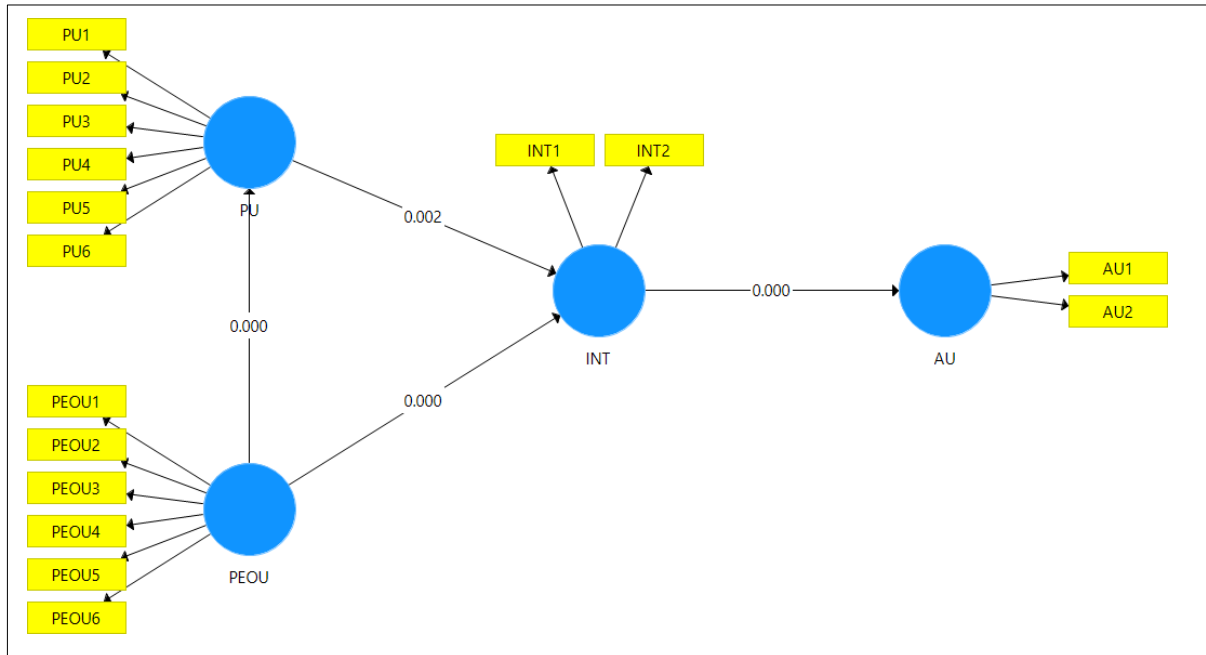
Figure 2: Result of Path Analysis

DISCUSSION

The findings of the research provide credence to the study's key aims.

H1: Perceived Ease of Use (PEOU) → Perceived Usefulness (PU)

The robust correlation between Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) is consistent with the original Technology Acceptance Model (TAM) proposed by Davis (1989), which asserts that users are more inclined to regard a system as beneficial if it is user-friendly. Research in educational technology, exemplified by Teo (2011) corroborates this conclusion, demonstrating that perceived ease of use (PEOU) substantially affects perceived usefulness (PU) in educational settings. This indicates that streamlining system interfaces and user experiences improves students' assessment of the system's worth in generative AI. This aligns with findings in AI-based systems where simplicity in design (e.g., intuitive prompts, streamlined interfaces) significantly affects usefulness (Braun et al., 2024). By streamlining the onboarding process for generative AI tools, such as by providing lessons or user-friendly interfaces, it is expected that both Perceived Usefulness (PU) and eventual acceptance will be increased.

H2: Perceived Usefulness (PU) → Behavioural Intention (BI)

According to the positive but moderate effect that perceived usefulness (PU) has on Behavioural Intention (BI), it may be deduced that students are more likely to plan to employ generative AI technologies if they recognise their usefulness for educational purposes. This discovery is in line with the findings of study conducted by Venkatesh and Bala (2008), who emphasised the key role that perceived usefulness (PU) plays in shaping behavioural intention (BI) across a variety of

platforms. If students recognise the utility of generative AI in activities such as brainstorming or problem-solving, then Behavioural Intention (BI) can be increased. However, Abdullah & Ward (2016) emphasized that in certain educational contexts, this effect might be moderated by cultural or institutional factors. Malaysian students may be more motivated by task-specific utility, such as improving project outcomes or saving time, as suggested by Soon Tan et al. (2022) in their study of Malaysian higher education. It is important for educators to demonstrate special benefits of generative AI in academic contexts, such as speedier brainstorming, personalised coaching, or automated feedback, in order to capitalise on this unique relationship.

H3: Perceived Ease of Use (PEOU) → Behavioural Intention (BI)

There is a direct correlation between the simplicity of use of generative AI tools and the intention of students to adopt them, as seen by the strong influence that PEOU has on BI. Abdullah & Ward (2016) came to similar conclusions, highlighting the fact that in educational settings, systems that are seen as being easy to navigate generate better user acceptance within the institution. For students attending Malaysian Polytechnic, this suggests that generative artificial intelligence systems that are easy to understand and have a low learning curve are necessary for general deployment. There is a direct correlation between the ease of use and the willingness of users to engage with technology, according to research conducted by Park (2009) on the adoption of e-learning in higher education. This is especially true for developing technologies such as artificial intelligence, among which a lack of knowledge might be a hindrance. According to Lazim & Ismail (2021), the importance of PEOU may be increased in Malaysia attributable to the fact that students' exposure to sophisticated technology varies to varied degrees. Training sessions and hands-on workshops should be prioritised by institutions in order to eliminate the perception of difficulty in utilising generative AI tools, which will ultimately lead to an increase in adoption intentions.

H4: Behavioural Intention (BI) → Actual Usage (AU)

The notable but weaker association between Behavioural Intention (BI) and Actual Usage (AU) aligns with extensions of the Technology Acceptance Model (TAM), as demonstrated by Venkatesh and Davis (2000). Their findings indicate that although BI serves as a primary predictor of AU, additional factors, such as facilitating conditions, may influence this relationship. In the realm of generative AI, this indicates that although students may plan to utilise the tools, external factors such as availability, infrastructure, or institutional support may influence actual usage. Venkatesh et al. (2003) in their Unified Theory of Acceptance and Use of Technology (UTAUT) emphasise that facilitating conditions, such as access to devices and internet connectivity, are crucial in transforming intention into actual behaviour. Hashim et al. (2021) conducted research in Malaysian educational contexts, highlighting the significance of institutional support in facilitating technology adoption. Barriers to usage, including access to devices, training resources, and reliable internet connectivity, must be addressed by policymakers and educators. Facilitating peer-to-peer knowledge exchange and support can effectively connect BI and AU.

CONCLUSION

This research validates the relevance of the Technology Acceptance Model (TAM) in analysing the adoption of generative AI systems by Malaysian Polytechnic students. The findings indicate that Perceived Ease of Use (PEOU) has a significant impact on both Perceived Usefulness (PU) and Behavioural Intention (BI), highlighting the importance of user-friendly interfaces. Perceived Usefulness (PU) influences Behavioural Intention (BI), suggesting that students are inclined to utilise tools they

consider advantageous for academic objectives. The relationship between Behavioural Intention (BI) and Actual Usage (AU) is relatively weak, underscoring the necessity of considering external factors, including infrastructure and institutional support, to facilitate the translation of intention into actual usage. The findings highlight the capacity of generative AI tools to improve learning experiences, contingent upon the resolution of issues pertaining to usability, perceived effectiveness, and external assistance.

Educators and institutions should prioritise the design or selection of generative AI tools featuring intuitive interfaces, offer training sessions and hands-on workshops, and integrate AI into academic curricula to illustrate its utility. It is essential to ensure reliable infrastructure, including internet connectivity and access to devices, in conjunction with institutional support such as technical assistance and provision of free or discounted tools. Investment in infrastructure, promotion of digital literacy, and facilitation of peer-to-peer learning are essential for bridging the gap between intention and usage. Future research should investigate external variables, including trust and cultural factors, and implement longitudinal studies to evaluate the evolution of students' perceptions with ongoing exposure to generative AI. Implementing these recommendations will enhance the potential of generative AI in transforming the educational experiences of Malaysian Polytechnic students.

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PERCEPTIONS OF STUDENT AND LECTURER
IN JKE AT PKS ON THE USE OF
"KALKULATOR PNM" APPLICATION

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ABSTRACT

This study investigates the perceptions of students and lecturers in the Electrical Engineering Department (JKE) at Politeknik Kuching Sarawak (PKS) regarding the "Kalkulator PNM" application, a tool designed to simplify Grade Point Average (GPA) calculations. By enabling students to effectively monitor their academic performance, the application aims to provide a clearer understanding of their standings and facilitate proactive academic planning. Utilizing a mixed-methods approach, the study integrates quantitative data collected through surveys and qualitative insights gathered from open-ended feedback section with both students and lecturers. The findings reveal a spectrum of responses towards the Kalkulator PNM. Many students appreciate its accessibility and the time-saving advantages it offers, which help them better manage their academic responsibilities. However, some students also express concerns regarding its usability and report occasional inconsistencies in the GPA calculations. Lecturers, on the other hand, recognize the application's potential to enhance academic advising by providing real-time academic data. They stress the importance of user training, highlighting that a better understanding of the application's features could enhance its effectiveness. Additionally, they emphasize the necessity of continuous updates to address any technical issues, ensuring that students can rely on the tool for accurate information. The research indicates that while the Kalkulator PNM holds promise in fostering academic success, several enhancements are necessary to maximize its impact. Improvements in the user interface could make the application more intuitive and user-friendly, addressing students' concerns about usability. Moreover, addressing the technical issues identified by users is crucial for building trust in the application's reliability. Providing ongoing support and guidance is also essential to encourage widespread adoption of the Kalkulator PNM among students and lecturers alike. By offering training sessions and user feedback mechanisms, the department can ensure that users remain engaged and informed about improvements and updates. In conclusion, while the Kalkulator PNM is a valuable tool for supporting academic performance monitoring in the JKE department, addressing

concerns about usability, technical reliability, and user support will be vital for enhancing its effectiveness and fostering a culture of proactive academic planning among students.

1.0 INTRODUCTION

Grade Point Average (GPA) is a vital metric in higher education, reflecting a student's academic performance and influencing their self-assessment, academic planning, and career readiness. For students in technical fields like electrical engineering, where the coursework is challenging and highly demanding, GPA tracking plays an even more significant role. To facilitate this process, the "Kalkulator PNM" application was introduced, a tool aimed at simplifying GPA calculations. By providing an efficient and accurate method for students to monitor their academic progress, Kalkulator PNM also supports lecturers in offering more targeted guidance and fostering meaningful academic discussions.

The adoption of digital tools for academic performance tracking is well-documented, with the Technology Acceptance Model (TAM) offering a framework for understanding user engagement. TAM highlights two key factors-perceived usefulness and ease of use—as determinants of whether users will embrace new technologies (Davis, 1989). Applications such as Kalkulator PNM exemplify these principles by reducing calculation errors, saving time, and promoting academic motivation through immediate feedback on performance (Harackiewicz et al., 2016). In engineering education, such tools are particularly valuable, allowing students to manage complex course structures, track progress toward graduation, and understand how individual courses affect their overall GPA.

However, the success of digital tools like Kalkulator PNM is heavily influenced by the perceptions of its primary users: students and lecturers. Students typically prefer tools that are intuitive and directly relevant to their academic objectives (Mahmood & Bokhari, 2012), while lecturers value applications that enhance their ability to advise students and facilitate meaningful discussions about academic performance (O'Flaherty & Phillips, 2015). For Kalkulator PNM to be effective, it must meet these expectations by delivering a user-friendly interface, ensuring accurate calculations, and integrating seamlessly with the existing academic systems at PKS.

In addition to technical accuracy, the role of usability is paramount. Students are more likely to engage with tools that are visually appealing and easy to navigate, while lecturers benefit from features that streamline their workflow, such as the ability to quickly generate and review reports on student progress. Furthermore, the alignment of Kalkulator PNM with institutional goals-such as enhancing academic advising and improving student retention-can significantly contribute to its adoption and long-term success.

This study investigates the perceptions of students and lecturers in the Electrical Engineering Department (JKE) at PKS regarding the usaKalkulator PNM application. It explores its usability, perceived benefits, and potential challenges, aiming to identify areas for improvement and ensure the application's alignment with user needs. Understanding these perspectives is crucial for optimizing the tool to better serve its users and achieve its intended purpose of supporting academic success.

By examining the impact of Kalkulator PNM, this study contributes to the broader discourse on digital tools in education, particularly in technical fields like engineering. It underscores the importance of designing applications that not only address academic needs but also foster positive user experiences. Ultimately, this study aims to refine Kalkulator PNM to become a cornerstone of academic support in the demanding and competitive field of electrical engineering.

2.0 LITERATURE REVIEW

The adoption of digital tools in educational settings has gained significant attention in recent years, particularly in higher education, where technology is increasingly leveraged to track and support students' academic progress. Among these tools, GPA calculation applications, such as the Kalkulator PNM have emerged as essential resources for both students and lecturers. These tools help monitor academic performance, provide real-time feedback, and aid in academic planning and guidance. This literature review examines study on the perceptions of students and lecturers regarding digital GPA tools, focusing on factors that influence their acceptance, ease of use, and perceived benefits, particularly within the context of engineering education.

2.1 Importance of GPA Tracking Tools

Tracking academic performance through GPA plays a crucial role in higher education. GPA serves as a key metric for assessing students' academic standing and is instrumental in fostering self-awareness, motivating improvement, and guiding academic planning. For students, particularly those in demanding disciplines like engineering, monitoring GPA can serve as both a motivator and a strategic tool for goal setting and progress evaluation.

Research in educational psychology emphasizes the importance of GPA awareness in promoting self-regulated learning. Harackiewicz et al. (2012) found that students with access to digital performance-tracking tools demonstrate higher engagement levels and a greater inclination toward setting and achieving academic goals. Real-time feedback provided by tools such as the Kalkulator PNM enhances students' ability to monitor their academic performance continuously, enabling them to adjust their efforts to meet desired outcomes. This immediate feedback loop is especially valuable in engineering programs, where students face rigorous coursework and need to manage complex academic schedules effectively.

Additionally, GPA tracking tools help students understand the impact of individual courses on their overall performance, empowering them to make informed decisions about course selection, workload management, and areas requiring improvement. For institutions, these tools can enhance academic outcomes by fostering a culture of accountability and continuous improvement among students.

2.2 Student Perceptions of Digital Tools in Academic Contexts

Students' acceptance and adoption of digital tools are influenced by several factors, including ease of use, perceived usefulness, and relevance to their academic goals. According to the Technology Acceptance Model (TAM), these factors are critical in determining whether students embrace new technologies (Davis, 1989). For engineering students, who often face substantial workloads and time constraints, digital tools that simplify administrative tasks, such as GPA calculation, are particularly appealing.

Study supports the notion that students value tools that save time and reduce errors. For example, Mahmood and Bokhari (2012) found that engineering students are more likely to adopt tools that provide immediate benefits, such as streamlined GPA tracking, as these tools allow them to focus more on academic content rather than administrative processes. Similarly, Alharbi and Drew (2014) reported that students using automated GPA calculators appreciated their efficiency, accuracy, and accessibility, which enhanced their overall academic experience.

However, challenges remain in ensuring widespread adoption of these tools. Usability issues, such as complex interfaces or limited compatibility with different devices, can discourage students from consistent use. Zanjani et al. (2017) observed that students often abandon digital learning platforms when they encounter technical difficulties or when the tools fail to integrate seamlessly with their existing workflows. For the Kalkulator PNM to succeed in PKS, it must prioritize user-centered design, ensuring the application is intuitive, visually appealing, and compatible across devices and operating systems.

Moreover, study indicates that students are more likely to adopt digital tools when they see clear connections to their academic goals. In engineering programs, where the academic journey is often mapped out in detail, tools like the Kalkulator PNM must align with students' needs by providing features such as progress tracking toward graduation requirements and insights into how individual courses affect GPA.

2.3 Lecturer Perceptions of Digital Tools

Lecturers play a pivotal role in shaping students' academic experiences, and their perceptions of digital tools can significantly influence students' adoption and usage. Lecturers view GPA tracking tools as valuable resources for improving academic advising and supporting students in achieving their goals. For instance, O'Flaherty and Phillips (2015) noted that lecturers appreciated GPA tools that facilitated precise tracking of student performance, enabling more productive and targeted advising sessions.

In engineering education, where academic rigor is a defining characteristic, lecturers often use GPA data to identify at-risk students and intervene early. Tools like the Kalkulator PNM provide lecturers with a streamlined way to monitor students' progress, reducing the manual workload associated with performance tracking. This efficiency allows lecturers to focus on providing tailored support and guidance, which is especially important in fields like engineering, where students frequently face significant challenges in balancing coursework and practical requirements.

However, successful implementation of these tools requires proper training and support for lecturers. Heinze and Procter (2004) emphasized the importance of training faculty members to integrate digital tools effectively into their advising practices. Without adequate support, lecturers may underutilize the tools or fail to recognize their potential, thereby limiting their impact on student outcomes. For the Kalkulator PNM, providing resources such as user guides, workshops, and ongoing technical support can ensure that lecturers fully understand the application's capabilities and can use it effectively to enhance their academic advising.

2.4 Challenges and Recommendations for Digital Tool Integration

Despite their benefits, digital GPA tools face several challenges that can hinder their adoption and effectiveness. Common issues include data accuracy, system reliability, and user privacy concerns. For instance, Smith and Caruso (2010) noted that

inconsistencies in calculation algorithms or lack of transparency in data handling could erode users' trust in digital tools. Similarly, students and lecturers may be reluctant to rely on a tool that fails to deliver consistent and accurate results or raises concerns about the security of their academic data.

To address these challenges, developers of tools like the Kalkulator PNM should prioritize accuracy and reliability by conducting rigorous testing and regularly updating the application to address bugs and incorporate user feedback. Transparency regarding data usage policies is also essential to build trust among users.

Another critical factor in promoting the adoption of digital tools is user-centered design. Study shows that applications developed with input from both students and lecturers are more likely to meet user needs and gain acceptance (Kim et al., 2016). For the Kalkulator PNM, incorporating features based on user feedback-such as customizable dashboards, compatibility with multiple devices, and visual progress tracking-can enhance its usability and relevance.

Furthermore, providing training and support is essential for successful adoption. Workshops, tutorials, and user manuals can help students and lecturers understand the full range of features offered by the Kalkulator PNM, enabling them to use the tool more effectively. Regular training sessions can also address common issues and ensure that users remain engaged with the application over time.

2.5 The Role of Digital Tools in Engineering Education

In engineering education, where academic demands are particularly high, digital tools like the Kalkulator PNM have the potential to transform the way students and lecturers' approach academic performance tracking. By providing real-time insights into GPA and progress, these tools help students take ownership of their academic journeys and make informed decisions about their coursework and career preparation.

For lecturers, GPA tracking tools offer a powerful way to support students by identifying challenges early and tailoring interventions to individual needs. In the context of PKS, the Kalkulator PNM can serve as a valuable resource for fostering a culture of continuous improvement and academic excellence within JKE.

2.6 Conclusion

The literature highlights the significant potential of GPA tracking tools in enhancing academic performance and supporting students and lecturers in higher education. Tools like the Kalkulator PNM align with the goals of fostering self-awareness, motivation, and informed decision-making among students, particularly in demanding fields like electrical engineering. However, successful adoption depends on several factors, including ease of use, data accuracy, lecturer training, and user-centered design.

By addressing these factors through continuous feedback, iterative design improvements, and comprehensive support resources, the Kalkulator PNM can become an integral part of academic support at JKE PKS. Its implementation offers an opportunity to improve academic outcomes, strengthen advising practices, and empower students and lecturers alike in achieving their educational goals.

3.0 METHODS

This study employs a mixed-methods approach, combining quantitative surveys with qualitative open-ended questions. A survey was distributed to students and lecturers in JKE at PKS, collecting data on their experiences with the Kalkulator PNM, including perceived usefulness, ease of use, and overall satisfaction.

3.1 Respondents

The study sample comprised 75 students and 18 lecturers from JKE at PKS. Respondents were recruited through convenience sampling to capture a broad spectrum of perspectives. This sampling method ensured accessibility while maintaining diversity in opinions and experiences.

3.2 Data Collection

To gather both breadth and depth of data, the study utilized two complementary methods:

- Quantitative Surveys: A structured online questionnaire was distributed to respondents. The survey included both closed-ended questions, designed to assess perceived usefulness, ease of use, and overall satisfaction, as well as open-ended questions for gathering qualitative insights on user suggestions and challenges.
- Qualitative Open-Ended Question: Open-ended survey responses to explore user experiences more deeply, uncovering nuanced insights into challenges faced and potential areas for improvement.

3.3 Data Analysis

The collected data were analyzed using a combination of statistical and thematic approaches:

- Quantitative Analysis: Data from the survey's closed-ended questions were analyzed using descriptive statistics to identify trends and patterns in user perceptions.
- Qualitative Analysis: Open-ended questions responses transcripts were analyzed thematically. A systematic coding process was employed to identify recurring themes and unique insights related to user experiences, challenges, and recommendations for enhancing the Kalkulator PNM.

3.4 Conclusion

This mixed-methods design allowed the study to capture both generalizable trends and in-depth, context-rich narratives, providing a holistic understanding of user interactions with the Kalkulator PNM.

4.0 RESULTS AND DISCUSSION

This section outlines the findings on the perceptions of students and lecturers in the JKE at PKS regarding the use of the Kalkulator PNM. The analysis explores how this tool is perceived in terms of its usability, effectiveness, and contribution to both learning outcomes and teaching practices. By examining these perspectives, the study provides a comprehensive understanding of the tool's impact within the academic environment.

The results highlight diverse opinions influenced by factors such as familiarity with digital tools, the ease of incorporating the Kalkulator PNM into academic routines, and the availability of technical support. These insights are critical for identifying the strengths of the Kalkulator PNM and addressing potential challenges. Ultimately, the findings aim to inform strategies for improving its functionality and integration, ensuring it supports the academic goals of students and lecturers in JKE at PKS.

The dataset contains survey responses related to the usage and perceptions of the Kalkulator PNM. Key columns represent respondents' demographics, responses to usability questions, and time comparisons between manual and app-based calculations. Below are preliminary observations based on the dataset:

Analysis of survey responses reveals the following trends regarding the Kalkulator PNM:

4.1.1   Demographics: Gender and age group distribution of respondents.
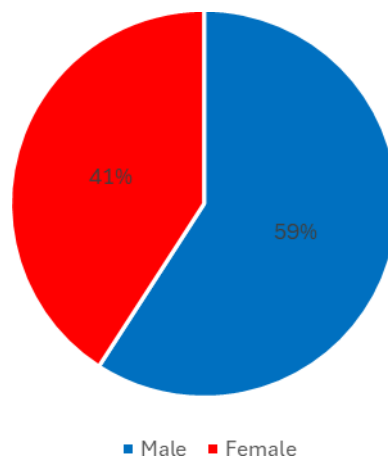
Figure 1: Gender Distribution

Figure 1 shows the gender distribution of the respondents. The respondents included 54 males (59%) and 39 females (41%). Most respondents in the survey were male, making up 59% of the total sample. This suggests that the survey may have attracted a higher number of male participants or that the male demographic is more engaged with the subject being surveyed. Females comprised 41% of the respondents, which still represents a significant portion of the sample. This percentage shows a relatively balanced gender representation, though slightly skewed towards males.
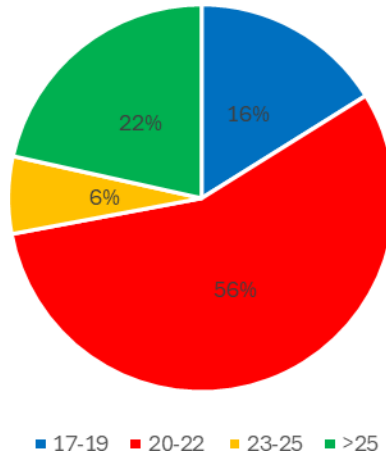
Figure 2: Age Distribution

Figure 2 shows then age distribution of the respondents. Most respondents were aged between 20 to 22 years (52 respondents, 55.9%), followed by those older than 25 years (20 respondents, 21.5%), the aged between 17 to 19 years (15 respondents, 16.0%) and lastly aged between 23 to 25 (6 respondents, 6.0%). This finding shows that respondents aged between 20 to 22 years are most likely a Diploma student.

4.1.2   Perceived Benefits: Responses to questions on usefulness, ease of use, and overall satisfaction with the Kalkulator PNM.
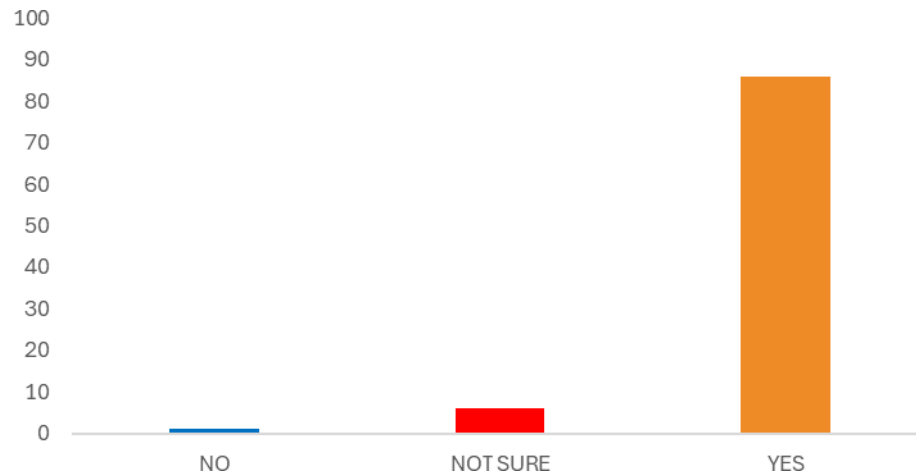
Figure 3: Usefulness of GPA calculations for setting academic targets

Figure 3 shows that 86 respondents (92.5%) agreed that GPA calculations are highly useful for setting academic targets, with 6 respondents (6%) unsure and only 1 participant (1%) disagreeing. This summary reflects that most respondents believe GPA calculations are useful for academic goal setting, with a very small percentage either unsure or disagreeing.
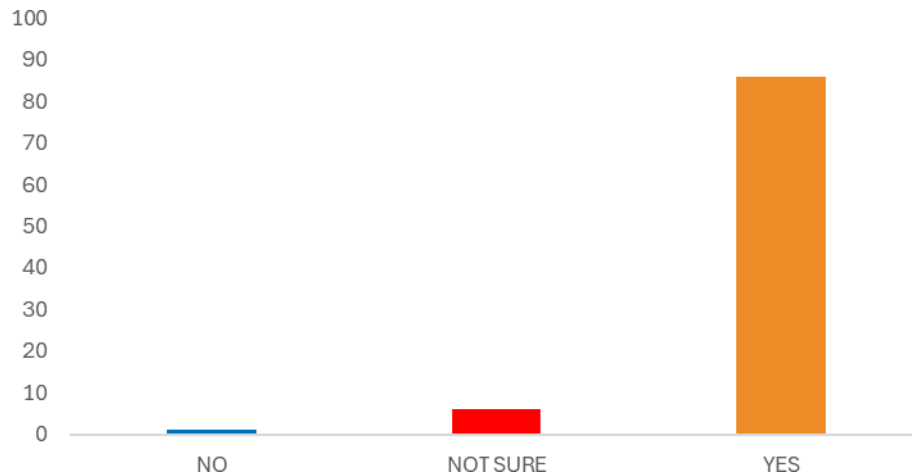
Figure 4: Ease of using Kalkulator PNM

Figure 4 shows that 86 respondents (92.5%) agreed that the Kalkulator PNM makes estimating GPA faster and easier, with 6 respondents (6%) unsure and only 1 participant (1%) disagreeing. This indicates that most respondents believe the Kalkulator PNM is effective in speeding up and simplifying the estimation process, with only a small percentage unsure or in disagreement.

Figure 5: Kalkulator PNM effectiveness in simplifying GPA achievement process

Figure 5 shows that most of the respondents (87.1%) believe that the Kalkulator PNM app simplifies the process of ensuring that their semester target GPA is achieved. This suggests that the app is considered helpful by most users in managing their academic goals, likely providing an efficient way to track GPA progress and make adjustments. This high percentage points to the app's effectiveness and its potential value to users who are trying to meet specific academic targets. A smaller portion of respondents (12%) were uncertain about the app's ability to simplify the process of achieving their semester target GPA. This uncertainty might stem from limited experience with the app, a lack of clarity on how it

works, or users who do not feel confident in using the app for this specific purpose. This could be an area for further investigation, such as user feedback or additional training resources, to help these respondents gain more clarity about the app's features and benefits.
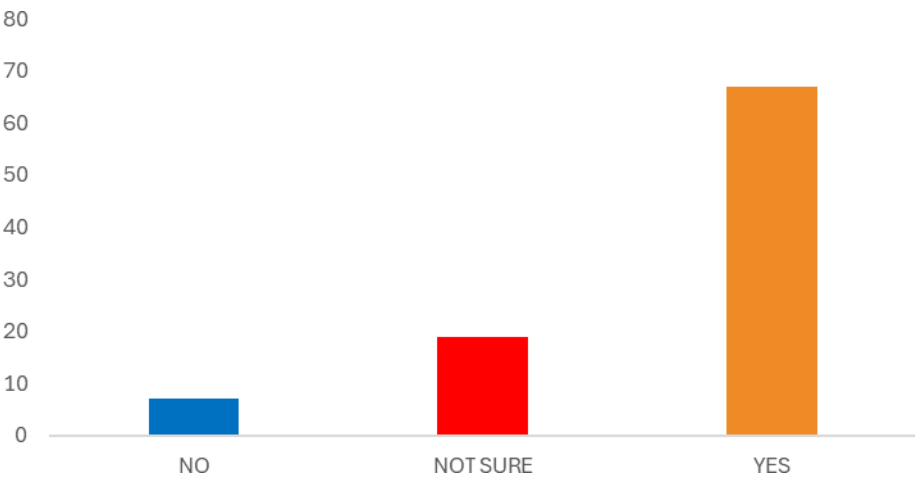
Figure 6: Ability to use Kalkulator PNM without prior knowledge of GPA calculation methods

Figure 6 shows most of the respondents (72%) confirmed that they could use the Kalkulator PNM app effectively without needing prior knowledge of manual GPA calculation methods. This indicates that the app is user-friendly and designed in a way that makes it accessible even to users who may not have a deep understanding of how GPA calculations work manually. A significant portion of respondents (20.4%) were unsure whether they could use the app without prior knowledge of manual GPA calculations. This uncertainty suggests that there may be some ambiguity in the app's usability for people who have little to no background in GPA calculations, or they may be uncertain about how intuitive the app is. A small percentage of respondents (7.5%) disagreed, indicating that they felt they would not be able to use the app without understanding manual GPA calculation methods. This group may have encountered issues with the app's interface, felt that some level of prior knowledge was required, or found the app's design difficult to follow without understanding the manual method.

Figure 7 shows majority of respondents (87.1%) found it easy to download the Kalkulator PNM app on their smartphones. This suggests that the app's availability and ease of installation are user-friendly, likely due to simple download processes from app stores or clear installation instructions. A smaller percentage (11.8%) were unsure about the ease of downloading the app. This could indicate some users may have had issues or did not attempt to download the app themselves, or they were not clear on the process. Only 1.1% of respondents disagreed, indicating that a very small group faced difficulty downloading the app, which might reflect problems related to app store availability, device compatibility, or technical issues.
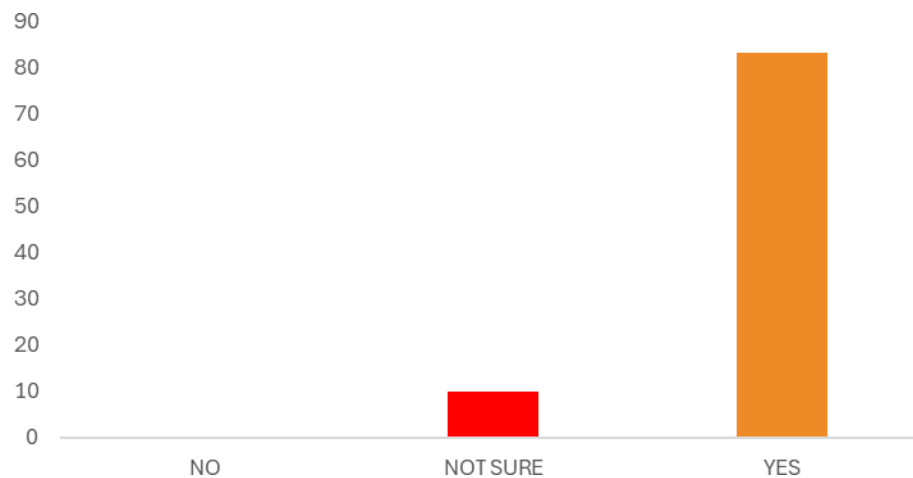
Figure 8: Suitability of Kalkulator PNM throughout academic journey

Figure 8 shows most of the respondents (89.2%) believed that the Kalkulator PNM app is suitable for use throughout their academic journey. This suggests that the app is considered a valuable tool by most users, and they think it can help them manage their academic goals over all semester. A smaller percentage (10.8%) were unsure about the app's suitability for their entire academic journey. This uncertainty could imply that some users may not yet fully understand how the app can be applied over the long term, or they may feel that it only addresses immediate academic needs.

4.1.3   Time Efficiency: Time required for GPA calculations manually versus using the application.

- Manual Calculations:
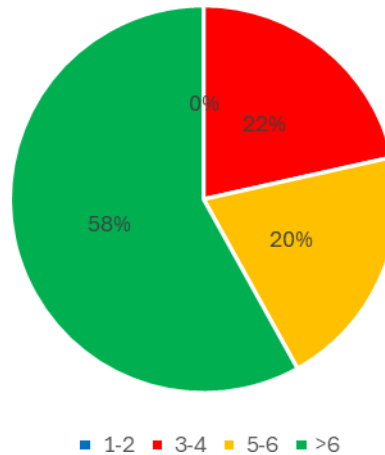
Figure 9: Time taken to manually calculate GPA

Figure 9 shows the largest group (58.1%) of respondents reported that it typically takes over 6 minutes to manually calculate their GPA. This suggests that most of the students find the process of manual GPA calculation to be time-consuming, possibly due to multiple steps involved, such as adding up grades, weighting them, and performing calculations. A smaller portion (20.4%) of respondents reported that it takes them between 5 to 6 minutes to calculate their GPA manually. This group may be slightly more efficient at the task but still finds it to be a relatively lengthy process, highlighting that even with some familiarity, manual calculation can still take a significant amount of time. A portion of respondents (21.5%) reported completing the manual GPA calculation in 3 to 4 minutes. This group likely includes respondents who are more familiar with the process or have a system in place to streamline the calculation, but the task still takes a moderate amount of time.

- Using the Kalkulator PNM Application:
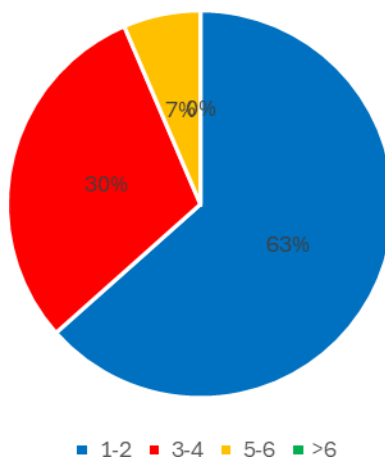
Figure 10: Time taken to use Kalkulator PNM

Figure 10 shows most of the respondents (63.4%) reported that using the Kalkulator PNM reduced the time required to just 1–2 minutes. This suggests that the Kalkulator PNM significantly improves the speed of GPA calculation, likely due to its user-friendly interface and automation, which makes it much faster than manual calculation. A smaller portion (30.1%) of respondents reported that using the Kalkulator PNM took them 3–4 minutes. While this is still faster than manual calculation, it suggests that some users may be slower or less familiar with the app, or there may be additional steps involved depending on their academic data. Only a small percentage (6.5%) of respondents reported taking 5 minutes or more to use the Kalkulator PNM. This group might experience some difficulty with the app or might be using additional features that extend the time slightly. However, this is still much faster than the manual calculation process.

4.2 Qualitative Analysis

Extract and categorize comments provided in the open-ended feedback section. Respondents provided brief comments about the application:

- Positive Feedback: Many described the app as "useful," "nice," and "easy to use.". These comments suggest that users generally find the app to be effective and user-friendly, highlighting its practicality and ease of use as key strengths.

- Some respondents noted "tiada" (nothing to add), indicating that they were satisfied with the app as it is and did not feel the need for further improvements. This suggests that a portion of users feel the app is already meet their needs and that they do not have any constructive feedback to offer.

- Suggestions for Improvement: Some respondents suggested that the app should be made available to all students in PKS (likely referring to a specific student group or institution). This implies that there may be interest in broader accessibility and inclusion. A few respondents emphasized the need for the app to be more accessible to a larger user base, possibly by improving compatibility with different devices or platforms. Some suggestions involved ensuring the app's functionality is adequate for a wider range of academic tasks or students' diverse needs.

4.3 Conclusion

The findings highlight the Kalkulator PNM's ability to significantly reduce the time required for GPA estimation while being user-friendly, beneficial even for those without prior knowledge of the calculation method and utility in achieving academic goals. However, there is room for improvement in promoting the app's capabilities and addressing uncertainties about its use among some users.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The Kalkulator PNM application at PKS in JKE has demonstrated its potential to significantly enhance academic performance tracking and advising. The study on student and lecturer perceptions reveals that both groups recognize the app as a valuable tool for simplifying GPA calculations, reducing errors, and increasing awareness of academic progress. For students, the app offers real-time insights into their performance, fostering self-efficacy and motivation to achieve academic goals. Meanwhile,

lecturers view Kalkulator PNM as a helpful resource for advising, providing easily accessible and accurate data that supports timely interventions and tailored guidance for students.

However, challenges remain that hinder the app's full adoption and optimal usage. Students have reported occasional inaccuracies in GPA calculations and difficulties navigating certain features, which can diminish their trust in the application. Lecturers have pointed out the need for training and technical support to ensure the app functions consistently and aligns with institutional grading standards. These challenges underscore the importance of addressing usability, reliability, and support systems to maximize the app's effectiveness.

5.2 Recommendations

To overcome these challenges and enhance the app's impact, the following recommendations have been developed:

5.2.1 Enhance User Interface and Functionality

Improving the user interface (UI) and functionality of the Kalkulator PNM is essential to address usability concerns raised by students. A well-designed UI should prioritize ease of navigation, intuitive layouts, and streamlined workflows that minimize the learning curve for new users. Compatibility with multiple devices, including smartphones, tablets, and desktops, is also critical to increase accessibility and convenience.

For example, incorporating features such as guided input fields, visual progress trackers, and clear error messages can make the app more user-friendly. Research by Kim and Lee (2016) suggests that applications with intuitive interfaces and cross-platform functionality achieve higher adoption rates among students. By investing in UI enhancements, Kalkulator PNM can better meet the needs of its diverse user base and encourage sustained usage.

5.2.2 Improve Calculation Accuracy and System Reliability

Accuracy and reliability are fundamental for building trust in any digital academic tool. Students have highlighted occasional errors in GPA calculations, which can undermine their confidence in the app. To address this, developers should implement rigorous testing protocols and conduct regular updates to ensure the app's algorithms align with PKS's grading policies and standards.

Collaborating with the institution's IT department and academic staff can help validate the accuracy of the app's calculations. Automated testing systems can also identify and resolve bugs more efficiently, ensuring that users consistently receive accurate and reliable data. Accurate GPA feedback empowers students to make informed decisions about their academic goals, while reliable functionality minimizes disruptions that could discourage usage (Smith & Caruso, 2010).

5.2.3 Provide Comprehensive Training and Support

Both students and lecturers need adequate training to fully leverage the Kalkulator PNM capabilities. Workshops, tutorials, and detailed user manuals can familiarize users with the app's features and demonstrate its benefits for academic planning and advising.

For students, training sessions can emphasize the importance of GPA tracking and demonstrate how to use the app to monitor progress, identify weaknesses, and set achievable goals. For lecturers, workshops should focus on integrating the app into academic advising practices, using its data to support meaningful conversations with students about their performance.

A dedicated support system, such as a help desk or in-app customer service feature, can further assist users in resolving technical issues or navigating complex features. Heinze and Procter (2004) emphasize the importance of training and support in facilitating the successful adoption of educational technologies. By providing these resources, PKS can ensure that all users feel confident and competent in using the Kalkulator PNM.

5.2.4 Incorporate Feedback Mechanisms for Continuous Improvement

Establishing a feedback system within the app can help developers gather valuable insights from users and guide future updates. A built-in feedback feature, such as a survey or suggestion form, allows students and lecturers to report issues, request new features, or share their experiences with the app.

Regularly reviewing and implementing user feedback ensures that the app evolves to meet the changing needs of its users. For instance, if multiple users report difficulty with a specific feature, developers can prioritize improvements in that area. Similarly, suggestions for additional functionalities, such as visual GPA projections or reminders for academic deadlines, can enhance the app's value.

Feedback-driven development not only improves usability but also fosters a sense of ownership and collaboration among users. Zanjani et al. (2017) highlights the importance of user-centered design in maintaining long-term engagement with digital tools. By incorporating feedback mechanisms, Kalkulator PNM can continuously adapt and improve over time.

5.2.5 Promote Awareness of the App's Benefits

Effective communication about the Kalkulator PNM's benefits is essential to encourage broader adoption among students and lecturers. Orientation programs for new students can include demonstrations of the app, emphasizing its role in supporting academic success. Similarly, informational workshops for lecturers can highlight how the app facilitates advising and helps monitor student performance.

Promotional efforts should focus on the app's ability to simplify GPA calculations, provide accurate and immediate feedback, and enhance academic planning. By linking these benefits to improved academic outcomes, such as better self-regulation and goal achievement, students and lecturers are more likely to perceive the app as an indispensable resource (Harackiewicz et al., 2016).

Additionally, creating promotional materials, such as brochures, videos, or posters, can increase visibility and interest in the app. Encouraging testimonials from early adopters, particularly students who have benefited from using Kalkulator PNM, can further enhance its credibility and appeal.

5.2.6 Potential Impact on Academic Success

Implementing these recommendations has the potential to significantly enhance Kalkulator PNM's usability, adoption, and impact within PKS's Electrical Engineering Department. For students, an improved app can serve as a vital tool for academic self-regulation, helping them track progress, set achievable goals, and stay motivated. The ability to monitor GPA in real-time empowers students to take proactive steps to address challenges and optimize their academic performance.

For lecturers, Kalkulator PNM streamlines the advising process by providing instant access to accurate GPA data. This facilitates more effective guidance and enables timely interventions for at-risk students. By integrating the app into their advising practices, lecturers can enhance their support for students and contribute to a collaborative academic environment focused on success.

The app's broader impact extends to institutional goals as well. By fostering a culture of accountability and continuous improvement, the app Kalkulator PNM aligns with PKS's mission to provide innovative and student-centered education. Its implementation can also serve as a model for other departments and institutions seeking to enhance academic performance tracking through digital tools.

5.2.7 Final Thoughts

Kalkulator PNM has shown promise as a valuable resource for supporting academic success at JKE PKS's. While challenges related to usability, accuracy, and support must be addressed, the app's potential benefits for students and lecturers are clear. By implementing the recommendations outlined in this study, PKS can maximize the app's effectiveness and ensure its long-term adoption and success.

Through enhancements to the user interface, rigorous accuracy checks, comprehensive training programs, and feedback-driven improvements, the Kalkulator PNM can become an indispensable part of the academic journey for both students and lecturers. Promotional efforts and awareness campaigns can further increase its adoption, solidifying its role as a key tool for academic planning and advising.

Ultimately, Kalkulator PNM has the potential to transform academic performance tracking at PKS, empowering students and lecturers to make informed, data-driven decisions that positively impact educational outcomes. Its successful implementation can contribute to a culture of excellence and innovation, helping PKS achieve its vision of fostering academic and professional success in the field of engineering.

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Hybrıd Neh-Bat Algorıthm- Artıfıcıal Bee Colony Algorıthm For Permutatıon Flowshop Schedulıng Problem----Yoong Chow, Ho, Syed Tarmizi Bin Syed Shazali, Khairul Fikri Tamrin, Magdalene Andrew-Munot, Abdul Rani Achmed Abdullah

HYBRID NEH-BAT ALGORITHM- ARTIFICIAL BEE COLONY ALGORITHM FOR PERMUTATION FLOWSHOP SCHEDULING PROBLEM

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Abstract

Flowshop scheduling in manufacturing primarily focuses on identifying the optimal makespan to maximize performance. This study demonstrates the effectiveness of employing the NEH heuristic as an initial solution for the Bat Algorithm (BA), followed by optimization using the Artificial Bee Colony (ABC) algorithm, to address the Permutation Flowshop Scheduling Problem (PFSP). The objective is to establish a hybrid approach (NEH-BA-ABC) that significantly enhances makespan compared to random initialization during the BA phase. Extensive experiments were conducted using benchmark datasets, including various Taillard instances, allowing for a comprehensive comparison between NEH-BA-ABC and random BA and ABC approaches. Outcome of the suggested appproach unequivocally indicates that NEH-BA-ABC consistently outperforms random BA and ABC, achieving lower makespan values, faster convergence rates, and more stable solutions. While NEH initialization may result in a slight increase in computational time, the overall quality and efficiency of this hybrid method position it as the superior choice for solving PFSP. The findings clearly indicate that the NEH-BA-ABC approach effectively minimizes makespan in flowshop scheduling, particularly for medium-scale and large-scale problems. By enhancing the global search capabilities of the BA, NEH initialization significantly improves outcomes when further refined by the ABC algorithm. This hybrid method is not only promising but also holds great potential for impactful applications in various scheduling challenges and industrial optimization tasks.

Üretimdeki akış atölyesi planlaması öncelikle performansı en üst düzeye çıkarmak için en uygun üretim süresinin belirlenmesine odaklanır. Bu çalışma, Permütasyon Akış Atölyesi Planlama Sorununu (PFSP) çözmek için Yarasa Algoritması (BA) için başlangıç çözümü olarak NEH buluşsal yönteminin kullanılmasının ve ardından Yapay Arı Kolonisi (ABC) algoritması kullanılarak optimizasyonun uygulanmasının etkinliğini göstermektedir. Amaç, BA aşaması sırasında rastgele başlatmaya kıyasla yapım süresini önemli ölçüde artıran hibrit bir yaklaşım (NEH-BA-ABC) oluşturmaktır. NEH-BA-ABC ile rastgele BA ve ABC yaklaşımları arasında kapsamlı bir karşılaştırma yapılmasına olanak tanıyan, çeşitli Taillard örnekleri de dahil olmak üzere kıyaslama veri kümeleri kullanılarak kapsamlı deneyler gerçekleştirildi. Önerilen yaklaşımın sonucu, NEH-BA-ABC'nin sürekli olarak rastgele BA ve ABC'den daha iyi performans gösterdiğini, daha düşük tamamlama süresi değerlerine, daha hızlı yakınsama oranlarına ve daha kararlı çözümlere ulaştığını açıkça göstermektedir. NEH başlatma,

hesaplama süresinde hafif bir artışa neden olsa da, bu hibrit yöntemin genel kalitesi ve verimliliği, onu PFSP çözümü için üstün bir seçenek olarak konumlandırıyor. Bulgular, NEH-BA-ABC yaklaşımının, özellikle orta ölçekli ve büyük ölçekli problemler için akış atölyesi planlamasındaki telafi süresini etkili bir şekilde en aza indirdiğini açıkça göstermektedir. NEH başlatma, BA'nın küresel arama yeteneklerini geliştirerek, ABC algoritması tarafından daha da iyileştirildiğinde sonuçları önemli ölçüde iyileştirir. Bu hibrit yöntem sadece umut verici olmakla kalmıyor, aynı zamanda çeşitli planlama zorlukları ve endüstriyel optimizasyon görevlerinde etkili uygulamalar için de büyük bir potansiyel taşıyor.

Keywords: Permutation Flowshop Scheduling Problem (PFSP), NEH Heuristic, Bat Algorithm (BA), Artificial Bee Colony (ABC), Scheduling Optimization, Makespan Minimization, Hybrid Algorithm

INTRODUCTION

Flowshop scheduling (FSP) is a well-known combinatorial optimization problem which can be found in many manufacturing as well as production contexts. In a flowshop, there are a number of jobs that have to be performed on the same series of machines in a sequential manner. The usual goal is to minimize the makespan which in this case is the total number of time units taken to finish all jobs (Pinedo, 2016)..

According to the authors of "Theory of Scheduling" (Maxwell, and Miller, 1967), "A flowshop is a system in which a set of jobs is worked upon in the order one after the other on a number of machines each of which does some work on each job for a fixed period of time".

The flowshop problem remains one of the great challenging issues in the field for its combinatorial characteristics. As the number of jobs on flowshop increases, the number of outputs that can be sequenced also increases exponentially making it impossible to use brute force in the search for optimal solutions. For this reason, a number of heuristic and metaheuristic algorithms were designed to deal with this problem (Baker, 1974; Pinedo, 2016).

Over the year, various optimization methods have been proposed given the complexity of FSP. These methods can be broadly categorized into traditional techniques and metaheuristics. Traditional techniques for FSP often rely on deterministic rules or heuristics to create feasible schedules. Some common examples include Johnson's Rule: a simple and efficient heuristic for two-machine flowshops (Johnson, 1954); Priority Rule Scheduling: which assigns priorities to jobs based on various criteria, such as shortest processing time or earliest due date (Baker, 1974); and Branch-and-Bound: a systematic search method that explores the solution space by branching and bounding the search tree (Lawler & Wood, 1966). While these traditional methods can provide good solutions for certain FSP instances, they may not always guarantee optimal solutions, especially for large-scale problems.

Metaheuristics are type of optimization algorithm that uses heuristic search techniques to efficiently traverse the solution space (Metaheuristic, 2011). They are commonly applied to solve complicated optimization problems for which exact algorithms would be computationally costly. Here, a few widely used metaheuristics for FSP includes: Genetic Algorithms (GA): where both biological evolution inspired GA apply principles like selection, crossover, and mutation to evolve a population of solutions closer towards optimality; Simulated Annealing (SA): based on the annealing of metals, which starts from a very high temperature and gradually cools down, allowing for exploration of the solution space while avoiding getting stuck in local optima; Tabu Search: a memory-based heuristic that avoids exploring previously visited solutions to prevent

cycling, and Ant Colony Optimization (ACO): inspired by the foraging behavior of ants which uses pheromones to guide the search towards promising solutions.

Metaheuristics often provide better solutions than traditional techniques, especially for large and complex FSP instances (Reeves & Yamada, 1998). However, they may not always guarantee optimal solutions and their performance can depend on the specific problem and parameter settings (Talbi, 2009).

LITERATURE REVIEW

NEH Heuristic: Principles, Strengths, and Limitations in FSP

NEH (Nehrou, Garey, and Johnson) is a straightforward yet effective heuristic for solving flow shop scheduling problems. It operates as a greedy algorithm, constructing a schedule by iteratively adding jobs to the sequence based on their total processing times (Nehrou, Garey, Johnson, 1976).

NEH aims to optimize solutions through the following steps:

i. Sorting: All jobs are arranged in descending order according to their total processing times.

ii. Initialization: The first job is placed at the beginning of the sequence.

iii. Insertion: For each subsequent job, the algorithm determines the optimal position within the sequence to insert the job, thereby minimizing the makespan.

iv. Iteration: Steps ii and iii are repeated until all jobs are positioned in the sequence (Nehrou, Garey, Johnson, 1976).

The strengths of NEH include:

i. Simplicity: NEH is easy to understand and implement.

ii. Efficiency: It demonstrates computational efficiency and is suitable for large-scale problems.

iii. Effectiveness: NEH often yields high-quality solutions, particularly for smaller instances (Nehrou, Garey, Johnson, 1976).

However, NEH's limitations include:

i. Local Optima: The algorithm may be trapped in local optima, hindering its ability to find the global optimal solution.

ii. Sensitivity to Job Characteristics: The performance of NEH can be influenced by job characteristics, such as processing times and machine requirements.

iii. Limited Applicability: NEH is primarily designed for two-machine flowshops and may not be as effective for problems involving a greater number of machines (Nehrou, Garey, Johnson, 1976).

Overall, NEH is a valuable heuristic for flowshop scheduling as it balances between simplicity and effectiveness. Nonetheless, its performance can be restricted by its susceptibility to local optima and its sensitivity to the specific characteristics of the problem. For complex scheduling problems, combining NEH with other optimization techniques or metaheuristics can often yield better results (Gao, Chen, 201).

Bat Algorithm: Principles, Strengths, and Limitations in FSP

The Bat Algorithm (BA) is inspired by the echolocation abilities of bats, which they use to navigate and locate their prey. This algorithm employs random walks and frequency modulation to efficiently explore the solution space. The main mechanism are the concepts of loudness and pulse rate, which bats modify based on their proximity to food. In the context of the algorithm, these adjustments correspond to variations in the step size and frequency of the random walks (Yang, 2010).

BA is recognized for its effective exploration capabilities as the integration of random walks and frequency modulation allows for thorough investigation of the solution space, making it particularly well-suited for complex problems such as flowshop scheduling. The algorithm's global optimization principle aids in avoiding local optima, thus striving for near-optimal solutions. BA is also flexible and can be easily tailored to various optimization challenges by altering the fitness function and parameters (Yang, 2010).

Nevertheless, the algorithm does have several limitations. Firstly, BA's performance can be sensitive to parameter tuning, including initial population size, loudness, and pulse rate. Premature convergence is also a concern, as the algorithm may settle too early on a local optimum, particularly in large-scale problems. Additionally, the computational cost can be considerable as running the algorithm on very large-scale problems can be resource-demanding (Yang, 2010).

In conclusion, the Bat Algorithm is a promising metaheuristic for flowshop scheduling, successfully balancing exploration and exploitation. However, achieving optimal performance may require careful parameter tuning and potential hybridization with other algorithms (Yang, 2010).

Bat Algorithm's Potential to Address ABC's Limitations

By examining the strengths and limitations of both the Bat Algorithm (BA) and the Artificial Bee Colony (ABC), BA offers efficient exploration through its echolocation mechanism which allows for a more effective search of the solution space and minimizes the risk of premature convergence (Yang, 2010).

BA's dynamic adjustment of loudness and pulse rate facilitates a balance between exploration and exploitation. This characteristic helps prevent the algorithm from getting trapped in local optima (Yang, 2010). Additionally, BA has the potential to converge more quickly than ABC, particularly when addressing complex problems.

However, it's important to note that the performance of both BA and ABC can vary based on the specific optimization challenges. In certain cases, adopting a hybrid approach that combines BA with ABC or other metaheuristic algorithms may lead to enhanced performance (Karaboga, 2007; Yang, 2010).

While BA mitigates some of the limitations associated with ABC, the optimal choice of algorithm for a given problem ultimately hinges on factors such as the problem's complexity, the desired quality of the solution, and the available computational resources.

Artificial Bee Colony (ABC) Algorithm

The Artificial Bee Colony (ABC) algorithm is inspired by the foraging behavior of honey bees. It is a swarm intelligence optimization technique that works well for continuous optimization problems. The core concepts of the ABC algorithm include:

iv. Colony: A group of artificial bees representing potential solutions,

v. Food Source: A location in the search space representing a potential solution,

vi. Employed Bee: A bee that is associated with a food source and performs local search,

vii. Onlooker Bee: A bee that observes the employed bees and chooses a food source based on their success, and

viii. Scout Bee: A bee that randomly explores the search space when a food source is abandoned (Karaboga, 2005).

The ABC algorithm comprises three primary phases: the Employed Bee Phase, the Onlooker Bee Phase, and the Scout Bee Phase (Karaboga, 2005).

In the Employed Bee Phase, each employed bee conducts a local search around its current food source to identify a superior solution. If a new solution is found to be better than the existing one, it replaces the old solution (Karaboga, 2005).

During the Onlooker Bee Phase, onlooker bees select food sources based on the amount of nectar (fitness) each source contains, with the probability of selection proportional to the source's fitness (Karaboga, 2005).

In the Scout Bee Phase, if an employed bee does not discover a better solution after a specified number of cycles, it transitions into a scout bee and randomly explores the search space to find new food sources (Karaboga, 2005).

The ABC algorithm has been successfully utilized in a variety of optimization problems.

iii. Numerical Optimization: Finding the minimum or maximum of a function;

iv. Engineering Design: Optimizing parameters of engineering systems (e.g., structural design, control systems);

v. Machine Learning: Training neural networks and other machine learning models;

vi. Scheduling: Optimizing schedules for various applications (e.g., job shop scheduling, timetabling); and

vii. Clustering: Grouping data points into clusters based on similarity (Baykasoğlu, Özbakır, Tapkan, 2007).

The ABC algorithm's ability to balance exploration and exploitation, combined with its simplicity and robustness, makes it a popular choice for many optimization tasks (Karaboga, 2005).

Limitations of Artificial Bee Colony (ABC) Algorithm
The Artificial Bee Colony (ABC) algorithm is a swarm intelligence optimization technique inspired by honey bee foraging, but it has several limitations.

i. Premature Convergence: The Artificial Bee Colony (ABC) algorithm can become trapped in local optima, which inhibits its ability to identify the global optimum.

ii. Slow Convergence: ABC often struggles to balance between exploration and exploitation, resulting in slower convergence rates.

iii. Sensitivity to Parameters: The algorithm's performance is significantly influenced by its parameters, such as colony size and maximum cycle number, making it challenging to determine the optimal settings.

iv. Inefficiency in High Dimensions: ABC may demonstrate reduced efficiency in high-dimensional problems due to the exponential growth of the search space.

v. Limited Applicability to Discrete Optimization: Although ABC has been adapted for discrete optimization tasks, its performance may not rival that of algorithms specifically designed for these scenarios.

vi. Lack of Theoretical Guarantees: ABC does not provide strong theoretical guarantees regarding its convergence or performance, which complicates the analysis of its behavior and predictions regarding its effectiveness (Han, Duan, Zhang, 2011).

Despite its limitations, the ABC algorithm serves as a valuable tool for continuous optimization problems. Researchers are actively seeking ways to enhance its performance (Talbi, 2011).

To improve its effectiveness in addressing the Flexible Job Shop Scheduling Problem (FSP), studies have employed initial solutions derived from the NEH heuristic to alleviate some of the ABC's weaknesses. The NEH heuristic provides notable advantages in this context.

i. Improved Starting Point: The NEH algorithm provides a strong initial solution based on job processing times, helping the Artificial Bee Colony (ABC) algorithm converge faster and avoid local optima.

ii. Reduced Premature Convergence: A solid initial solution decreases the likelihood of the ABC algorithm settling on suboptimal results.

iii. Enhanced Exploration: Starting with NEH encourages the ABC algorithm to explore a wider search space, increasing the chances of finding a better global optimum (Sidek, Bareduan, Nawawi, 2023).

However, researchers have noted that:

i. NEH is a heuristic approach that does not guarantee an optimal solution, and its effectiveness can vary based on the specific characteristics of the problem.

ii. Integrating NEH with ABC may require experimentation and precise adjustments of parameters (Fernandez-Viagas, Framinan, 2013).

METHODOLOGY

Research Questions

Does using NEH as an initial solution for the BA's global search, then passing the best solution to ABC algorithm improve the makespan in PFSP compared to random initialization?

Experimental Design

1. Problem Instances

The experiments will employ well-established benchmark datasets for the Permutation Flowshop Scheduling Problem (PFSP), specifically chosen instances of varying sizes from the Taillard benchmark. The instances selected for this study are as follows:

i. Taillard instances: small-scale problem (20 jobs x 5 machines), medium-scale problem (50 jobs x 10 machines), and large-scale problem (500 jobs x 20 machines).

ii. Each problem will be evaluated using a minimum of 30 generations for the same problem sizes to assess performance consistency..

2.   Parameter Tuning

We will optimize the parameters of the Bat Algorithm (BA) and the Artificial Bee Colony (ABC) algorithm to minimize makespan and improve performance.

      ii.   Bat Algorithm Parameters:

            a.   Loudness: 0.5

            b.   Pulse Rate: 0.5

            c.   Frequency: 0.2

            d.   Number of bats: 100

      iii.   Artificial Bee Colony (ABC) Parameters:

            a.   Number of employed bees: 100

            b.   Number of onlooker bees: 100

            c.   Number of scout bees: 20

For both BA and ABC, the maximum number of iterations is set to 500.

3.   Replications

Each experiment will be conducted multiple times, with 30 replications for each instance, to account for the stochastic nature of the algorithms. This repetition ensures that the results are statistically significant. The randomness inherent in both the BA and ABC algorithms requires multiple trials to reduce fluctuations in performance.

4.   Implementation

The hybrid algorithm (NEH-BA-ABC) will be implemented in a Python programming environment. First, the NEH heuristic will be used to generate an initial solution. This solution will then move to the global search phase of the BA (Bat Algorithm). Once the BA phase is complete, the best solution will be passed on to the ABC (Artificial Bee Colony) phase for further optimization.

Two experimental conditions will be implemented in the study:

      i.   NEH Initialization (NEH-BA-ABC): This process uses NEH to initialize the solution for the Bat Algorithm, which will then act as the initial solution for the ABC algorithm.

      ii.   Random Initialization (for both BA and ABC): In this scenario, a random solution is utilized to initialize both the Bat Algorithm and the Artificial Bee Colony algorithm.

Both implementations will use the same datasets, parameters, and evaluation methods.

5.   Performance Evaluation

The performance of the algorithms will be evaluated based on the following metrics:

      ii.   Makespan: The main goal is to reduce the total time taken for the last job to be completed.

      iii.   Computational time refers to the total duration taken by an algorithm to achieve a solution.

      iv.   Convergence Rate: This indicates how quickly the algorithms approach near-optimal solutions.

v.   Statistical tests, including paired t-tests, ANOVA, and Tukey's HSD, were conducted to assess whether the difference in makespan between the hybrid NEH-BA-ABC method and the BA and ABC methods is statistically significant.

6.   Tools

ii.   Hardware: All experiments were performed on a 12th Gen Intel(R) Core(TM) i5-12500 3.00 GHz, 16 GB RAM.

iii.   The hybrid algorithm was implemented in Python, using optimized libraries to ensure computational efficiency.

DATA ANALYSIS AND RESULTS

Descriptive Statistics

Summary of findings based on the output data highlights the best makespan achieved by each algorithm (BA, ABC, NEH-BA-ABC) for the three datasets (20×5, 50×10, and 500×20). The findings indicate that the NEH-BA-ABC algorithm consistently generates the shortest makespan across all datasets.

Table 1 Summary of best makespan between 3 algorithm

Dataset	Best Makespan (BA)	Best Makespan (ABC)	Best Makespan (NEH-BA-ABC)	Best Performing Algorithm
20×5	1358	1358	1358	All Equal
50×10	3464	3459	3459	ABC & NEH-BA-ABC
500×20	28814	28731	28697	NEH-BA-ABC

In the 20×5 dataset, all three algorithms achieved the same best makespan of 1358. This suggests that the dataset is relatively simple or lacks sufficient complexity to differentiate between the performance of the algorithms.

In the 50×10 dataset, both ABC and NEH-BA-ABC outperformed BA, with a best makespan of 3459. This demonstrates the improved performance of these algorithms on a medium-sized dataset.

However, in the 500×20 dataset, the NEH-BA-ABC algorithm achieved the best makespan of 28697, followed by ABC with 28731 and BA with 28814. This confirms that the NEH-BA-ABC algorithm is superior for large-scale datasets.

Performance Comparison

1.   Paired T-Test

A comprehensive comparison of both initialization methods across various problem instances is performed using paired t-tests to assess whether the differences in makespan are statistically significant.

i.   Hypothesis:

o   Null Hypothesis (H0): There is no significant difference in the makespan between NEH-BA-ABC with both BA and ABC.

o   Alternative Hypothesis (H1): NEH-BA-ABC provides a statistically significant improvement in makespan compared to BA and ABC.

ii.   Statistical Test Result:

Table 2 Paired T-Test Result

Dataset	Comparison	T-Statistic	P-Value
20×5	NEH-BA-ABC vs BA	3.525	0.0014
20×5	NEH-BA-ABC vs ABC	NaN	NaN (identical)
50×10	NEH-BA-ABC vs BA	13.717	3.29e-14
50×10	NEH-BA-ABC vs ABC	1.410	0.1693
500×20	NEH-BA-ABC vs BA	11.302	3.83e-12
500×20	NEH-BA-ABC vs ABC	2.949	0.0062

Based on the result, it is observed that:

iv.   20×5 Dataset:

- NEH-BA-ABC vs BA: Significant difference ($p < 0.05$).

- NEH-BA-ABC vs ABC: Identical values, no T-test applicable.

v.   50×10 Dataset:

- NEH-BA-ABC vs BA: Significant difference ($p < 0.05$).

- NEH-BA-ABC vs ABC: No significant difference ($p > 0.05$).

vi.   500×20 Dataset:

- NEH-BA-ABC vs BA: Significant difference ($p < 0.05$).

- NEH-BA-ABC vs ABC: Significant difference ($p < 0.05$).

Table 3 Standard Deviation

Dataset	BA	ABC	NEH-BA-ABC
20x5	13.52	0.00	0.00
50x10	18.32	3.03	0.43
500x20	82.98	27.63	39.37

The standard deviation results for the makespan in the flowshop scheduling data provide insight into the consistency of the three algorithms (BA, ABC, and NEH-BA-ABC) across different problem sizes (20x5, 50x10, and 500x20).

i.   20x5 Dataset

- o   BA: The standard deviation of 13.52 indicates variability in the performance of the Bat Algorithm (BA) for this smaller problem size. Some makespan values are higher (e.g., 1387), while others are lower (1358). This suggests that BA struggles to consistently find the best solutions in this scenario.

- o   ABC and NEH-BA-ABC : Both have a standard deviation of 0.00, meaning they consistently return the same makespan (1358) for all groups. This suggests that the solutions provided by ABC and the Hybrid algorithm are highly stable for small-sized problems.

ii.   50x10 Dataset

- o   BA: The standard deviation of 18.32 reflects a moderate level of variability in BA's performance. While BA generally produces competitive solutions, its makespan fluctuates across groups, indicating potential sensitivity to problem characteristics or parameter settings.

- o   ABC: A low standard deviation of 3.03 indicates that ABC is more consistent than BA, though it still shows minor fluctuations in performance. This consistency might be attributed to the inherent structure of the ABC algorithm, which is good at maintaining a balance between exploration and exploitation.

- o   NEH-BA-ABC : The lowest standard deviation of 0.43 demonstrates that the NEH-BA-ABC algorithm is extremely consistent and robust. This stability suggests that combining NEH, BA, and ABC reduces the variability in performance, making the Hybrid algorithm more reliable for medium-sized problems.

iii.   500x20 Dataset

- o   BA: The highest standard deviation of 82.98 reveals significant variability in BA's performance for large-scale problems. This high variability might stem from BA's sensitivity to complex search spaces, where it struggles to consistently converge on high-quality solutions.

- o   ABC: A standard deviation of 27.63 shows moderate variability, indicating that ABC performs better than BA in terms of consistency but is still influenced by the increased complexity of larger problem instances.

- o   NEH-BA-ABC : The NEH-BA-ABC algorithm has a standard deviation of 39.37, lower than BA but higher than ABC. This suggests that while the NEH-BA-ABC algorithm is less affected by variability than BA, the increased problem size introduces some inconsistencies. However, given its overall performance (closer makespan values), it still represents a strong compromise between consistency and solution quality.

2.   ANOVA

To test whether the means of more than two groups are statistically different from each other, ANOVA is essential for simultaneously comparing all three algorithms (BA, ABC, NEH-BA-ABC) across each dataset (20×5, 50×10, and 500×20). ANOVA helps determine if there are any statistically significant differences in makespan performance among the algorithms, eliminating the need for multiple pairwise comparisons and thereby reducing the risk of errors. The results of the ANOVA tests for the datasets are as follows:

iii.   20×5 Dataset:

  o   F-statistic: 12.43

  o   p-value: 1.79×10^{-5}

The p-value is significantly less than 0.05, indicating a statistically significant difference in the makespan values across the algorithms (BA, ABC, and NEH-BA-ABC) for this dataset.

iv.   50×10 Dataset:

  o   F-statistic: 178.18

  o   p-value: 1.72×10^{-31}

The p-value confirms a significant difference in makespan values across the algorithms for this dataset.

v.   500×20 Dataset:

  o   F-statistic: 113.74

  o   p-value: 5.29×10^{-25}

Similarly, the p-value is far below 0.05, indicating significant differences among the algorithms for this dataset.

3.   Tukey's HSD Test

A post hoc test using Tukey's HSD was then conducted to gain a clearer understanding of the differences among the algorithms. After the ANOVA indicated a significant difference, Tukey's HSD was employed to identify the specific algorithms that differed: BA vs. ABC, BA vs. NEH-BA-ABC, and ABC vs. NEH-BA-ABC. This test adjusts for multiple comparisons, ensuring that the results are not biased or inflated due to repeated pairwise testing. Below are the results of the pairwise comparisons among the algorithms.

The results shows that:

i.   Across all datasets, BA vs. NEH-BA-ABC and BA vs. ABC comparisons show significant differences in performance, with BA generally having a higher makespan.

ii.   ABC vs. NEH-BA-ABC shows no significant difference for the 20×5 and 50×10 datasets, but a significant difference is observed in the 500×20 dataset.

Table 4 Tukey's HSD Result

20×5 Dataset

Comparison	Mean Difference	p-value	95% Confidence Interval	Significant?
BA vs. ABC	29.83	0.001	[12.35, 47.31]	Yes
BA vs. Hybrid	29.83	0.001	[12.35, 47.31]	Yes

Comparison	Mean Difference	p-value	95% Confidence Interval	Significant?
ABC vs. NEH-BA-ABC	0.00	1.000	[-17.48, 17.48]	No

50×10 Dataset

Comparison	Mean Difference	p-value	95% Confidence Interval	Significant?
BA vs. ABC	51.43	<0.001	[47.13, 55.73]	Yes
BA vs. NEH-BA-ABC	51.70	<0.001	[47.39, 56.00]	Yes
ABC vs. NEH-BA-ABC	0.27	0.900	[-3.85, 4.39]	No

500×20 Dataset

Comparison	Mean Difference	p-value	95% Confidence Interval	Significant?
BA vs. ABC	64.93	<0.001	[56.78, 73.07]	Yes
BA vs. NEH-BA-ABC	87.57	<0.001	[79.42, 95.72]	Yes
ABC vs. NEH-BA-ABC	22.63	<0.001	[14.48, 30.77]	Yes

The NEH-BA-ABC algorithm demonstrates superior performance with a lower makespan than BA, while also showing comparable or slightly better performance than ABC.

Analysis of Findings

1.	From the Paired T-test results obtained, different dataset size shows different findings.

   i.	Dataset 20×5

- NEH-BA-ABC vs BA:

  o	The T-test indicates a significant difference (p = 0.0014), showing that the NEH-BA-ABC algorithm outperforms the BA algorithm regarding makespan.

  o	The NEH-BA-ABC algorithm combines the strengths of NEH and ABC to enhance the BA solutions, leading to consistent and improved outcomes.

- NEH-BA-ABC vs ABC:

  o	The makespan values for both NEH-BA-ABC and ABC are the same across all groups. This indicates that for this small-scale problem, the NEH-BA-ABC algorithm reaches the same solution as ABC. This similarity may be due to the problem's minimal complexity and the effectiveness of the ABC algorithm in addressing such cases.

   ii.	Dataset 50×10

- NEH-BA-ABC vs BA:

- A significant difference was observed (p < 0.0001), confirming that the Hybrid algorithm outperforms the BA method. This result supports the expectation that the NEH-BA-ABC approach, which integrates NEH and ABC, enhances the search capabilities and solution quality of BA.

- NEH-BA-ABC vs ABC:

    - The T-test results show no significant difference (p = 0.1693), indicating that for medium-scale problems, the ABC algorithm is competitive with the NEH-BA-ABC algorithm. For this case, the NEH-BA-ABC approach does not offer substantial additional benefits over ABC, likely because the complexity of the problem is not high enough to take full advantage of the NEH-BA-ABC's enhanced search capabilities.

iii. Dataset 500×20

- NEH-BA-ABC vs BA:

    - A highly significant difference (p < 0.0001) indicates that the NEH-BA-ABC algorithm outperforms the BA algorithm in large-scale problems. By incorporating NEH for initialization and ABC for local optimization, the NEH-BA-ABC algorithm is better equipped to manage the complexity of larger datasets.

- NEH-BA-ABC vs ABC:

    - A significant difference (p = 0.0062) has been observed, indicating that the NEH-BA-ABC algorithm outperforms the ABC algorithm in large-scale problems. This suggests that, while ABC is effective, the additional optimization steps incorporated in the NEH-BA-ABC algorithm—such as contributions from Bat Algorithm (BA) and NEH—enhance the makespan by allowing for a more thorough exploration of the solution space.

- Standard Deviation:

    - Across all datasets, BA shows the highest standard deviation, particularly as the problem size increases. This suggests that BA is more sensitive to problem complexity and may require parameter tuning or additional mechanisms (e.g., local search) to improve its stability.
    - ABC consistently outperforms BA in terms of stability, especially for smaller and medium-sized problems. However, as the problem size grows, its variability increases slightly, suggesting room for improvement in handling large-scale instances.
    - NEH-BA-ABC algorithm demonstrates the lowest variability in smaller and medium-sized datasets, showcasing its reliability. Although its standard deviation increases for larger problems, it still performs better than BA in terms of consistency. This result supports the hypothesis that combining algorithms can harness the strengths of each while mitigating their weaknesses.

2.   The results of the ANOVA test indicate that there are statistically significant differences in the performance (measured by makespan) among the three algorithms across all dataset sizes. To gain a deeper understanding of these differences, post hoc tests is conducted to identify specific variations between the algorithms.

3.   Based on the Tukey's HSD results, the key findings are as below.

   i.   BA vs. NEH-BA-ABC

   - The NEH-BA-ABC algorithm consistently outperforms the Bat Algorithm (BA) across all dataset sizes, showing statistically significant differences. The mean makespan difference ranges from 29.83 in the 20×5 dataset to 87.57 in the 500×20 dataset.

   - This result strongly supports the hypothesis that the NEH-BA-ABC algorithm, which combines NEH, BA, and ABC methods, benefits from its structured initialization through NEH, enhanced global exploration through BA, and effective local search through ABC. While BA is efficient on its own, it tends to suffer from premature convergence. The hybrid model addresses this issue effectively.

   ii. BA vs. ABC

   - ABC significantly outperforms BA across all dataset sizes. The difference in mean makespan is most pronounced in the 500×20 dataset (64.93) and least in the 20×5 dataset (29.83).

   - The ABC algorithm's focus on three phases—employed, onlooker, and scout bees—ensures better exploration and exploitation compared to the Bee Algorithm (BA). BA tends to struggle as the problem size increases, likely due to a lack of diversity in the population during stagnation.

   iii. ABC vs. NEH-BA-ABC

   - For small datasets (20×5) and medium-sized datasets (50×10), there is no significant difference between the ABC and NEH-BA-ABC algorithms. Both algorithms perform similarly because the problem's complexity does not fully test the combined strengths of the NEH-BA-ABC model.

   - In the larger 500×20 dataset, the NEH-BA-ABC algorithm demonstrates statistically significant improvements over the ABC algorithm, with a mean makespan difference of 22.63. The multi-phase structure of the NEH-BA-ABC algorithm combines the strengths of the NEH and BA algorithms along with ABC, resulting in superior solutions. This finding emphasizes the scalability and robustness of the NEH-BA-ABC algorithm in addressing larger and more complex scheduling problems.

In conclusion, the analysis indicates that the NEH-BA-ABC algorithm significantly reduces makespan for medium-scale instances, such as 50 jobs across 10 machines, and performs comparably for larger instances, like 500 jobs against 20 machines.

Computational Time Analysis

While the makespan is the primary objective, the time taken to reach the solution is also important in real-world applications. However, this research did not include a comparison of computational time between the new hybridized algorithm (NEH-BA-ABC) and the original algorithms (BA and ABC), as the computational times are similar across all stages. Future research could focus on evaluating the convergence rate to find the best solution.

Summary of Key Findings

Conclude the analysis by summarizing the major insights:

- Improvement in Makespan: NEH-BA-ABC consistently outperforms both BA and ABC regarding makespan, especially for medium and large-scale instances.
- Consistency and Stability: NEH-BA-ABC exhibits less variability in solution quality than BA and ABC, indicated by a lower standard deviation.

CONCLUSION AND RECOMMENDATION

Conclusion

In this study, we investigated the effects of using the NEH heuristic as an initial solution for the Bat Algorithm (BA) and optimizing it with the Artificial Bee Colony (ABC) algorithm to tackle the Permutation Flowshop Scheduling Problem (PFSP). The primary objective was to determine whether this NEH-BA-ABC approach, results in a significant improvement in makespan compared to using random initialization in the BA and ABC.

Key findings include:

iii.   Makespan Improvement: The experimental results consistently showed that the NEH-BA-ABC algorithm performed better than the Random-BA-ABC across various problem instances. The NEH initialization provided a superior starting point for the BA's global search, leading to faster convergence and a reduced makespan, regardless on smaller, medium or large-sized instances. This confirms that using NEH as an initial solution enhances the search efficiency of the BA, resulting in higher-quality solutions.

iv.   Solution Stability: The NEH-BA-ABC algorithm exhibited reduced variability in solution quality, indicated by lower standard deviations in makespan across various replications. This implies that the algorithm delivers more consistent and reliable results compared to the random initialization method.

v.   Computational Time: Although there was a slight increase in computational time due to the NEH initialization phase, this was offset by the improved quality of solutions and quicker convergence. As a result, NEH-BA-ABC proved to be a more efficient method overall.

The study concludes that using the NEH heuristic as an initial solution for the BA algorithm, followed by the ABC algorithm, leads to improved makespan performance in the PFSP compared to random initialization. This hybrid approach effectively balances solution quality and computational efficiency, especially when the problem size is manageable.

Recommendation

Based on the findings of this research, the following recommendations are made:

vi.   Adoption of NEH-BA-ABC for PFSP: For manufacturing industries and applications that requires efficient solutions to the Permutation Flow Shop Problem (PFSP), the NEH-BA-ABC approach may recommended as

this method consistently yields superior results with minimal additional computational cost, particularly for small to medium-sized instances.

vii. Algorithm customization: It is recommended to customize the NEH-BA-ABC algorithm according to the problem size to improve performance. For smaller instances, the NEH initialization provides a distinct advantage. However, for larger instances where the time cost of the NEH approach can be considerable, a hybrid initialization method that combines random and heuristic strategies should be considered.

viii. Application to other scheduling problems: The effectiveness of NEH-BA-ABC in the PFSP suggests that this approach may also be effective for other combinatorial optimization problems. Future research could explore the application of this method to various scheduling challenges, such as job shop scheduling or open shop scheduling, to assess its overall effectiveness.

ix. Further enhancements: Further modifications to the Bat Algorithm (BA) or the Artificial Bee Colony (ABC) phases, such as adaptive parameter tuning or hybridization with other metaheuristics like Genetic Algorithms or Particle Swarm Optimization, could enhance performance and impact the balance between solution quality and computational time.

x. Convergence rate: The convergence time could shows if the NEH-BA-ABC algorithm achieved near-optimal solutions more quickly than the randomized BA and ABC algorithm. The initial advantage gained from the NEH heuristic throughout the BA and ABC optimization phase should be tested to the overall improved performance.

xi. Real-World Testing: While benchmark instances provide useful insights, it is recommended to test the NEH-BA-ABC algorithm in real-world manufacturing environments. This practical validation will evaluate the approach's effectiveness and allow for adjustments based on actual production data and constraints.

In conclusion, the NEH-BA-ABC approach has shown considerable potential in enhancing makespan solutions for PFSP, presenting a promising direction for future research and industrial applications.

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MODIFIED BITUMEN BY USING SPENT BLEACHING CLAY (SBC) AND SLUDGE (REFINED BLEACH DEODORISED OIL) ON THE ASPHALT MIXTURE

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Abstract

Modified bitumen are made from the palm oil mill waste is one of the ways to connect the environment with construction field where we used the Spent Bleaching Clay (SBC) and Refined Bleach Deodorised (RBDO) oil. In our project, we used different ratios of Spent Bleached Clay (SBC), Refined Bleach Deodorised (RBDO) oil and pure bitumen that present in the asphalt mixture. The modified bitumen has pass and fail result based on the percentage of SBC and Sludge (RBDO) in bitumen on pavement. Therefore, the analysis shows the best result on the percentage of SBC was 0.3% and the percentage of Sludge (RBDO) was 0.2% that based on JKR Standard Specification 1988 part wearing course for Road Works. The application of modified bitumen on road pavement is very useful for construction especially for road maintenance.

1.0 INTRODUCTION

The damage path beginning at the surface layers of the failure receives the load of the traffic and a change in temperature. Damage to highways mostly occurs in the top layer, in the binder and erosion layers, rather than the foundation and lower layers. The binder and erosion layers generally include surface cracks, deformations, wheel ruts and potholes. Structural changes in the bitumen mixture cause an increase in the temperature of the surface of the road, approaching the softening point of bitumen.

Wearing course is the top layer of the road pavement. It is in direct contact with traffic and consequently, it must resist abrasion and prevent skidding. Wearing course is typically placed on the base course, which is normally placed on the sub-base, which rests on the subgrade. The mix designation for wearing course is followed ACW 20 refer to JKR Standard Specification for Road Works. In the design, 60% of aggregate used is quarry sand and 40% of aggregate used is 20mm of Granite stone and bitumen is 5%. The aggregate and pure bitumen prepared by CMS Premix Kuching Sdn Bhd.

Spent Bleach Clay (SBC) are waste from palm oil processing. Sludge is the Refine Bleached Deodorised (RBD) oil from the overspill of final product from a refinery. Spent Bleach Clay (SBC) and Refine Bleached Deodorised (RBD) oil is a waste material from manufacturing process of palm oil that produced by Assar Refinery Sdn. Bhd.

Spent Bleach Clay (SBC) is an industrial waste, mainly generated from the edible oil processing has been thermally regenerated under normal atmosphere by various temperature calcinations (200,400,600 and 800°c) for overnight. SBC is importance process to improve the colour of crude palm oil before being further processed.

Refine Bleached Deodorised Oil (RBDO) is obtained from fractionating refine palm oil to separate liquid parts (olein) from solid parts (stearin). It is a clear yellow liquid after filter with 10mm diameter of sieve at high temperature of 120 ℃ and then will be a solid form at room temperature.

To produce refined oil, crude palm oil and crude palm kernel oil are processed through three refining stages, namely degumming, bleaching and deodorising. In degumming, the gum and fatty acid in crude palm oil and crude palm kernel oil are separated together with other impurities such as trace minerals, copper and iron by the application of phosphoric acid. In bleaching, the oil is mixed with bleaching earth (bentonite calcium) in a vacuum room to remove impurities and pigments in the palm oil. In deodorising, the odour and taste of the oil are removed when oil is steamed at high temperatures of between 240 ℃ to 260 ℃ and then cooled to room temperature.

Bitumen is a black to dark brown sticky material, composed principally of high molecular-weight hydrocarbons. In some countries, it can be found as a component of natural rock asphalt, but most bitumen is derived from the distillation of crude oil. Not all crude oils are sufficiently rich in heavy components to yield bitumen economically.

2.0   PROBLEM STATEMENT

In general, some asphalt mixes for road pavement flow in response to the load due to their plastic deformation at high temperatures. Such deformation properties accumulate due to repetitive loads. Changes in the surface layers are cause early damage to the road pavement structure.

Damage to highways mostly occurs in the top layer, in the binder and erosion layers, rather than the foundation and lower layers. Damage to the binder and erosion layers generally includes surface cracks, deformations, wheel ruts, and potholes. To address this problem, research has been conducted to improve the performance of bitumen as the road surface layer.

3.0   OBJECTIVE

1. To develop model of asphalt bitumen with Spent Bleaching Clay (SBC) and Refined Bleach Deodorised Oil (RBDO) additive.
2. To evaluate the laboratory performance of different ratios of Spent Bleaching Clay (SBC), Refined Bleached Deodorised (RBD) oil and bitumen that present in virgin asphalt in different percentage.
3. To get a result for stability, flow, stiffness, air void in aggregate filled with bitumen and air void in mix design by JKR Standard Specification 1988 part wearing course.

4.0   SCOPE

This study focused on modified bitumen by using Spent Bleaching Clay (SBC) and Sludge (Refined Bleach Deodorised Oil) on the asphalt mixture. In this project, we used 60% aggregate of quarry sand and 40% of 20mm aggregate of Granite stone and bitumen is 5% based on JKR Standard Specification 1988 part wearing course. For the percentage of SBC and Sludge (RBDO) is from 0% to 0.5%. There are 2 tests that have been carried out on the samples of specimen; Marshall Test and Bulk Density Test. The result that we got from the tests is to measure the stability, flow, stiffness, air void in aggregate filled with bitumen and air void in mix design.

5.0 LITERATURE REVIEW

5.1 INTRODUCTION

Roads are of vital importance in order to make a nation grow and develop. Especially in the third world, good maintained roads also will enhance poverty reduction by improving access between regional and rural communities and, ultimately, enhancing socio-economic growth and development. Road networks form vital links between production centres and markets. In addition, its multiple function of providing access to employment, social, health and education services makes road network crucial in fighting against poverty by opening up more areas and stimulating economic and social development. There is a problem, however, which is common throughout the world, the neglect of maintaining our roads. Building new roads cost money, but without maintaining the roads properly, they deteriorate very quickly. If nothing is done, roads with a design life of decades can need replacing or major repair work after just a few years.

Many studies have confirmed the fact that a lot of waste material can make some good improved materials for pavement construction. The expensive disposal of waste material can well be mitigated by way of having it added to the asphalt mixture or road pavement. Add some additive in asphalt mixture will reduce the cost of road maintenance. The additive will be use in asphalt mixture for wearing course.

5.2 WEARING COURSE AND ITS COMPOSITION

Wearing course is a upper layer in roadway, airfield, and dockyard construction. It designed to be impervious to the ingress of water, running surface, be durable, and have a high resistance to skidding, and be chosen so as not to deform under the weight of traffic appropriate to the road. The material for wearing course consists of a high sand content along with a specific amount of stone held together with enough bitumen to give a well bound mix. Asphalt is a very strong material and is also extremely durable. It is used mainly on very high traffic areas where the addition of chippings can be used to give good skid resistance. For example: Shopping centre, car parks where there is a lot of twisting and turning and heavy load delivery vehicles, main motorways, airport runways.

5.3 THE ADDITIVE IN BITUMEN FOR WEARING COURSE

Sludge and SBC is added in mixture of bitumen as additive to decrease the usage of bitumen. Sludge and SBC is a waste from palm oil that have to filter before put it into the mixture. The characteristics of sludge is oily and sticky when in a room temperature, while SBC is like an ash and easy to dissolved in water. Based on our research, we find a journal that using additive in their mixture for road construction. To evaluate the laboratory performance of different sizes of coconut fibres present in virgin asphalt in different percentages. This goal was achieved by evaluating various engineering properties. The behaviour of coconut fibres asphalt (CFA) modified mixture was compared to that of conventional asphalt mixtures. (Sigit Pranowo Hadiwardoyo, 2003)

The investigated the reuse of discarded deactivated bleaching earths in the bleaching of oils. Discarded bleaching earth was used after its reactivation for the bleaching of sunflower, soybean and corn oils. The efficiency of reactivated bleaching earth was compared to the efficiency of virgin activated bleaching earth. Acid reactivated earth (pH 2.5-3) had a slightly higher content in silicone than virgin activated or neutralized reactivated earths. The best results in the color of

sunflower and corn oils were obtained when neutralized earth (pH 6-7) was used at 1 and 2% levels. Acid reactivated earth used at 2% achieved a higher reduction in soybean oil color than virgin earth (pH 3) at the same dosage. Both reactivated earths reduced peroxide value, iron, conjugated dienes and soap, while they increased acidity and conjugated trienes. Furthermore, these reactivated earths determined higher decrements in the oil induction period than virgin earth. Reactivated earth could be used for 5 cycles for the bleaching of soybean or corn oils and for more than 6 cycles for sunflower oil. (Adel Y. Girgis, 2005)

Mixtures of Asphalt with Palm Oil Shells and Coconut Shells as additives. This study was aimed to look into the effect of adding Palm Oil Shells (POS) and Coconut Shells (CS) on the characteristics of hot mix asphalt where its volumetric properties are concerned, and then ascertain the optimum bitumen content that contributes the most to the improvement of the modified hot mix asphalt mixes; assess the mixes by running a test for the resilient modulus and creeps; and comparing all results between the POS, CS and control mixes. Hence, there is an urgency to embark on a detailed study on Malaysian hot mix asphalt (HMA) performance using the modifying agents of POS and CS. (Ramze A. Al-Mansob. Amiruddin Ismail, Mohammed A. Algorafi, Mohammad Hesam Hafezi & Mojtaba Shojaei Baghini, 2013)

5.4   MATERIAL IN ASPHALT MIXTURE

5.4.1 Bitumen

Bitumen is an oil-based substance. It is a semi-solid hydrocarbon product produced by removing the lighter fractions (such as liquid petroleum gas, petrol and diesel) from heavy crude oil during the refining process. As such, it is correctly known as refined bitumen.

5.4.1.1 Characteristics of bitumen

i.   Adhesion: Bitumen has the ability to adhere to a solid surface in a fluid state depending on the nature of the surface. The presence of water on the surface will prevent adhesion.

ii.   Resistance to Water Bitumen is water resistance. Under some conditions water may be absorbed by minute quantities of inorganic salts in the bitumen of filler in it.

iii.   Hardness: To measure the hardness of bitumen, the penetration test is conducted, which measures the depth of penetration in tenths of mm. of a weighted needle in bitumen after a given time, at a known temperature. Commonly a weight of 100 gm is applied for 5 sec at a temperature of 77 °F. The penetration is a measure of hardness. Typical results are 10 for hard coating asphalt, 15 to 40 for roofing asphalt and up to 100 or more for water proofing bitumen.

iv.   Viscosity and Flow: The viscous or flow properties of bitumen are of importance both at high temperature during processing and application and at low temperature to which bitumen is subjected during service. The flow properties of bitumen vary considerably with temperature and stress conditions. Deterioration, or loss of the desirable properties of bitumen, takes the form of hardening. Resultantly, decrease in adhesive and flow properties and an increase in the softening point temperature and coefficient of thermal expansion.

v. Softening point: Softening point is the temperature at which a steel ball falls a known distance through the bitumen when the test assembly is heated at a known rate. Usually the test consist of a (3/8)in dia steel ball, weight 3.5 gm, which is allowed to sink through a (5/8) in dia, (1/4) in thick disk of bitumen in a brass ring. The whole assembly is heated at a rate of 9 °F per min. Typical values would be 240 °F for coating grade asphalts, 140 °F to 220 °F for roofing asphalt and down to 115 °F for bituminous water proofing material.

vi. Ductility: Ductility test is conducted to determine the amount bitumen will stretch at temperature below its softening point.

A briquette having a cross sectional area of 1 in^2 is placed in a tester at 77 °F. Ductility values ranges from 0 to over 150 depending on the type of bitumen.

5.4.2   Course Aggregate

The ability of an aggregate to resist the polishing action of traffic has long been recognized as a highly important requirement for its use in pavement construction. Coarse aggregate characteristics (e.g., angularity and resistance to wear) are believed to have a significant role in providing sufficient skid resistance in pavements. The desired texture is attained and retained by use of hard, irregularly shaped coarse aggregate. Hard, polish-resistant coarse aggregate is essential to avoid reducing skid resistance of asphalt surface.

5.4.3   Quarry sand

Quarry sand is crushed granite typically screened to about 5mm and less in size. This product provides most of the dust portion of the mix design and also the majority of the fine aggregates, i.e. less than 2.36mm in size. The quantity of dust in the 7mm to 14mm aggregates is negligible so it is important that the amount of dust going into a mix is controlled. This is achieved by using washed quarry sand which has less dust (removed by washing in the quarry) and allows the asphalt supplier to maintain control of the amount of dust in the mix.

5.4.4   Spent Bleaching Clay (SBC)

SBC sample were obtained from Assar Senari Refinery Sdn. Bhd. SBC is disposal, extraction with organic solvents is a well-known method contaminated SBC (Nur Sulihatimasyila ABD Wafti, Deoiling Efficiency for Oil Extraction from Spent Bleaching Clay and the quality of recovered oil, The Journal of Oil Palm Reseacrh Vol. 23 April 2011).

5.4.5   Sludge (RBDO)

Sludge also were obtained from Assar Senari Refinery Sdn. Bhd. Sludge (RBDO) is a form like a 'span cake' and yellowish colour.
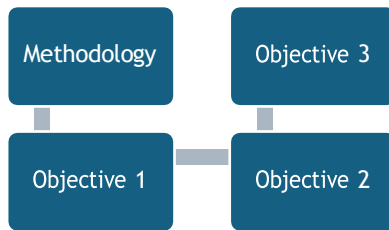
5.0 METHODOLOGY

Chart 3.1 Methodology Chart

Refer on our Chart 3.1 , our methodology is based on our objective. Table 3.1 Percentage Mixture Bitumen with SBC and sludge.

Test and analysis parameters for wearing course are Stability, Flow F, Stiffness , Air Voids in Mix, Voids in aggregate filled with bitumen

Laboratory Testing

Based on objective 1, we must prepare the test specimens. For our modified bitumen we have prepare percentage of mixture bitumen with SBC and sludge. We are using Bitumen Content 5% , Weight of bitumen 60g. The coarse aggregate, fine aggregate, and the filler material should be proportioned so as to full fill the requirements of the relevant standards. The required quantity of the mix is taken so as to produce compacted bituminous mix specimens of thickness 63.5 mm approximately. 1200gm of aggregates and filler are required to produce the desired thickness. The aggregates are heated to a temperature of 175° to 190°C the compaction mould assembly and rammer are cleaned and kept pre-heated to a temperature of 100°C to 145°C. The bitumen is heated to a temperature of 121°C to 138°C and the required amount of first trial of bitumen and spent bleaching clay and sludge (using percentage provided) is added to the heated aggregate and thoroughly mixed. The mix is placed in a mould and compacted with number of blows specified. The sample is taken out of the mould after few minutes using sample extractor (Figure 3.2).

Figure 3.2 : Marshall specimen Extractor

Figure 3.4 : Marshall Stability and Flow Setup
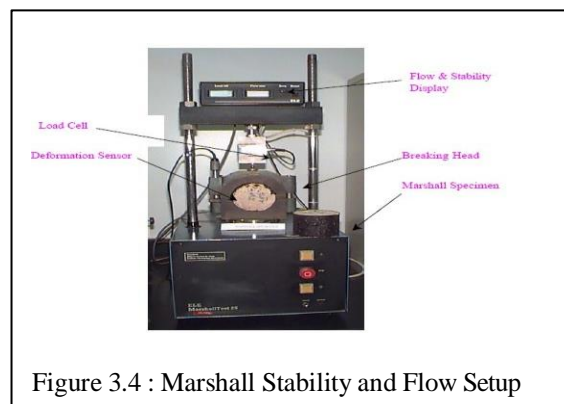
After done the mould modified bitumen , based on our 2nd and 3rd objective the laboratory suitable testing are Marshall Method of Mix Design. The complete test are includes stability, flow, density, void in Total Mix (VTM), Void in the Mineral

Aggregate(VMA), Voids Filled with Binder (VFB), Resilient Modulus (M_R). Objective this is to prepare standard specimens of asphaltic concrete for the determination of stability and flow in the Marshall apparatus and to determine density, percentage air voids and percent of aggregate voids filled with binder.

Bulk density is simply determined by weighing in air and water. Steps for do the bulk density and void in Total Mix are the specimen carefully removed from the mould. transferred to a smooth flat surface and allowed to cool to room temperature.

Figure   3.3
Specimen   weight
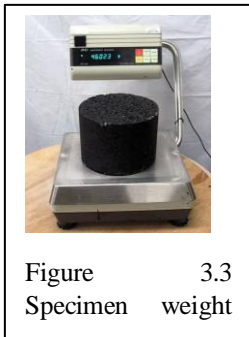
Then, specimen is measured and weighed in air and water (for determination). If the bitumen mix has an open(porous) texture the weighing in water will lead to error in the volume and so the specimen must be coated with measured mass of paraffin wax. The specimen is then marked and stored for stability and flow measurement. Next, the percentage of air voids in the mix is determined by firstly calculating the maximum theoretical density TMD(zero voids) and then expressing the difference between it and the actual bulk density as a percentage of total volume. Besides, the volume of void in mineral aggregate(VMA) is an important factor for the asphalt mixture design. Futhermore, voids filled with asphalt also important because this calculation involve the manipulation of small difference, so great precision is needed for accurate results

Items	Calculations	Desriptions
Bulk Density	$d = G_{mb} \times \rho_w$ $G_{mb} = [W_D/(W_{SSD}-W_{SUB})]$	d= bulk density (g/cm^3) ρ_w = density of water (1g/mm^3)
Void in Total Mix (VTM)	$VTM = [1-(d/TMD)] \times 100$ $TMD = G_{mm} \times \rho_w$ $G_{mm} = (1/(1-P_b)/G_{se}+P_b/G_b))$	W_D = mass of specimen in air(g) W_{SUB} = mass of specimen in water (g) W_{SSD} = sutured surface dry mass (g) G_{mm} = maximum theoretical specific gravity of the mix TMD = Maximum theoretical specific energy of the mix P_b = asphalt content, percent by weight of the mix G_{se} = effective specific gravity of the mix G_b = specific gravity of asphalt cement
Voids in Mineral Aggregate (VMA)	$VMA = 100 \times (1-(G_{mb}(1-P_b)/G_{sb}))$	G_{mb} = bulk specific gravity of the mix G_{sb} = bulk specific gravity of the aggregate
Voids Filled with asphalt (VFA)	$((VMA-VTM)/VMA) \times 100$	

Table 3.3 Theoretical Maximum Density

Next, is Marshall stability and flow test. This test is to measure resistance to plastic flow of cylindrical specimens of an asphaltic paving mixture loaded on the lateral surface by means of the Marshall Apparatus. The method is suitable for mixes containing aggregates up to 25mm maximum size. Then step is transfer the mixed material to the compaction mould arranged on the compaction pedestal. The specimen compacted is in 135°C-145°C. Give 75 blows on the top side of the specimen mix with a standard hammer (45cm, 4.86kg). Reverse the specimen and give 75 blows again. Take the mould with the specimen and cool it for a few minutes. Then Remove the specimen from the mould by gentle pushing. Mark the specimen and cure it at room temperature, overnight. A series of specimens are prepared by a similar method with varying quantities of bitumen content, with an increment of 0.5% (3 specimens) or 1 bitumen content. Before testing of the mould, keep the mould in the water bath having a temperature of 60°C for half an hour. Check the stability of the mould on the Marshall stability apparatus. Each Specimen stability is adjusted if its thickness is not exactly 63.5mm and the averaged and the result recorded to the nearest whole unit.

6.0 Data Analysis and Result

Specimen No.		P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13	P 14	P 15
% Bit by T. Wt.		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Specimen Ht.	(mm)	61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	63.5	63.5	63.5	61.9	61.9	61.9
Weight in air	(gm)	1189.1	1183.1	1193.3	1171.1	1191.6	1192.2	1200	1200	1200.9	1186.6	1195.6	1196.2	1196.5	1187.8	1190.2
Weight in water	(gm)	688.4	685.8	691.4	676.1	689.7	686.1	690.9	694.4	693.8	681.3	680.5	689.9	691.6	686	679.1
Bulk Vol.	(cc)	500.7	497.3	501.9	495	501.9	506.1	509.1	505.6	507.1	505.3	515.1	506.3	504.9	501.8	511.1
S. G. Bulk		2.37	2.38	2.38	2.37	2.37	2.36	2.26	2.36	2.37	2.35	2.32	2.36	2.34	2.37	2.37
Average		2.38			2.37			2.37			2.34			2.36		
S. G. Max. Theory		2.4421														
Volume	Bit	11.7822			11.7833			11.7327			11.5842			11.6832		
%	Agg.	85.6732			85.3132			85.3132			84.5932			84.9532		
Total	Voids	2.5446			2.9035			2.9541			3.8226			3.3636		
Voids	Agg.	14.3268			14.6868			14.6868			15.4068			15.0468		

%	Filled (Bit)	99.1776	■	■	99.1977	■	■	79.886	■	■	99.2481	■	■	77.65	■	■
	Total Mix	2.54289	■	■	2.9524	■	■	2.9524	■	■	4.1808	■	■	3.36	■	■
STABILITY KG/KN	CORR. FACTOR	1.04			1.04			1.04			1	1	1	1.04	1.04	
	MEASURED	1107	925	1177	821	762	796	778	965	1028	903	952	976	998	988	1017
	CORRECTED	1151.28	962	1229.08	853.84	792.48	827.84	809.12	1003.6	1069.12	903	952	976	1037.92	1027.52	1057.68
average		1112.45			824.72			960.62			943.67			1041.04		
FLOW	(mm)	5.44	3.36	5.66	4.4	6.12	5.96	4.25	3.84	5.15	3.56	3.76	4.47	4.1	4.05	3.99
Average		4.82			5.49			4.41			3.93			4.05		
Brg Capacity	■	230.8			150.22			217.83			240.12			257.05		

Analysis Data
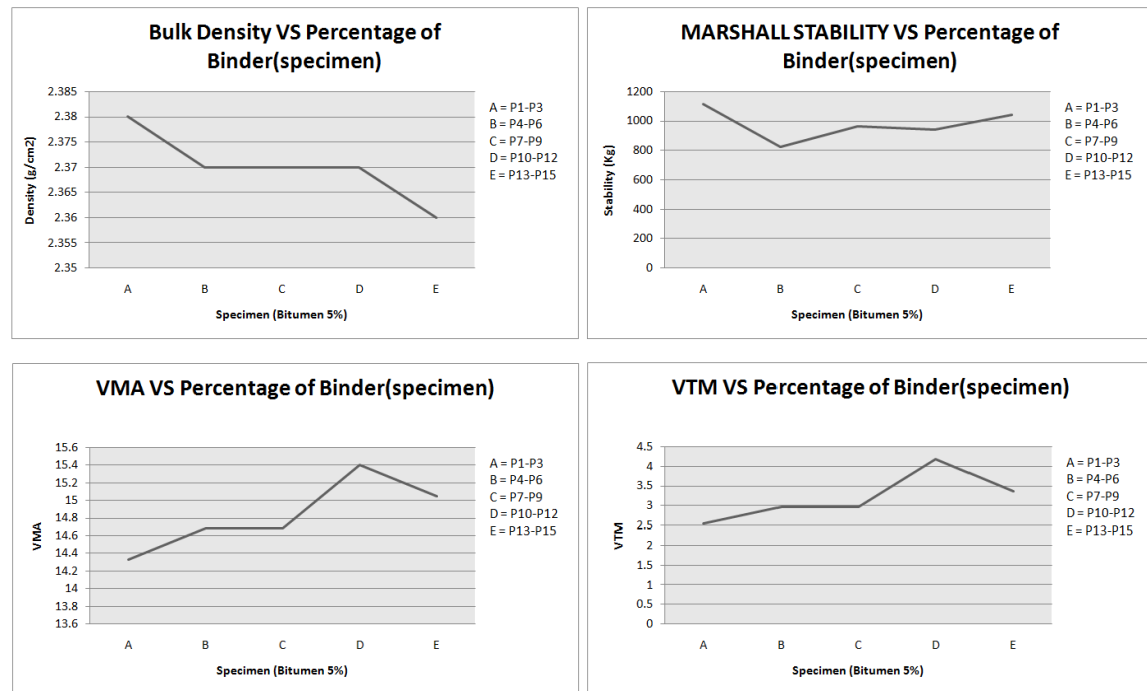
Result Based on JKR Specification 1988 (wearing course) for specimen P13-P15

JKR Spec 1988	Specification	Result	Remark
>500kg	Stability	1041.4	Pass!
>2.0 mm	Flow	4.05	Pass!
>250kg/mm	Stiffness	257.05	Pass!
75 – 85%	Void in aggregate fill with bitumen	77.65	Pass!
3.0 – 5.0%	Air void in mix	3.36	Pass!

8.0   DISSCUSIONS

The laboratory work being carried out at CMS Premix laboratory, by using the compositions of pure Bitumen, quarry sand, 20mm Aggregates. A complete test being carried out which includes the test on Stability, Flow, Density, void in Total Mix (VTM), void in the mineral aggregate (VMA), void filled with binder (VFB). Different ratio between Sludge and SBC will be mixed with 5% of Bitumen. The ratio for P1 to P3 comprised of Sludge 0.25% and SBC 0.25%, P4 to P6 Sludge 0.5% and SBC 0%, P7 to P9 Sludge 0% and SBC 0.5%, P10 to P12 Sludge 0.3% and SBC 0.2%, P13 to P15 Sludge 0.2% and SBC 0.3%.

The experimental ratios of Sludge and SBC, thus gives the result which comply with JKR's Specification 1988 of wearing course. Test result for the specimens P1 to P3 obtained the Stability of 1112.45 kg, Flow is 4.82mm, Stiffness is 150.22 kg/mm, VFA is 99% and VTM is 2.543%. Whereas the specimens P4 to P6 gives the Stability of 824.72 kg, the Flow is 5.49mm, Stiffness is 150.22 kg/mm, VFA is 99% and VTM 2.95%. Furthermore, the specimens P7 to P9 the results obtained for the Stability is 960.62 kg, Flow 4.41mm, Stiffness 217.83 kg/mm, VFA 79.89% and VTM 2.95%. P10 to P12 the Stability 943.67 kg, Flow 3.93mm, Stiffness 240.12 kg/mm, VFA

99.25% and VTM 4.18%. Lastly, the specimens P13 to P15 indicates the Stability of 1041.04 kg, Flow 4.05mm, Stiffness 257 kg/mm, VFA 77.65% and VTM 3.36%.

Conclusively, 15 specimens being tested and the best ratio mix with Bitumen between Sludge and SBC shows that the specimen P7 – P9 are more stable in terms of the Flow, VFA and VTM had passed the JKR Specification 1988, however it is not stable on the Stiffness which is less than 250 kg/mm. These results show that the SBC are good mixture combination with Bitumen. Due to the slack in mixture bonding, specimen P13 – P15 give good results to all JKR specification 1988 compliance. The ratio for the specimen P13 – P15 is Sludge 0.2% and SBC 0.3%.

From the results, indicates that the Sludge is not suitable to be mixed with Bitumen compared the mixtures of Bitumen and SBC. The experiments results show that the specimen P4 – P6 with a composition mixture of Sludge 0.5% and SBC 0% and specimens P10 – P12 composition mixture of Sludge 0.3% and SBC 0.2%, does not complied with the JKR specification 1988.

Last but not the least, the laboratory performance for P13 – P15 specimen should be proceed to a site investigation to know how this modified bitumen react with weather and dynamic loads condition in real road surface traffic usage.

9.0 CONCLUSION AND RECOMENDATION

For the overall results, the most suitable and optimum binder content for bitumen is 5% which have good mixture with SBC 0.3% and Sludge 0.2%. The experiments of 15 specimens being carried out, only 3 of the tests comply the JKR Specifications 1988 standard.

The results show that the mixture of SBC and Sludge have similarity characteristic with the bitumen that generates 1041.04kg loads stability. As a result, this modifies bitumen are recommended for low loads usage such as creational track, jogging and running tracks, and; bicycle and motorcycles tracks. For future development of this modified bitumen, more waste byproducts from the industries might help to reduce the costly 100% bitumen usage. Sample preparations are considered important in this experiment, suitable sieving aggregate is 20mm is recommended. The correct mixture of 5% of bitumen, 0.2% of SBC and 0.3% of Sludge gives good results, by increased the amount of sludge might decrease the amount of bitumen usage.

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Kənan Novruzov[3],

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TEZ

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Yeni media və kommunikasiya nəzəriyyəsi kafedrasının müdiri

Media məhsulu (reklam, xəbərlər, filmlər və s.) hədəf kütlənin gerçəkliyə münasibətimizi formalaşdırır, müəyyənləşdirir, hətta davranışlarını dəyişdirir. Media savadlılığı hə gün qəbul etdiyimiz yenilikləri təhlil etməyə, təqdim edilən faktları araşdırıb dəqiq nəticəyə gəlməyə və nəhayət istifadəçinin də yeni media kontenti yaratmasına yardım edir. İctimaiyyət arası kəsilmədən yeni informasiyanın qəbulunda, emalında və ötürülməsində maraqlıdır. Texnoloji inkişaf və medianın çatımlılğı nəticəsində cəmiyyətin əsas kəsimi olan yeniyetmələr və gənclər də medianın istehsal etdiyi məlumatların hədəfi olur.

Media təhsili olmayan təcrübəsiz istifadəçi üzərinə yağan aramsız informasiya selində özünə lazım olan məlumatı tapmaqda çətinlik çəkir, aldanır, bəzən də şəxsi məlumatlarını təhlükə qarşısında qoyur. Bir çox hallarda məlumatın doğruluğu yoxlanmadan, qaynağın güvənli olub-olmadığı araşdırılmadan xəbər tirajlanır və ya yoxlanılmamış fakta dayanan müxtəlif kontentlər yayımlanır. Bu səbəbdən yeniyetmə və gənclərin mediadan düzgün istifadəsini təmin etmək önəmlidir, yəni onların mediadan faydalanarkən doğru resursu, dəqiq məlumatı seçmək vərdişlərinin formalaşması üçün media savadlılığına böyük ehtiyac var.

Media savadlılığının tədrisinin əhəmiyyətini zəruri edən amilləri nəzərdən keçirək. Medianın cəmiyyətə təsir gücünün artması faktdır. Bu təsir gücünün artması təhsil prosesində də media vasitələrinin imkanlarından faydalanma hallarını artırır. Şəxsin fərdi inkişafında da medianın rolu böyükdür – müxtəlif seminarlar, onlayn təlimlər, əlverişli öyrədici vasitələr, açıq ensiklopediyalar bunlara misal ola bilər. Sadalanan üstünlüklərlə yanaşı, təbii ki, media məkanı ilk baxışdan cəlbedici görünə bilər. Amma unutmamalıyıq ki, bu məkan gəncləri radikalizmə, faşizmə, şiddətə, nifrətə yönəldən mətnlərlə durmadan "çirkləndirilir". İstifadəçilər bəzən sosial şəbəkələrdə heç bir fakta əsaslanmayan uydurma məlumatlar yayırlar. Texnoloji inkişaf özü ilə bir çox problemlər də gətirməkdədər. Süni intellektin inkişafı bəzən saxta xəbərlərin yayılmasına da rəvac verir.

Media təhsili görmüş media savadlı fərd aşağıdakı bacarıqlara sahib olur:

1. Saysız-hesabsız qaynaqların olduğu media məkanında doğru istiqamət seçə bilir;
2. Trollinq, monipulyasiya və feyk xəbərlərlə uğurla mübarizə aparmaq qabiliyyəti qazanır;
3. Axtarış saytlarında sorğuları düzgün yönləndirib informasiyanı filtrdən keçirməyi bacarır;
4. Nəhayət, özü də yeni media kontekstini yaradıb yayımlaya bilir.

Bu baxımdan belə nəticəyə gəlmək olar ki, yeniyetmə və gənclərin media savadlı yetişdirilməsi üçün məktəblərdə və ixtisasından asılı olmayaraq ali təhsil ocaqlarında media təhsilinin tədris proqramına salınması vacibdir.

Açar sözlər: media təhili, media savadlılığı, informasiya savadlılığı, feyk xəbər, manipulyasiya

Televiziya və informasiya diplomatiyası: müasir dövrdə beynəlxalq media siyasəti

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Qlobal dünyada media texnologiyalarının sürətli inkişafı televiziyanı beynəlxalq informasiya siyasətinin bir hissəsinə çevirib. Televiziya yalnız əyləncə və məlumatlandırma vasitəsi olmaqla kifayətlənmir, eyni zamanda ölkələrin daxili və xarici siyasətlərində strateji alət kimi çıxış edir, milli mədəniyyətin, siyasi ideyaların və beynəlxalq imicin formalaşdırılmasında mühüm rol oynayır. Bundan əlavə, rəqəmsal media platformaları ilə sintezi televiziyanın əhatə dairəsini də genişləndirib. Rəqəmsal texnologiyaların inteqrasiyası, informasiya siyasətində televiziya kanallarının strategiyaları, televiziyanın ictimai rəyin formalaşdırılması və beynəlxalq təsir aləti kimi istifadəsi, informasiya müharibəsində rolu da xüsusi vurğulanmalıdır. Bu vasitələrlə qlobal informasiya siyasətinin mühüm elementlərindən biri olan televiziya kanalları dünya ictimaiyyətinin diqqətini mühüm məsələlərə yönəldir və siyasi gündəmi formalaşdırır. Canlı yayımlar, sosial şəbəkələrdə paylaşılan video kontentlər və interaktiv formatlar isə televiziyanın təsir dairəsini daha da genişləndirir.

Dövlətlər televiziya kanallarından siyasi mesajları yaymaq, rəqib ölkələrə qarşı informasiya hücumları həyata keçirmək, beynəlxalq arenada mövqelərini gücləndirmək üçün istifadə edir. Televiziyanın bu sahədəki rolu həm müsbət, həm də mənfi reaksiya yarada bilər, belə ki, yayılan məlumatlar tez bir zamanda qlobal ictimaiyyətə çatır və ictimai rəyin formalaşmasına təsir göstərir. Məsələn, Qarabağ münaqişəsi dövründə beynəlxalq kanallarda, xüsusən Türkiyə televiziyalarında yayımlanan materialların Azərbaycanın mövqeyinin beynəlxalq aləmdə tanınmasında önəmi danılmazdır.

Beynəlxalq televiziya kanalları dünya ictimaiyyətinin diqqətini mühüm məsələlərə yönəltmək və siyasi gündəmi formalaşdırmaqda böyük təsirə malikdir. Bu kanalların yayımladığı informasiyalar beynəlxalq səviyyədə geniş auditoriyaya çatır. BBC, CNN, Al Jazeera, France 24, Rusya Today (RT) və s. kimi kanallar yalnız əyləncə və xəbər təqdim etməklə kifayətlənmir, həm də siyasi, sosial və iqtisadi məsələlərə dair geniş analitik proqramlarla dünya ictimaiyyətinin maraq dairəsindəki məsələlərə təsir edir.

Beynəlxalq televiziya kanallarının müstəqil və qərəzsiz olması onların izləyicilərə doğru və dolğun informasiya təqdim etməsinə şərait yaradır. Yayımlarında müxtəlif mövzulara dair xəbərləri təhlil edərkən bir çox ölkə və mədəniyyətin nəzər nöqtələrinin əksi onların qlobal təsirini artırır. Beynəlxalq televiziya kanalları ölkələr arasındakı diplomatik münasibətlərin inkişafında və ya pozulmasında da əhəmiyyətli rol oynaya bilər. Beynəlxalq televiziya kanallarının gündəmə gətirdiyi mövzular, yalnız həmin kanalın deyil, həm də onun yayımlandığı ölkələrin siyasi maraqlarını əks etdirir.

Televiziyanın təqdim etdiyi mövzuların seçimi çox vaxt qlobal siyasi gündəmin bir hissəsi olur və müxtəlif ölkələrdə bu mövzulara dair müzakirələr yaradır. Məsələn, təbii fəlakətlər, müharibələr, iqtisadi böhranlar, insan

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haqları pozuntuları və s. kimi məsələlər beynəlxalq televiziya kanallarında geniş şəkildə işıqlandırılır. Siyasi krizlər və müharibələr barədə yayımlanan xəbərlər ətrafında müzakirələrin açılması ölkələrin və beynəlxalq təşkilatların qərarlarına təsir edir. Bu mövzuların təhlili və təqdimatı təkcə xəbərlərdən ibarət olmur, həm də ictimai rəyin formalaşdırılmasında, siyasətçilərin və dövlət başçılarının fəaliyyətinə təzyiq göstərilməsində mühüm vasitəyə çevrilir. Televiziya kanallarının yayımladığı mövzular, müəyyən bir dövlətin və ya beynəlxalq təşkilatın mövqeyini formalaşdıraraq, dünya ictimaiyyətinin o məsələyə yanaşmasını müəyyən edir. Yaxın Şərq, Rusiya-Ukrayna münaqişələri barədə yayımlanan xəbərlər, həmin bölgədəki dövlətlərin, beynəlxalq təşkilatların və dünya ictimaiyyətinin məsələyə olan münasibətini müəyyənləşdirir. eynəlxalq televiziya kanalları, bu cür məsələlərin işıqlandırılmasında əsas rol oynayır və qlobal ictimaiyyətin həmin mövzuya diqqətini yönəldir.

Televiziya kanallarının qarşısında duran əsas çağırışlar informasiya manipulyasiyası və yanlış məlumatların yayılmasıdır. Müxtəlif mədəniyyətlər və cəmiyyətlər arasında məlumat axınını təmin edən televiziya müasir informasiya diplomatiyasının əsası olan dövlətlər və beynəlxalq aktorlar arasında qarşılıqlı anlaşma və dialoq üçün mühit yaradır. Beynəlxalq media siyasətindəki dinamikaları formalaşdıraraq, qlobal ictimaiyyətin məlumatlandırılmasında, siyasi münasibətlərin gücləndirilməsində və qarşılıqlı anlaşmanın təmin edilməsində böyük rol oynayır.

Anahtar kelimeler: televiziya, beynəlxalq media, informasiya siyasəti, ictimai rəy, informasiya müharibəsi.

Yapay Zeka ve Klinik Karar Destek Sistemleri: Etik ve Yasal Sorunlar --------- **Hande Haykır, Zafer Yıldız**

Yapay Zeka ve Klinik Karar Destek Sistemleri: Etik ve Yasal Sorunlar

Hande Haykır*, Dr. Öğr. Üyesi Zafer Yıldız**

Özet:

Bu çalışmanın amacı, yapay zekâ (YZ) destekli klinik karar destek sistemlerinin (CDSS) sağlık hizmetlerinde kullanılmasına ilişkin etik ve hukuki sorunları ele almaktır. Sağlık alanında yapay zekânın artan kullanımı, klinik karar verme süreçlerini dönüştürmekte, ancak aynı zamanda önemli etik ve hukuki sorular ortaya çıkarmaktadır. Yapay zekâ tabanlı CDSS'lerin hasta verilerini işlemesi, veri gizliliği ve güvenliği konusunda ciddi endişeler yaratmaktadır. Ayrıca, yapay zekâ tabanlı CDSS'lerin hatalı kararlar vermesi durumunda sorumluluğun kime ait olduğu belirsizdir. Yapay zekâ algoritmalarının ve veri setlerinin sahipliği ve kullanım hakları konusunda yasal düzenlemelerin yetersiz olduğu görülmektedir. Yapay zekâ destekli CDSS'ler, sağlık hizmetlerinin kalitesini artırma potansiyeline sahip olsalar da, etik ve hukuki sorunlar bu teknolojilerin güvenli ve adil bir şekilde uygulanmasını engelleyebilir. Bu nedenle, yapay zekânın sağlık hizmetlerine özellikle etik bir şekilde entegre edilmesi için kapsamlı düzenleyici çerçeveler ve kılavuzlar oluşturulmalıdır. Ayrıca, sağlık profesyonelleri ve yapay zekâ geliştiricileri arasında sürekli işbirliği ve iletişim sağlanmalıdır.

Anahtar kelimeler:

Yapay Zeka, Klinik Karar Destek Sistemleri, Etik Sorunlar

Biyolojik Veri Tabanları Oluşturulması Ve Yönetilmesi İçin Yapay Zekâ Tabanlı Yöntemler -------**Mehmet Hakan Güzel**

Biyolojik Veri Tabanları Oluşturulması Ve Yönetilmesi İçin Yapay Zekâ Tabanlı Yöntemler

Mehmet Hakan Güzel*

Özet:

Biyoloji alanındaki hızlı veri üretimi, geleneksel veri tabanı yönetim sistemlerinin sınırlarını zorlamaktadır. Bu zorluklarla başa çıkabilmek için yapay zekâ (YZ) tabanlı yöntemlerin biyolojik veri tabanları oluşturulması ve yönetilmesinde kullanımı giderek artmaktadır. Yapay zekâ teknikleri, büyük miktarda ve karmaşık biyolojik veriyi işleyebilme, analiz edebilme ve bu verilerden anlamlı bilgiler çıkarabilme yeteneği ile öne çıkmaktadır. Araştırmalar yapay zekâ algoritmalarının, genomik, transkriptomik, proteomik ve metabolomik veriler gibi çeşitli biyolojik veri türlerini etkili bir şekilde analiz edebilme yeteneğine sahip olduğunu göstermektedir. Yapay zekâ, veri entegrasyonu, veri temizleme, veri normalizasyonu ve veri tabanı tasarımı gibi aşamalarda önemli katkılar sağlayabilir. Otomatik veri etiketleme ve sınıflandırma sistemleri, veri tabanlarında tutarlılık ve doğruluk sağlama konusunda ise önemli rol oynayabilir. Yapay zekâ, sürekli olarak artan veri hacimleri ve karmaşıklığıyla başa çıkabilme yeteneği ile biyoloji alanındaki araştırmacılara önemli katkı sağlayabilir. Yapay zekâ tabanlı yöntemlerin biyolojik veri tabanları oluşturulması ve yönetilmesindeki rolü, biyomedikal araştırmalarda ve tıbbi uygulamalarda önemli yenilikçi adımlar sağlamaktadır. Bu yöntemler, veri yoğun alanlarda bilgi keşfi ve anlamlandırma kapasitesini artırarak biyolojik bilimlerde ileri düzeyde araştırmalar yapılmasına olanak tanıyabilir.

Anahtar Kelimeler: Yapay Zeka, Biyoloji, Veri Tabanı

Yapay Zekanın Madde Bağımlılığı ile Mücadelede Kullanılabilirliği Üzerine Bir Araştırma---------Ömer Faruk Çetinkaya, Zafer Yıldız

Yapay Zekanın Madde Bağımlılığı ile Mücadelede Kullanılabilirliği Üzerine Bir Araştırma

Ömer Faruk Çetinkaya*, Dr. Öğr. Üyesi Zafer Yıldız**

Özet:

Bu çalışmanın amacı, madde bağımlılığı ile mücadelede yapay zekâ (YZ) teknolojilerinin nasıl kullanılabileceğini araştırmak ve bu teknolojilerin potansiyel faydalarını, zorluklarını ve sınırlamalarını incelemektir. Yapay zekânın bağımlılık tedavisi, önleme ve rehabilite etme süreçlerinde sağladığı katkılar yadsınamaz öneme sahiptir. Literatür taraması ve vaka analizleri ile yapay zekânın bağımlılık alanındaki mevcut uygulamaları ve kullanım alanları incelenmiştir. Bu araştırma doğrultusunda yapay zekânın, büyük veri kümelerini analiz ederek madde bağımlılığı riskini tahmin edebileceği ve bu sayede, erken teşhis ve müdahale imkânlarını artırabildiği görülmüştür. Yapay zekâ destekli mobil uygulamalar ve giyilebilir cihazlar ile fizyolojik ve davranışsal veriler toplanarak bağımlılık belirtileri izlenebilir ve erken teşhis imkânı sağlanabilir. Yapay zekâ, madde bağımlılığı ile mücadelede önemli bir potansiyele sahiptir. Erken teşhis, kişiselleştirilmiş tedavi planları ve sürekli destek sistemleri sağlayarak bağımlılık tedavisinin etkinliğini artırabilir. Ancak, yapay zekânın bu alanda etkin bir şekilde kullanılması için veri gizliliği, etik sorunlar ve algoritma önyargısı gibi zorlukların aşılması gerekmektedir. Yapay zekânın bağımlılıkla mücadelede etkin bir şekilde kullanılabilmesi için kapsamlı araştırmalar ve düzenlemeler gereklidir.

Anahtar Kelimeler: Yapay Zeka, Madde Bağımlılığı, Bağımlılıkla Mücadele

Yapay Zekâ Kullanımının Sağlık Çalışanlarının İş Yükü Ve Performansları Üzerine Etkisi --------Emre Kemal ardan

Yapay Zekâ Kullanımının Sağlık Çalışanlarının İş Yükü Ve Performansları Üzerine Etkisi

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Özet

Günümüz gelişen teknolojileri içerisinde uygulanan yapay zekâ, sağlık hizmetleri dâhil pek çok alanda kullanılmaktadır. Yapay zekâ; makinelere akıl yürütme yeteneği kazandıran ve bunun yanı sıra makinelerin problem çözme, kelime ve nesneleri ayırt edebilme ve kendi kendine karar üretebilme gibi kognitif fonksiyonları yani kavramaya ilişkin bilişsel fonksiyonları yerine getirmek adına programlanmış makinelerde insan zekâsının bir simülasyonu olarak ifade edilebilir. Makinenin öğrenmesi, doğal dil işleme, yapay sinir ağları, bilgisayarla görü yapay zekanın odaklandığı disiplinler arasındadır.(Hashimoto 2018: 70-76). Yapay zekânın ana avantajları iş yükünü azaltması, süreçleri hızlandırması ve zaman ekonomisi sağlamasıdır.(Güzel vd, 2022:509). Özellikle tıbbi görüntüleme, genetik araştırmalarda, operasyonel süreçler ve hasta verilerinin analizinde yapay zekâ kullanımı, daha hızlı ve doğru sonuçlar elde etmeyi sağlamaktadır. Yapılan çalışmalarda yapay zekânın sağlık çalışanlarının verimini ve iş doyumunu artırdığı gözlemlenmiştir. (Shinners vd, 2020:1230). Sağlık uygulamalarında Türkiye'de yapay zekâ kullanıma örnekler; Aile Hekimliği Bilgi Sistemi (AHBS), Merkezi Hekim Randevu Sistemi (MHRS), MEDULA Sistemi, 17 Kasım 2019 yılında ortaya çıkan Covid Pandemisiyle birlikte, Tele Tıp uygulamaları, yapay zekâ destekli uzaktan uygulamalar, sağlık çözümlerinin cazip hale gelmesine, Türkiye de artan nüfusa bağlı olarak sağlık çalışanlarının iş yüklerinin azaltılması ve performans düzeylerinin yükseltilmesinde son yıllarda çok büyük katkılar sağlamaktadır. Türkiye'de Sağlık hizmetleri uygulamalarında, Yapay zekâ teknolojisinin sağlık çalışanlarının iş yükü ve performanslarına etkisi üzerine Literatür de araştırma ve istatistik boyutunda çok fazla çalışma yapılmadığı gözlemlenmiştir. Bu bağlamda sunulan bildiri ile yapay zekâ kullanımının, sağlık çalışanlarının iş yükü ve performansları üzerine ne derece de etki ettiği ve yapılacak olan çalışma ile literatüre katkı sunabileceği düşünülmektedir.

Anahtar Kelimeler: Yapay Zeka, Sağlık, Sağlıkta Yapay Zeka

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THE EFFECT OF ARTIFICIAL INTELLIGENCE USE ON THE WORKLOAD   AND PERFORMANCE OF HEALTH CARE WORKERS

Abstract

Artificial intelligence embedded in today's hardware technologies is used in many areas, including healthcare. Artificial intelligence; Machines have been given the ability to reason, as well as cognitive functions such as problem solving, distinguishing words and signs, and making decisions on their own. Technically, it can

be expressed as a simulation of human intelligence in programmed machines to determine the location of nutrition. Machine learning, natural language processing, artificial neural networks, computer vision are among the disciplines on which artificial intelligence focuses. (Hashimoto 2018: 70-76). The main competence of artificial intelligence is to reduce the share of work, speed it up and provide time economy. (Güzel et al, 2022:509). The use of artificial intelligence, especially in medical imaging, genetic research, operational systems and analysis of patient data, enables faster and more accurate results. It has been observed that artificial intelligence increases the income and job satisfaction of healthcare workers. (Shinners et al, 2020:1230). Artificial intelligence options in Turkey in healthcare applications; Family Medicine Information System (AHBS), Central Physician Appointment System (MHRS), MEDULA System, along with the Covid Pandemic that emerged on November 17, 2019, Tele Medicine programs, artificial intelligence supported remote applications, health solutions have come to Turkey, albeit to a small extent. In recent years, it has made great contributions to reducing the workload of healthcare professionals and increasing the level of performance due to the increasing population. Literature research and statistical results have observed that not many studies have been conducted on healthcare practices in Turkey and the impact of artificial intelligence technology on the workload and performance of healthcare professionals. The integration of artificial intelligence with this flexible presentation, the extent to which it affects the workload and performance of healthcare workers, and the contributions that the literature can provide with the study to be done.

Keywords: Artificial Intelligence, Health, Artificial Intelligence in Health

Innovative Solutions And Emerging Technologies For Sustainable Tourism Industry ------------- **Gayathri Puwanendram And Dr. Sidar Atalay Şimşek**

Innovative Solutions and Emerging Technologies for Sustainable Tourism Industry

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Abstract. The study of Innovative Solutions and Emerging Technologies for the Sustainable Tourism Industry examines innovative solutions and emerging technologies that enhance sustainability in the tourism industry. This conceptual study employs a qualitative approach, the research analyses the effectiveness of digital platforms, AI-driven resource management, and eco-friendly innovations in promoting sustainable tourism practices. The qualitative data refers based on secondary sources such as research papers, journal articles, websites etc. The critical literature-based study leads to and indicates that these technologies improve visitor experiences, support environmental conservation, and generate economic benefits, demonstrating the potential of technology to address sustainability challenges according to SDGs. The study offers a framework for integrating these tools to aid policymakers, industry stakeholders, and academics in fostering responsible tourism growth.

Keywords: Sustainable Tourism, Emerging Technologies, AI, Eco-Friendly Innovations, Resource Management, Tourism Development

Beynəlxalq Media Orqanlarının Strukturu Və Xüsusiyyətləri -------------- **Könül Niftəliyeva**

Beynəlxalq Media Orqanlarının Strukturu Və Xüsusiyyətləri

Dosent Könül Niftəliyeva[5]

filologiya üzrə fəlsəfə doktoru

Bakı Dövlət Universiteti, Jurnalistika fakültəsi, Yeni media və kommunikasiya kafedrası

20-ci əsrin əvvəllərindən etibarən mühüm kommunikasiya vasitələrindən birinə çevrilən media öncə yalnız

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fəaliyyət göstərdiyi bölgədəki hadisələri diqqət mərkəzinə alırdısa, qloballaşma ilə birlikdə insanların dünyadaki hadisələrdən xəbərdar olma ehtiyacı medianın sərhədləri aşaraq beynəlmiləşməsinə səbəb olmuşdur. Bunun nəticəsində də informasiyanın əldə edilməsi və istehsalı mərhələsi də zamanla bu istiqamətdə inkişaf etmişdir.

Beynəlxalq medianın ilk nümunələri xəbər agentlikləri olmuşdur. İkinci Dünya müharibəsindən sonra ABŞ-ın bir çox sahədə olduğu kimi, kommunikasiya sahəsində də üstünlüyü ələ keçirməsi bu zamana qədər hakim mövqedə olan Reuters və France Press (AFP) kimi agentliklərinin nisbətən geri planda qalmasına gətirib çıxarmışdır. Belə ki, beynəlxalq arenada sərbəst informasiya axınını müdafiə edən ABŞ əsasını qoyduğu Associated Press (AP) agentliyi ilə digərləri ilə rəqabətdə üstünlüyü əldə etmişdir. Əsas funksiyası xəbər və ya xəbər üçün lazımi matreallarını toplamaq, onları müxtəlif formatlarda istehsal etmək və hədəf auditoriyaya, maraqlı tərəflərə, abunəçilərə yaymaq və müştərilərə satmaq olan xəbər agentlikləri inkişaf edən hər bir yeni texnologiya ilə ayaqlaşmağı bacarmışdır (Şahin, 2013, s. 197).

Kommunikasiya texnologiyasının inkişafı, siyasi blokların dağılması və investisiya dövriyyəsinin asanlaşması beynəlxalq media orqanlarının başqa ölkələrdə nümayəndəliklər açaraq, məzmun istehsalı prosesi ilə məşğul olmasına və dünyanın müxtəlif ölkələrində yaşayan milyonlarca insana çatmasına şərait yaratmışdır (Artun, 2016, s. 12). Beynəlxalq media orqanları, həmçinin həyata keçirdikləri satınalmalar və birləşmələr vasitəsi ilə istehsal resusları ilə paylaşım kanalları arasında əlaqə yaradaraq daha tez və az xərclə daha geniş auditoriyaya xitab edə bilmişdir (Kadıoğlu, 2014, s. 25).

Beynəlxalq media orqanlarının həyata keçirdikləri satınalmaları vəya birləşmələrin səbəblərini aşağıdaki şəkildə sıralamaq mümkündür:

1. Potensial riskləri bölüşmək;
2. Sinerji effekti yaratmaq;
3. Vergi üstünlüklərindən yararlanmaq;
4. Xərcləri azaltmaq;
5. Rəqabət qabiliyyətini artırmaq;
6. Maliyyə yeniliklərindən faydalanmaq;
7. Texniki məlumat axınını sürətləndirmək;
8. Kapitalı gücləndirərək daha güclü olmaq (Aytekin, 2016, s. 426-427).

Bütün bunlar beynəlxalq media qurumlarının daha da güclənməsinə və təsir dairəsini genişləndirməsinə şərait yaratmışdır.

Beynəlxalq media qurumlarının daxili strukturuna və iş üslubuna nəzər salındığında bir-birləri ilə əlaqəli bir neçə tendensiyanın olduğunu görmək mümkündür. Belə ki, mülkiyyətlərini gücləndirməyə çalışan beynəlxalq media qurumları artıq bir platformada çox sayıda müxtəlif formatlı məzmunlarla yanaşı, eyni zamanda bir neçə platformada tək məzmunu da təqdim edə bilirlər. Platformalar arasında kommunikasiya məhsullarının bu axıcı hərəkəti reklam gəlirlərini artırmaq üçün auditoriyaların fərdiləşdirilməsini və seqmentləşdirilməsini təşviq etmişdir (Leandros, 2011).

Açar sözlər: media, kommunikasiya, auditoriya, xəbər agentlikləri, platforma, rəqabət

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Sağlik Kuruluşlarinda Yapay Zeka Uygulama Alanlarinin İncelenmesi…..Mehmet Oğuz PERÇİN

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Her ne kadar Yapay zeka günümüzün konusu olsa da ,konunun özü 90'lı yıllara dayanır. İnsanoğlu, günlük hayattaki işlerini hafifletmek ve zaman tasarrufu adına hep bir arayış içinde olmuştur. Zaman içinde yapılan tüm buluşlar ve üretilen her türlü araç gereç bunun sonucudur. Günümüz şartlarında ise Yapay zekanın en insancıl kullanım alanı sağlık kuruluşlarıdır. Yapay zeka destekli Radyolojik görüntüleme sistemlerindeki başarı oranı her geçen gün artmaktadır. Çalıştığım hastanedeki yapay zeka destekli tomografi raporlarının , fiziksel olarak görüntüleri izleyen doktorların çıkarmış olduğu sonuçlarla yüksek oranda eşdeğerlik göstermesi güvenilirliğini artırmaktadır. Nükleer Tıp alanında PAT\BT görüntüleme sistemlerinde hastanın iki görüntüsü arasında karşılaştırma yapan yapay zeka uygulamaları hastanın olası nüks ve yayılım süreçlerinin takibi açısından önem arz etmektedir. Son yıllarda sağlık kuruluşlarında kullanıma sunulan tıbbi cihazlar ve teknik donanımlar bir bilgisayar yazılımı tarafından yönetilen yapay zeka destekli hale gelmişlerdir. Üroloji bölümünde kullanılan taş kırma cihazlarında kullanılan yapay zeka desteği böbreklerde bulunan taşın, işlemlerden sonra ne durumda olduğu kıyasını yaparken bize etkili bilgiler vermektedir. Bu alanda en güzel örneklerden biride kişiye ait röntgen filmlerinin arasındaki farkı hesaplayarak hastanın tedavi süreci ile ilgili gözlemde bulunabilmektedir.

Gerek günümüzde üniversitelerimizde açılan Yapay zeka geliştirme ile ilgili bölümler, gerekse özel sektörün bu konuda yapmakta oldukları geliştirme çalışmaları yakın gelecekte Yapay zekanın hayatımızda daha yoğun bir şekilde hayatımıza dahil olacağını göstermektedir.

Sonuç olarak; Yapay Zeka uygulamalarının insanlığın geleceğine sirayet edeceği çok açıktır. Ancak insanların mı yapay zekayı kontrol edeceği, yapay zekanın mı insanları kontrol edeceği konusu sınırları çok iyi belirlenmelidir.

December 22, 2024 Author Information Participating In The Symposium

1st Session: Doç. Dr. Mustafa ERSOY		
Subject	**Name - Surname**	**Country**
Yapay zekânın madde bağımlılığı ile mücadelede kullanılabilirliği üzerine bir araştırma	Ömer Faruk ÇETİNKAYA	TURKEY
Biyolojik veri tabanları oluşturulması ve yönetilmesi için yapay zekâ tabanlı yöntemler	Mehmet Hakan GÜZEL	TURKEY
Yapay zekâ kullanımının sağlık çalışanlarının iş yükü ve performansları üzerine etkisi	Emre Kemal KARDAN	TURKEY
Sağlık yönetiminde yapay zekânın kullanım alanları ve önemi	Mustafa Burak KARAGÖZ	TURKEY

Prof. Dr. Hidayet TAKCI (Invited Speaker) 2st Session: Doç. Dr. Mustafa ERSOY		
Subject	**Name - Surname**	**Country**
Yapay zeka ve klinik karar destek sistemleri: etik ve yasal sorunlar	Hande HAYKIR	TURKEY
The effect of using artifical intellegence in education on student success	Şeymanur TUNAHAN	TURKEY
Hemşirelikte yönetim açısından yapay zekâ ve kullanımı	Nuriye SARIAKÇALI	TURKEY
Öğretmen adaylarında yapay zekâ bağımlılığının yordayıcısı olarak bilişsel esneklik ve duygu düzenleme becerileri	Mehmet Enes SAĞAR	TURKEY
Üstün zekâlı öğrencilerin eğitiminde güncel teknolojilerin kullanılma amaçlarının incelenmesi	Hasibe KUZU	TURKEY

3st Session: Dr. Öğr. Üyesi Kürşad ÖZKAYNAR		
Subject	**Name - Surname**	**Country**
Televiziya və informasiya diplomatiyası: müasir dövrdə beynəlxalq media siyasəti	Aynur NESIROVA	AZERBAIJAN
Azərbaycanın qarabağdakı uğurlarının beynəlxalq mətbuatda işıqlandırılması	Aytekin ZEYNALOVA	AZERBAIJAN

Media təhsili media savadliliğini artiran zəruri amil kimi	Hatire HÜSEYNOVA	AZERBAIJAN
Beynəlxalq media orqanlarının strukturu və xüsusiyyətləri	Konul NİFTALİYEVA	AZERBAIJAN

4st Session: Öğr. Gör. Rıza ÖZUTKU		
Subject	**Name - Surname**	**Country**
Hybrid neh-bat algorithm-artificial bee colony algorithm for permutation flowshop scheduling problem	Yoong Chow HO	MALAYSIA
Case study data generator for djf51082: a teaching innovation for quality control education	Yoong Chow HO	MALAYSIA
Modified bitumen by using spent bleaching clay (sbc) and sludge (refined bleach deodorised oil) on the asphalt mixture	Zainal Abiddin BIN AHMAD	MALAYSIA
Perceptions of student and lecturer in jke at pks on the use of "Kalkulator pnm" application	Hyril Farithz BIN AHMAD	MALAYSIA
Exploring technology acceptance of generative ai in higher education: insights from malaysian polytechnics	Faizan Maisarah ABU BAKAR	MALAYSIA

5st Session: Öğr. Gör. Rıza ÖZUTKU 01.30 – 02.00 pm		
Subject	**Name - Surname**	**Country**
Publisistikanin cəmiyyət həyatinda oynadiği rol	Kenan NOVRUZOV	AZERBAIJAN
Innovative solutions and emerging technologies for sustainable tourism industry	Gayathri PUWANENDRAM	SRI LANKA
Merkeziyetsiz otonom organizasyonlar: örgüt yapıları ve yapay zekâ kapsamında bir değerlendirme	Vahid SINAP	TURKEY
Smart Classrooms And Artificial Intelligence In The Context Of Educational	Nalan KAZAZ	KOSOVA