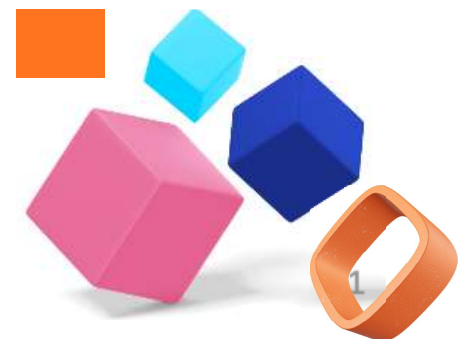




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Basri Badyalina
Nur Azlina Mat Noor
Muhammad Zulqarnain Hakim Abd. Jalal
Faten Elina Kamaruddin
Nurul Huda Md Yatim



FAKULTI SAINS KOMPUTER DAN MATEMATIK
UNIVERSITI TEKNOLOGI MARA
CAWANGAN JOHOR



Terbitan Edisi 2025

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Tiada mana-mana bahagian dari risalah ini yang boleh diubah, disalin, diedar , dihantar semula, disiarkan, dipamerkan, diterbitkan, dilesenkan, dipindah, dijual dalam bentuk apa sekalipun tanpa mendapat kebenaran secara bertulis yang jelas kepada Fakulti Sains Komputer dan Matematik, Universiti Teknologi MARA Cawangan Johor.

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Diterbitkan oleh:
Universiti Teknologi MARA Cawangan Johor
Jalan Universiti Off KM 12 Jalan Muar ,

85000 Segamat, Johor .
Tel: 07-9352000
Fax: 07-9352716
<https://johor.uitm.edu.my>





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PREFACE

Praise be to Allah SWT, with His will, this eBook, ICT Trends that Matter, has been successfully compiled to capture some of the most relevant and transformative discussions in the world of Information and Communication Technology (ICT).

The work is a compilation of various views of the different practitioners, scholars, and professionals who have contributed their ideas and thoughts regarding the emerging technologies and their influence. The chapters provide just a few examples of how cybersecurity, big data harmonisation, artificial intelligence, novel learning tools, and social media analytics demonstrate the extent to which ICT has permeated our everyday worlds, our classrooms, workplaces, and communities.

ICT Trends that Matter offers readers a comprehensive exploration of 14 contemporary ICT themes that are shaping education, industry, and society. The eBook covers a wide spectrum of topics such as Big Data & AI, Digital Learning & Tools, Practical ICT Applications, Social Media & Communication and Smart Campus Initiatives highlighting UiTM Johor's experience in developing a data-driven digital ecosystem.

This eBook is informative and inspirational, with contributions that combine theory, research, and practical work. It makes the readers consider the existing ICT issues and opportunities and provides practical knowledge on personal, educational, and professional development. I would like to say that I am very grateful as the chief editor to all the contributors whose commitment, professionalism, and innovativeness have added value to the contents of this eBook. I believe ICT Trends that Matter will be useful to academicians and students, as well as any industry professional, policymaker and those who are keen to learn more about the dynamic ICT environment.

Whether you are an academic, student, or industry professional, ICT Trends that Matter provides valuable insights into the technologies that are redefining our world today. May this work inspire further dialogue, innovation, and collaboration toward building a smarter and more sustainable digital future.

Dr. Shamsatun Nahar Ahmad
Chief Editor
Brain Hub: ICT Trends that Matter

SYNOPSIS

ICT Trends that Matter is a compilation of 14 thought-provoking chapters, which discuss the most significant trends in Information and Communication Technology (ICT) and their implications on education, industry, and society.

The elements cut across essential areas of the digital world. Discussions about the harmonisation of big data and artificial intelligence to fight cybersecurity and comparative studies concerning popular AI tools will be available to the readers. The eBook also highlights innovative approaches to teaching and learning, such as Easymath2U and V-CCMPedia, to improve conceptual learning in calculus, and AI-assisted tools to improve student engagement.

The useful experience is presented with the help of the following topics: computer tips and tricks, free e-learning applications used by children, and the successful utilisation of social media analytics tools. The role of contemporary communication mediums such as Telegram and the global presence of TikTok are also discussed in the chapters, as well as reflections on institutional work towards data-driven digital ecosystems, such as the UiTM Johor RSP16 experience.

This eBook contains the work of numerous scholars and researchers and offers both theoretical insights and practical solutions, which is why it can be of interest to academics, students, practitioners in the industry, or policymakers. ICT Trends that Matter is not merely an anthology of articles but rather is a convenient way to learn about the latest trends in ICT and predict what to expect and what to take advantage of in the digital age.

ACKNOWLEDGEMENT

The Editorial Board of ICT Trends that Matter would like to thank everyone whose assistance and commitment enabled us to make this publication possible.

We would like to thank the Department of Linkage Industry and Alumni, UiTM Johor, Segamat Campus, for enabling the acquisition of eISBN and subsequent guidance throughout the publication process.

A special mention of gratitude belongs to all contributors, whose skills, knowledge and dedication have been instrumental in the content of this eBook. Every chapter is an embodiment of how well, creatively, and committed our writers were to delivering substantial discussions on the current issues in ICT.

We also recognise the unwearying efforts on the part of the Editorial Board, which have been tireless from the very beginning of the conception to the final production of this eBook, which makes it and guarantees its success.

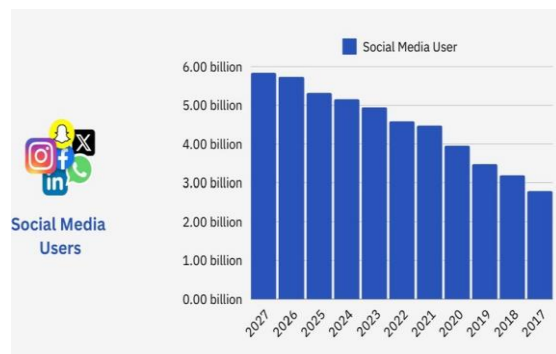
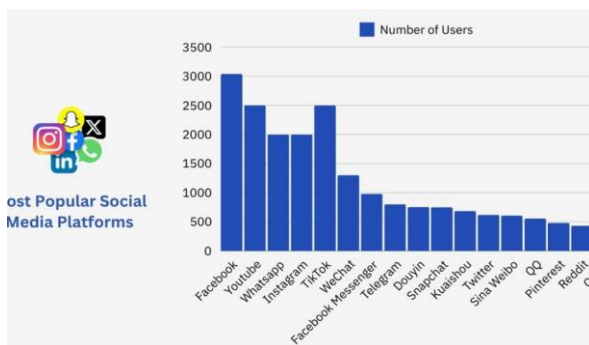
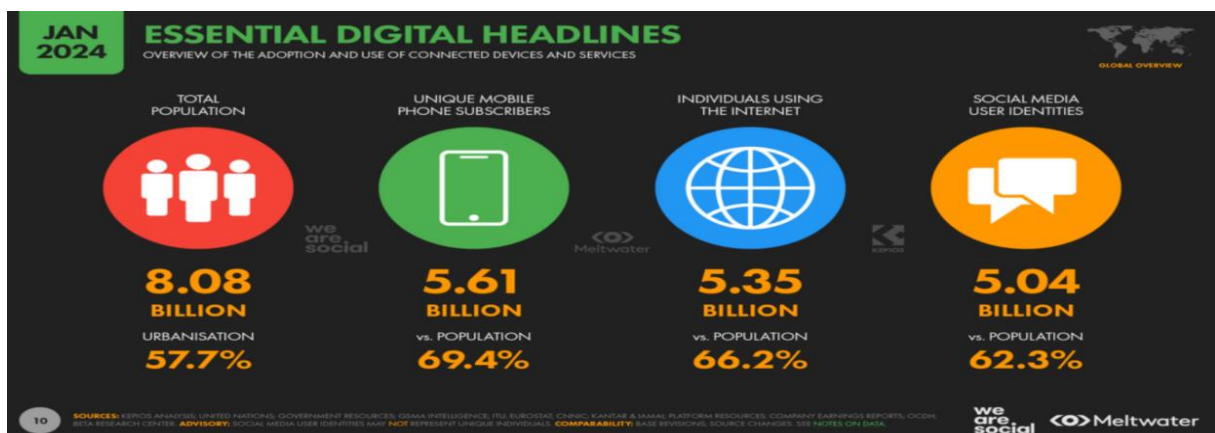
We are most thankful to all who have assisted this undertaking either directly or indirectly. May Allah SWT bless this endeavour and enable it to do good for the readers and the community at large.

UNDERSTANDING AND UTILISING SOCIAL MEDIA ANALYTICS TOOLS

RABIATUL ADAWIYAH KAMARULZAMAN, MOHD LEZAM LEHAT,
NURFAIZAH KAMARUDIN, SITI HAJAR BAHARIN.

Social media has become an integral part of communication, marketing, and education. With millions of users engaging daily, understand how content performs is crucial for businesses, educators, and influencers. Social media analytics tools help in measuring performance,

understanding audience behaviour, and optimizing content strategies. This essay explores the key analytics tools available for three major social media platforms: Facebook, Instagram, and TikTok, highlighting their importance in decision-making and engagement optimization.



What Are Social Media Analytics Tools?

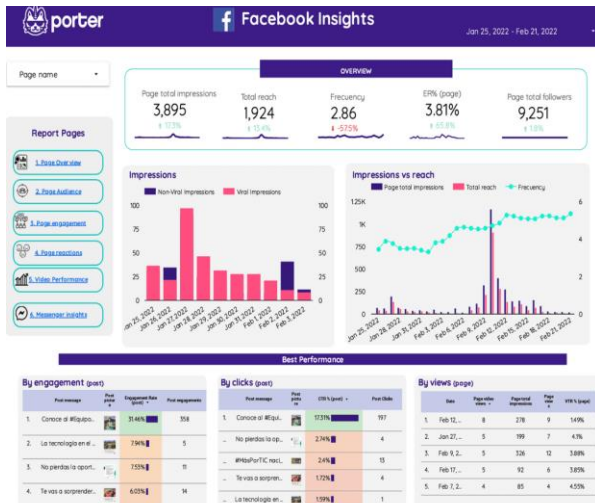
Social media analytics tools collect and analyse data from various platforms to provide insights into user engagement, content reach, and audience

demographics. These tools assist in evaluating performance, planning effective marketing strategies, and improving audience interaction. By leveraging analytics, content creators can make data-driven decisions that enhance their online presence and engagement levels.

Facebook Analytics Tools

Facebook Insights is a free tool available to page administrators that provides valuable data on audience interaction. It includes:

- Reach: The number of users who have seen a post.
- Engagement: The number of likes, comments, and shares a post receives.



- Post Performance: Insights into which posts perform best and the optimal posting time.

- Demographics: Data on the age, gender, and location of an audience.

For university educators, Facebook Insights can help determine which educational posts or announcements attract the most student engagement, allowing them to tailor their content accordingly.

Instagram Analytics Tools

Instagram Insights is a free built-in tool for business and creator accounts that provides an overview of reach, engagement, impressions, and follower growth. More advanced tools such as **Iconosquare** and **Sprout Social** offer detailed analytics but require a subscription. These tools provide:

- Audience Analysis: Information on follower activity and demographics.

- Content Performance: Data on which posts, stories, or reels generate the most interactions.
- Posting Recommendations: Suggestions on the best times to upload content.

For educators who are using Instagram, these tools can help to determine whether short educational reels or static posts generate better engagement among students, thereby optimizing content strategies.

TikTok Analytics Tools

TikTok Analytics is available for Pro account users and provides insights into follower demographics, video views, engagement rates, and trending content. Additional paid tools like **Pentos** and **Hootsuite** offer more detailed performance tracking across multiple platforms. Key insights include:

- Follower Growth: Tracking increases or decreases in followers over time.
- Video Performance: Measuring total views, likes, shares, and watch time.
- Content Trends: Identifying which videos and hashtags are performing well.

Educators can utilise TikTok Analytics to see whether the short educational videos (e.g., 15-second tips) perform better than the longer content and adjust their approach accordingly.

Making Data-Driven Decisions

Analytics tools help users refining their content strategy. For instance, data from Instagram Insights might show that posts receive higher engagement on Thursdays at 3.00 PM, allowing users to schedule posts for that time. Similarly, TikTok data may indicate that short-form videos gain more traction than longer ones, prompting content adjustments to maximise reach.

Conclusion

Social media analytics tools play a vital role in content optimization and audience engagement. Whether used for business, marketing, or education, these tools provide essential insights that allow users to refine their strategies and achieve better results. As educators, leveraging analytics can significantly enhance student engagement and content effectiveness. By understanding how to use Facebook Insights, Instagram Insights, and TikTok Analytics, users can make informed decisions that enhance their digital presence and outreach.

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TOWARDS A SMART AND DATA-DRIVEN CAMPUS: DIGITAL ECOSYSTEM DEVELOPMENT AND THE UITM JOHOR RSP16 EXPERIENCE

NOOR AZRIN ZAINUDDIN, ABD MALIK MOHD RICK

Introduction

As global institutions transition into the digital age, universities are redefining themselves to meet future challenges. A Smart Campus integrates digital tools, platforms, and data systems to provide seamless experiences for students, faculty, and administrators. UiTM Johor has embraced this transformation through RSP16—a flagship initiative aimed at modernising infrastructure, improving digital literacy, and fostering innovation. Central to this approach is the development of a Data Analytics Task Force and a Data War Room to support evidence-based governance

and campus-wide performance monitoring.

The Smart Campus Vision

Smart Campuses blend physical and digital infrastructure. Features include smart classrooms, virtual reality (VR) labs, AI-powered academic advisors, and integrated learning management systems (LMS). The goal is not only digital modernisation but also cultural transformation that encourages collaboration, sustainability, and innovation.

Digital ecosystems will enhance access, safety, and decision-making. UiTM Johor adapts these models to suit its local context and community needs.

The Digital Ecosystem Framework

A robust digital ecosystem consists of:

- Unified Digital Identity: Single sign-on access for all users.
- Integrated LMS: Centralised, mobile-responsive learning platforms.
- Open Data Platform: For secure research sharing and analytics.
- Smart Infrastructure: IoT sensors, smart devices, and campus-wide connectivity.
- Data Governance Tools: Dashboards, KPIs, and advanced analytics.

This integrated ecosystem enhances student engagement (+40%), learning outcomes (+15%), and administrative efficiency (+30%).

UiTM Johor's RSP16 Initiative

RSP16 (Rector's Special Project #16) aims to transform UiTM Johor into a smart, inclusive, and data-enabled campus. Implementation is divided into three phases:

Phase 1 (Years 1–2): Infrastructure and Capacity Building

- Upgrade Wi-Fi and install mesh networks in key areas.
- Deploy a responsive LMS and IoT-based energy monitoring.
- Launch digital signboards and laptop loan schemes for B40 students.
- Provide training to staff and students to bridge digital literacy gaps.

Phase 2 (Years 3–4): Innovation and Community Engagement

- Integrate AR/VR for simulation-based learning.
- Introduce AI academic advisors for personalised learning support.
- Launch a campus app and community portal.
- Pilot “smart parking,” digital library, and IoT-enabled vending machines.

Phase 3 (Year 5): Full Smart Campus Integration

- Implement a central Smart Campus Dashboard.
- Track attendance, energy, safety, and facility status in real-time.
- Create innovation labs and mentorship programs with industry partners.
- Position UiTM Johor as a regional hub for smart campus excellence.

Smart Data Governance: The Data War Room

Complementing RSP16, the Data War Room proposal provides a structured approach to analytics:

Phase 1: Data Structuring and Management

Form a Data Analytics Task Force with academic, technical, and administrative representatives. Use Google Sheets for central data collection and standardisation. Build an online data centre accessible to stakeholders.

Phase 2: Analytical Tools and Visualisation

Adopt Power BI or Google Looker to build interactive dashboards. Integrate data from all departments for deep performance insights, train staff in advanced analytics and visualisation techniques.



Phase 3: Physical Data Room Deployment

Establish a centralised space with smart screens and dashboards. Visualise key metrics such as academic performance, infrastructure use, and financial tracking.

Challenges and Mitigation Strategies

UiTM Johor anticipates several challenges:

- Digital Infrastructure Gaps: Mitigated by phased upgrades and public-private partnerships.

- User Adoption: Addressed through training, peer mentoring, and awareness campaigns.
- Cybersecurity Risks: Managed via access control, encryption, and data backup strategies.
- Budget Constraints: Resolved through CSR support, government grants, and innovation funds.

Monitoring Success and Impact

Key performance indicators (KPIs) include:

- +10 points increase in student satisfaction (Net Promoter Score)
- +20% improvement in faculty digital engagement
- +15% growth in research output and collaborations
- 10% cost savings in operations

Dashboards from the Data War Room will enable real-time monitoring and course correction.

Strategic Outlook and Vision

Using SWOT analysis, UiTM Johor identifies key strategic levers:

- Strengths: Strong branding, diverse student body, and committed faculty.
- Weaknesses: Ageing tech infrastructure and inconsistent digital standards.
- Opportunities: AI, IoT, national innovation funds, and industry collaboration.
- Threats: Cyberattacks, unstable policy shifts, and rising digital maintenance costs.

The Smart Campus vision includes community empowerment, green technology adoption, and student-led innovation. Students will be equipped for future industries, while staff and administrators evolve into digital leaders.

Conclusion

The UiTM Johor Smart Campus journey reflects a comprehensive transformation powered by digital tools, strategic planning, and inclusive values. By combining infrastructure upgrades, data analytics, and community involvement, the RSP16 and Data War Room initiatives offer a replicable model for other institutions in Malaysia and the region. This collective effort will not only modernise the UiTM Johor but establish it as a national leader in smart and data-driven education.

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TELEGRAM: 9 REASONS WHY WE SHOULD USE IT?

MOHD LEZAM LEHAT

With an ever-growing list of messaging platforms, choosing the right one can be a challenge. However, Telegram has managed to distinguish itself with a rich set of features that cater to both personal and professional users. Whether you're seeking enhanced privacy, versatile communication tools, or seamless file sharing, Telegram offers it all. Here are nine compelling reasons why you should consider using Telegram.

9 Reasons Why We Should Use Telegram



Cloud Storage

Access your data anytime, anywhere; no manual backup needed.



File Sharing

Send files up to 2GB (or 4GB with Premium); perfect for large projects



Group Management

Keep big groups organized with topics and threads



Channels & Supergroups

Broadcast to unlimited subscribers; great for business and education



Enhanced Privacy Options

Secret chats, message timers, hidden numbers



Username Feature

Connect via usernames, not phone numbers



Administration Tools

Role-based permissions, analytics, and engagement tracking



Multi-Device Support

Stay synced on phone, tablet, and desktop



User Interaction

Polls, quizzes, scheduled messages, and customizable bots for engagement

1. Cloud Storage

One of Telegram's standout features is its unlimited cloud storage. Unlike other messaging apps that require you to back up your media manually, Telegram stores all your messages, photos, videos, and documents in the cloud. This means you can access your files from any device without worrying about losing them. Whether you're switching phones or using multiple devices, your data is always at your fingertips, securely stored in the cloud.

2. File Sharing

When it comes to sharing files, Telegram is in a league of its own. Users can share files up to 2GB in size, and premium users can share files up to 4GB. This is a significant advantage over other messaging apps like WhatsApp, which limits file sharing to just 100MB. Whether you're sending high-resolution videos, large documents, or entire project files, Telegram handles it with ease, making it an ideal tool for both personal and professional use.

3. Group Management

Managing large groups can be challenging, but Telegram simplifies this with advanced group management features. Telegram offers topics, threads, and clusters that help organize conversations within large groups. Whether you're managing a small team or a large community, these tools ensure that discussions remain focused and organized, preventing the chaos that often arises in group chats.

4. Channels and Supergroups

Telegram is designed for large-scale communication. It offers Channels, which can have unlimited subscribers, and Supergroups that can accommodate up to 200,000 members. Even for smaller groups, Telegram allows up to 200 members. This makes Telegram an ideal platform for businesses, communities, and influencers who need to broadcast messages to large audiences or manage large groups efficiently.

5. Enhanced Privacy Options

Privacy is a significant concern in the digital age, and Telegram addresses this with a range of enhanced privacy options. Users can hide their phone numbers, engage in encrypted secret chats, and set messages to self-destruct after a certain period. These features give users control over their personal information and ensure that their conversations remain private and secure.

6. Username Feature

Telegram allows users to communicate without sharing their phone numbers by using usernames. This feature is particularly useful for public interactions or when you want to maintain a level of anonymity. Instead of exchanging phone numbers, you can simply share your username, making it easier to connect with others while keeping your personal information private.

7. Administration Tools

For those managing groups or channels, Telegram provides a suite of advanced administration tools. These include setting specific admin roles with varying levels of permissions, and accessing comprehensive analytics to track engagement and activity within the group or channel. These tools are invaluable for businesses and communities looking to manage their communications effectively.

8. Multi-Device Support

One of Telegram's most convenient features is its multi-device support. Unlike many messaging apps that limit you to one device at a time, Telegram allows you to log in from multiple devices simultaneously. Whether you're using your phone, tablet, or desktop, all your messages and media are synchronized across devices, ensuring a seamless experience no matter where you are.

9. User Interaction

Telegram excels in creating an interactive user experience. It offers features like scheduled and silent messages, which allow you to control when and how messages are delivered. Additionally, Telegram supports polls and quizzes, rich media sharing, and extensive customization options, including bots that automate tasks or provide services within the app. These features enhance user engagement and make communication more dynamic and flexible.

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TIKTOK GOES GLOBAL

NOR DIANA ABD RAHMAN

TikTok is a social media application that can be downloaded for free by users of any age. It allows its users to create content, watch, and share videos with others at no cost. TikTok was first launched in 2016 by the Chinese tech company ByteDance. Remarkably, by the end of 2017, TikTok was already being downloaded more actively than its competitors, such as Instagram (which took six years to gain popularity) and Facebook (which took four years).

Today, TikTok has offices in cities such as Beijing, Los Angeles, Moscow, India, South Korea, and Japan. Despite having faced bans in countries such as Bangladesh and United States of America, TikTok remains one of the most popular and widely used applications. The following statistics were gathered as of February 2025.

A global report in February 2025 ranked TikTok as the fourth most-used platform, after Facebook, WhatsApp, YouTube, and Instagram, with 1.59 billion users aged 18 and above. The gender distribution was nearly balanced, with 30.8% male users and 24.3% female users. Data from March 2025 indicated that TikTok had 2.28 billion visits globally per month, with 65% of access coming from mobile devices.

The five countries with the highest number of TikTok visits as of January 2025 were:

COUNTRY	MONTHLY VISITS
United States of America	409.5 million
Brazil	144.4 million
Indonesia	83.5 million
Mexico	62.6 million
German	57.3 million

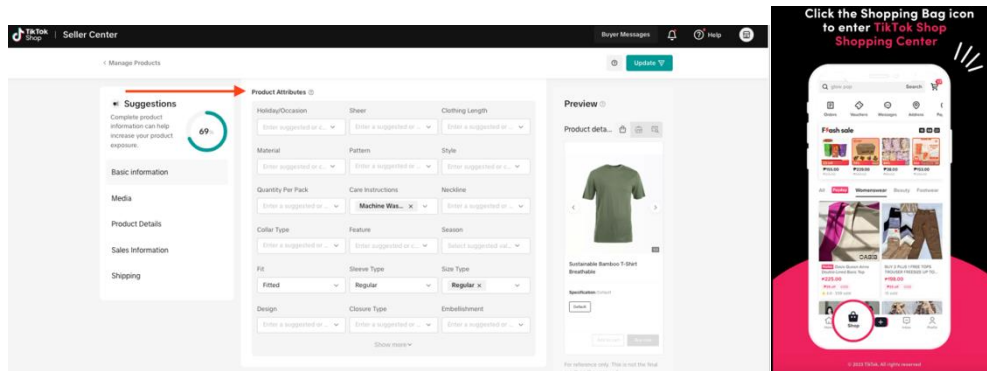
Among these, the United States of America recorded the highest usage with 409.5 million visits, followed by Brazil with 144.4 million, and Indonesia with 83.5 million visits.

The average time spent on TikTok also varies by country. Finland has the highest average usage time per user, with 54 hours and 37 minutes per month, followed by Bulgaria and Croatia. In Asia, Indonesia ranks highest with an average of 44 hours and 54 minutes monthly, followed by Malaysia at 42 hours and 42 minutes, Vietnam at 40 hours and 45 minutes, and the Philippines at 40 hours and 39 minutes. Detailed usage statistics by country are illustrated in the graph below.

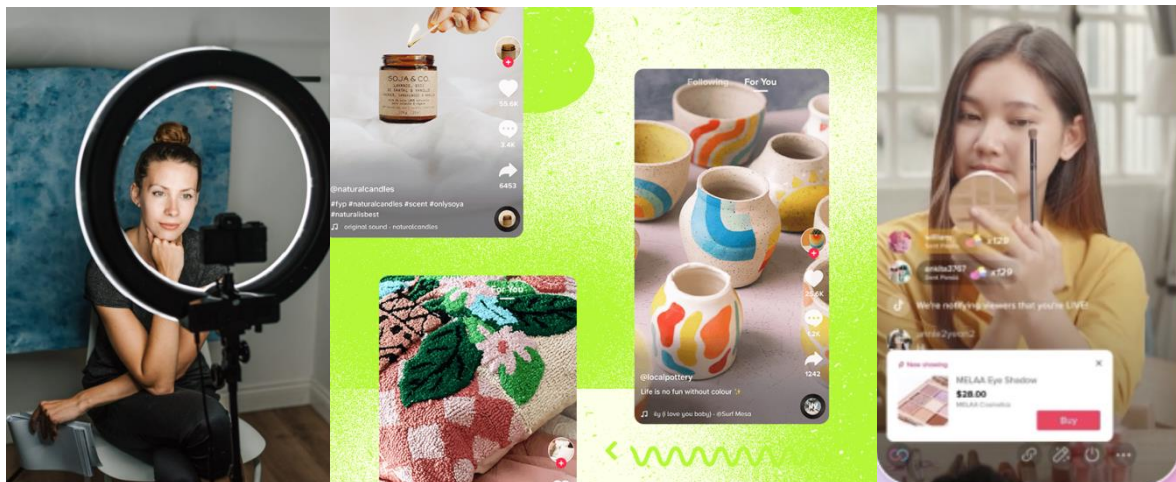
In Malaysia, TikTok's popularity continues to grow annually. Early 2025 data revealed that over 17 million Malaysians were active TikTok users. Similar to global trends, users are predominantly aged 18 and above. However, when broken down by gender, 50.7% of Malaysian users are female and 49.3% are male.

Research has identified several factors driving the increased usage of TikTok in Malaysia and globally:

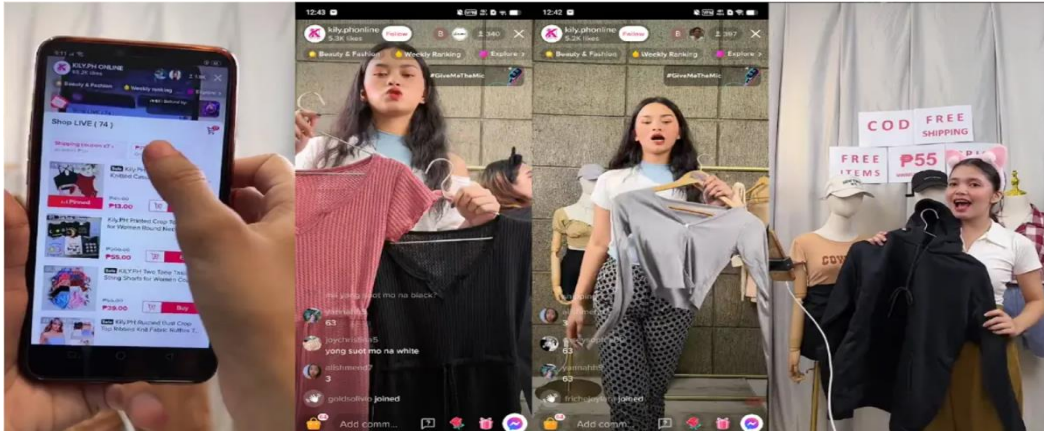
1. **In-App Shopping Features** - TikTok Shop allow users to make purchases directly within the app, improving user experience and streamlining the shopping process.



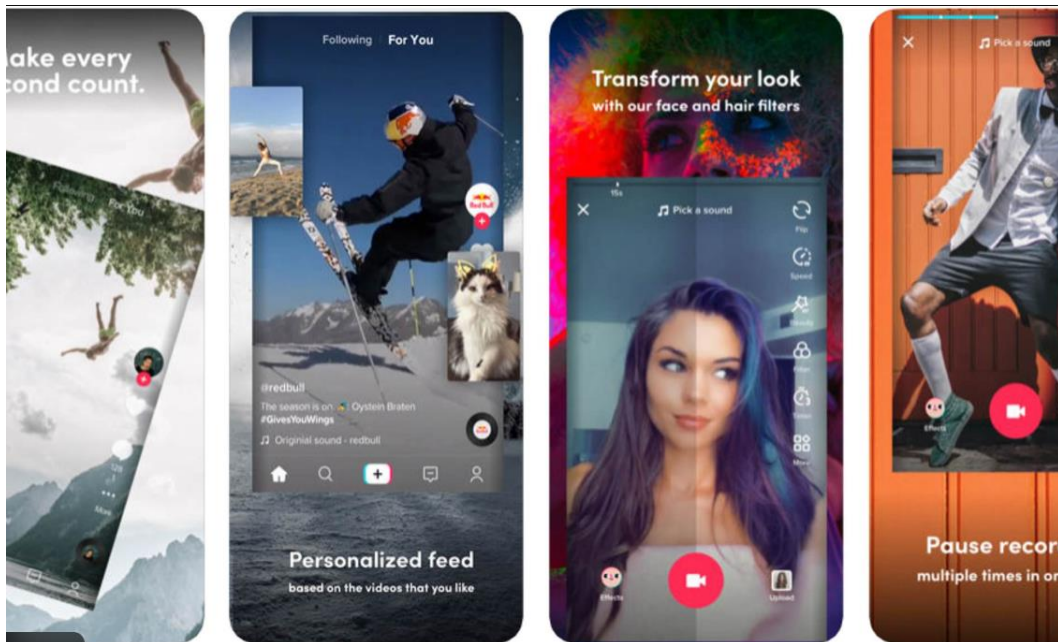
2. **Influencers and Content Creators** – Significantly influence buying behaviour through authentic reviews and product demonstrations.



3. **Live Shopping Phenomenon** - Enable real-time interaction between sellers and buyers, allowing questions to be answered and exclusive discounts to be offered.



4. **Ease of Use & Personalisation** - TikTok's algorithm suggests products based on user interests. Integrated digital payment options and e-commerce systems facilitate smooth transactions.



These factors enable users to express their creativity and talents through short videos, dance challenges, health advice, political commentary, religious content, beauty tips, comedy skits, and educational material. TikTok is also the platform of choice for online sellers, especially with the TikTok LIVE feature that enables real-time interaction. This allows prospective buyers to view a product's size, colour, and functionality before making a purchase. Products on TikTok are often cheaper, with lower or even free delivery charges, which adds to its appeal.

As the popularity grows, more users including content creators, influencers, artists, and individuals are switching to the platform, as it offers opportunities to earn income through views and gifts (tokens) from followers. Below are some of Malaysia's top influencers by follower count and total likes:

1. Angel Lowee (@angelloweee) – 10.3 million followers, 227.5 million likes
2. Roshan Jeet (@roshannn) – 7.7 million followers, 188.5 million likes
3. Rozyana Roslan (@rozyanaroslan2) – 5.7 million followers

4. Baby Shima (@babyshimaofficial) – 5.1 million followers, 51.5 million likes
5. Dr Ben Gee (@drbengee) – 4.3 million followers, 49 million likes

In conclusion, TikTok is a platform that empowers its users to craft and share content freely. Nevertheless, users must remain responsible for the content they post. In the first six months of 2024 alone, the Malaysian government ordered the removal of 2,606 TikTok posts due to violations. This underscores the importance of being discerning and responsible in our digital choices.

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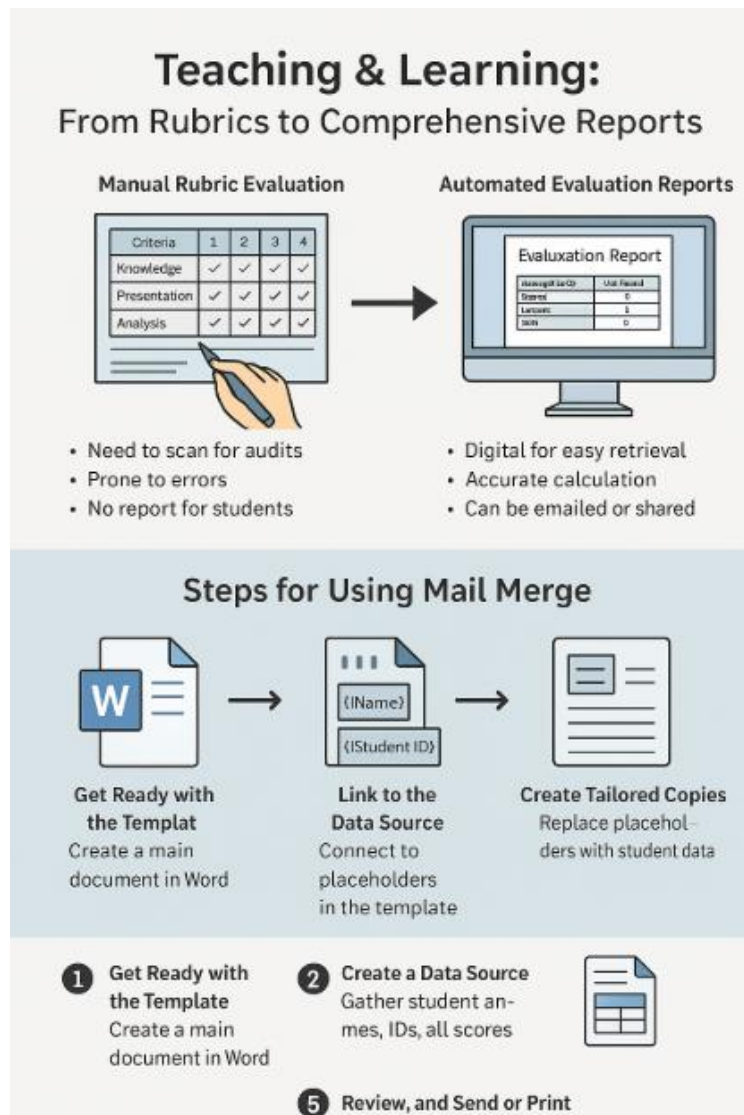
TEACHING & LEARNING: FROM RUBRICS TO COMPREHENSIVE REPORTS

ZURIATI ISMAIL @ KHORI

Rubric-based assessments such as lab tests and group projects are usually evaluated manually using a printed rubric or one in a spreadsheet table. One of the problems with manual evaluation based on a hardcopy rubric is that an extra step has to be taken to scan the evaluation form for audit purposes that usually take place at least six months to five years after the semester ends. Besides the need to scan the hard copy of the evaluation form, calculations of the marks are also done manually and as such are prone to errors. Transferring the marks to the system or the lecturer's ongoing assessment marks records is prone to error in the recording process. On the other hand, while evaluations that are recorded directly in a spreadsheet table may reduce the calculation and typing errors in the transfer process, they lack the report to be returned to the students, unless a printed copy is used to rewrite the evaluation scores. In the end, we still need a copy of the evaluation report.

This problem can be resolved by using the Mail Merge feature in Microsoft Word. It is used to generate personalised documents—such as letters, emails, labels, or envelopes—by combining a template with a data source. It is often utilised by companies and organisations to transmit mass messages with a human touch. Using this feature together with a Microsoft Excel spreadsheet helps to automate the creation of the evaluation report. The following are the steps in using the Mail Merge tool to produce a comprehensive report:

1. Get ready with the template by creating a main document in Microsoft Word. This is the process that translates the rubric into a report template.
2. Create a data source by methodically gathering recipient data from an Excel file. They include the students' names, their identification numbers, and all the scores for each evaluation criteria. Prepare the formula to get the final score. This is tedious and must be done carefully to prevent mistakes.
3. Link the template document to the data source and placeholders (e.g., {{Name}}, {{Student ID}}) where tailored details will be entered.
4. Create several tailored copies of the document by means of the Mail Merge feature, which pulls data from the source (students' names, identification numbers, all the evaluation scores, and the final score) and substitutes matching values for placeholders.
5. Review, and send or print the comprehensive report of the evaluation. It might be emailed to students or shared with them through Learning Management Systems platforms such as Google Classroom or UFUTURE.



Recommendation: A short conclusion should be added to wrap up the ideas.

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FUN & FREE E-LEARNING APPS FOR KIDS: MAKING LEARNING AN ADVENTURE!

WAN NOR HAFIDZAH WAN MOHD, CHE' KHALILAH MAHMOOD

The time has changed when the word “education” is limited to books and blackboards. Today, kids are learning in an entirely new way, thanks to an innovative model of education that makes lessons feel like playing, turns homework into interactive games and even makes study periods a blast! The development of technology today makes access to quality education easier. We can see an increase in the trend of using educational apps in Malaysia from 2020 to 2024. Children these days explore math, science, languages and even coding through the engaging opportunities afforded by free e-learning apps. This article will share five free applications for school students and will focus on the advantages of using them based on engagement and accessibility.



i.Khan Academy

Khan Academy has a very comprehensive module and offers free resources covering many subjects, including mathematics, science, history, and many more; yet the curriculum still aligns with Malaysian standards (KSSR/KSSM). The users can keep track of their progress, and it also provides personal recommendations based on it. Khan Academy has the most common features, such as video lessons, exercises and quizzes; and interestingly, it is available in multiple languages, including Bahasa Melayu.



ii. Duolingo

Learning a language is no longer boring and dry. Duolingo is a free language learning platform with wide variety of courses offered, such as English, Arabic, Korean, Japanese, French, Spanish, and many more. It offers engaging, gamified lessons, which are bonus points for kids to stay focused on game-based points, levels and rewards. It also provides interactive exercises for speaking, listening, writing and reading. You can access this application not only through mobile and web-based platforms, but it also provides offline access.



iii. Quizlet

Quizlet is a platform where teachers can help by generating flashcards and study sets for various subjects, which can be accessed by their students at any time and repeatedly. It offers several types of study modes, including learning, spelling, writing, testing, and matching. Additionally, users can engage in collaborative learning by sharing and studying with their classmates. Users can access Quizlet both online and offline, and it offers millions of study sets for their use.



iv. Scratch

If the kids love to learn about coding, Scratch is one of the best applications with the concept of learning through a drag-and-drop interface. The visual programming language is developed by the MIT team. It's worthwhile investigating its appealing features, which include the capacity to produce interactive narratives, games, and animations. Since Scratch is an open-source application, it has an online community where the user can share and collaborate with other developers as well.



v. Photomath

This application solves math problems by scanning them with a camera and uploading them through the app. It will then provide step-by-step explanations and solutions, which will help the user have better understanding. This application covers many mathematics areas, such as arithmetic, trigonometry, algebra, calculus, and so on. Although this application is very useful for assisting users with their homework and self-study, it also has limitations that may make it unsuitable for certain types of mathematical problems.



Challenges and Ethical Considerations in Kids' E-Learning Apps

We celebrated the evolution of education into a fun and engaging experience for children with e-learning apps like Khan Academy, Duolingo and Scratch. But like all technology, these digital aids have their challenges and ethical dilemmas. Though they can be game changers, it's important to confront the potential hitches so they can be used safely, effectively and equitably. Let's delve into these considerations to maintain focus on creating a healthy and responsible learning environment for children.



i) Screen Time: Finding the Right Balance

One of the most immediate concerns with e-learning apps is screen time. While apps like Khan Academy and Duolingo make learning fun, excessive screen exposure can lead to eye strain, reduced physical activity, and difficulty concentrating on non-digital tasks. Children need a healthy mix of screen-based and offline activities to develop holistically. Ethically, developers bear the responsibility of designing apps that encourage moderation. Features like Duolingo's short, gamified lessons or Scratch's creative projects that can be completed in bursts to help prevent overuse. Parents can also play a role by setting rules, for instance, following the 20-20-20 rule to reduce eye strain or balancing screen time with outdoor play. The goal is to harness the benefits of these apps without letting them overshadow other critical aspects of a child's development.

ii) Privacy and Data Security: Protecting Young Users

Another pressing issue is the collection and use of children's data. Many e-learning apps track progress, record voices for language exercises, or even gather location data for personalised ads. While such data collection can enhance the learning experience, it also raises significant concerns. Opting for apps like Khan Academy and Scratch, which are ad-free and prioritise user privacy, can provide peace of mind. Transparency from developers about data usage and robust security measures are essential to building trust and safeguarding young learners.

iii) Accessibility: Ensuring Equal Opportunities for All

Not all children have equal access to technology or the internet. High-quality devices, stable internet connections, and apps designed for diverse learning needs are not universally available. This digital divide can leave some students at a disadvantage, particularly those in rural areas or from low-income families. Ethical app development must include features that bridge these gaps. Offline modes, like those offered by Duolingo and Quizlet, allow learning to continue without an internet connection. Additionally, incorporating accessibility tools—such as text-to-speech for dyslexic learners or simplified interfaces for younger children—ensures that e-learning apps are inclusive. Developers and educators must work together to make these tools accessible to every child, regardless of their circumstances.

iv) Quality and Misinformation: Upholding Educational Standards

With the abundance of e-learning apps available, not all maintain the same standards of accuracy and educational value. Some may contain outdated information, overly simplistic content, or excessive gamification that distracts from real learning. Choosing reputable apps vetted by educators, like Khan Academy or Photomath, can mitigate this risk. These platforms are known for their rigorous content reviews and alignment with school curricula. Parents and teachers should critically evaluate apps before recommending them, making sure they prioritise learning outcomes over flashy

features. By supporting high-quality, evidence-based tools, we can foster a more effective and trustworthy e-learning ecosystem.

v) Social Interaction: Fostering Collaboration without Isolation

While e-learning apps offer convenience, they can sometimes reduce opportunities for face-to-face interaction, which is vital for developing social skills. Apps like Quizlet and Scratch encourage collaboration through shared projects and study groups, but they shouldn't replace human connection entirely. Striking a balance is key. Encouraging group study sessions, family participation in language learning with Duolingo, or collaborative coding projects on Scratch can help maintain social engagement. These educational apps are viewed as a supplement to traditional learning and interpersonal interactions, rather than as a replacement.

Conclusion

These innovative educational apps demonstrate that learning doesn't have to be a chore. By combining education with entertainment, they help children explore new subjects, overcome academic challenges, and even discover hidden talents. The key to maximising their benefits lies in their careful implementation. Parents and teachers can start by setting achievable daily goals, like completing one Duolingo lesson or designing a simple Scratch animation for weekly goals. Making apps exploration as a family activity enhances learning and creates valuable bonding moments.

The most exciting revelation from these apps is how they naturally spark children's curiosity. When education is presented in an engaging, interactive format, kids develop a genuine enthusiasm for learning that extends beyond the classroom. This positive attitude towards education might be the most valuable lesson of all. By embracing these resources while maintaining balance and supervision, we can help children develop a lifelong love for learning that will serve them well in all their future endeavours.

E-learning apps have the potential to revolutionise education, but their success hinges on carefully addressing these challenges. Parents, teachers, and developers all have roles to play in ensuring these tools are used responsibly. By setting healthy boundaries, prioritising privacy and accessibility, selecting high-quality content, and fostering social connections, we can create a digital learning environment that is effective and ethical. The future of education is undoubtedly digital, but it must also be inclusive, safe, and balanced. With careful consideration and collaboration, we can empower children to learn, grow, and thrive in the digital age—without compromising their well-being or potential.

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SWOT ANALYSIS OF CHATGPT AND SIRI: UNDERSTANDING THEIR ROLE AND IMPACT AS POPULAR AI TOOLS

PALANIAPPAN SHAMALA, QATRUNNADA ATIQAHA SHAZLIN ARKIN,
MURUGA CHINNIAH, NOOR AZRIN ZAINUDDIN

INTRODUCTION

Artificial intelligence (AI) has become one of the most talked-about topics in technology, and for good reason. In recent years, numerous advancements that once seemed confined to science fiction have started to become a reality. Many view AI as a powerful driver of production, with the potential to unlock new avenues for growth and transform how tasks are carried out across various industries. Essentially, AI refers to the development of machines designed to mimic human intelligence and behaviour. This is achieved by examining human brain patterns and cognitive processes, which in turn leads to the creation of intelligent systems and software.

AI systems typically function by processing vast amounts of labelled training data, identifying patterns and correlations within that data, and using these insights to make future predictions. AI has been used in various industries and sectors to ensure efficiency in the process such as learning, plantation and accounting. There are several types of AI, including self-aware AI, theory of mind AI, reactive machines, and limited memory AI. These forms of AI have paved the way for numerous applications that enhance both everyday life and

professional environments, such as Siri and ChatGPT.

In today's generation, Artificial Intelligence applications, devices or websites play an important role in human life. Almost up to 70% of people rely on the internet to be able to go through their day smoothly. For example, most people rely on Google maps to go to certain destinations, some medical treatments need AI to proceed with the treatment and business mainly uses AI to operate and it goes as simple as taking a daily selfie as the interaction with AI when a filter is involved. AI is especially useful in repetitive tasks or simply wanting the task to be done quicker as AI can be modified according to the tasks. In general, AI is important to make one's life better and have a smoother process or progress.

GOAL OF STUDY

This study aims to conduct a SWOT analysis of two AI tools, ChatGPT and Siri, which have gained increasing popularity and are widely utilised by diverse groups in society for various purposes. ChatGPT has become famous because it delivers human-like responses, supports learning, writing, and problem-solving, and is accessible to a wide range of users. Siri is widely used due to its integration with Apple devices, voice-

command convenience, and ability to simplify daily digital interactions. The reason to apply SWOT analysis in this study is because a SWOT analysis helps to evaluate whether these tools truly deliver value by weighing their advantages against limitations. SWOT analysis guide to provide deeper insight for users, researchers, and organizations in deciding how these AI tools can be best applied for practical benefits.

OVERVIEW OF CHATGPT

ChatGPT is an artificial intelligence program developed by OpenAI which was designed to generate general conversational-like dialogue based on any topics asked. This chatbot utilises machine learning algorithms to analyse large amounts of data which make it effective. As it operates using natural language processing capabilities, this allows ChatGPT to understand human language in terms of writing and speaking which makes it easy to interpret the input it receives and provide relevant responses. For example, students can ask as simple questions as what is the meaning of cloud and ChatGPT can still answer it with a clear and easy to understand language. It could answer any question using vast vocabulary that suits the students' needs. The application is not only used by students but also the variety of ages that is needed. It goes as far as being used as a daily system or an entertainment for some people. ChatGPT offers wide variations capabilities such as translation text, debug code, write code, create a poem, and write an email.

CHATGPT SWOT ANALYSIS

The strength of ChatGPT falls under various sections such as ChatGPT can come up with an idea very fast for example, creating an idea for any topic asked by the users and it is also free and very easy to use for anyone with devices. Not to mention for students particularly, it is good in editing and can help with the sentence structure. Due to its vast operations worldwide, ChatGPT supports more than 50 languages which makes it easier for students to participate and understand the information. Additionally, it can adapt its tone to specific requests, such as writing like a middle schooler or adopting a particular voice or style. This helps students to write their work appropriately as according to their nature of speaking. Beyond text-based tasks, ChatGPT can also generate melodies and chord progressions for music composition, write fictional narratives, and produce or debug code effectively.

However there lies few weaknesses for ChatGPT such as its knowledge base only up to 2021 which is far back and unreliable for current references. It also has a limited context window, which means it struggles with very long texts or conversations. This makes it difficult for people whenever they want a clarification or a summarisation of certain essays or statements. Not to mention, one of the worst drawbacks of ChatGPT is the fact that it could create its own facts such as "hallucinate" references or citations that do not exist as it is in ChatGPT's nature to give plausible responses whenever they are asked. Also, the AI model was trained on human-generated data, it can unintentionally

replicate biases, stereotypes, or harmful present in its training material. This can result in biased or offensive responses under certain conditions such as sexism or gender equality.

Other than that, ChatGPT has the capability to understand and interpret human language, responding accordingly. For instance, ChatGPT can currently answer questions, complete sentences, and generate text based on a provided prompt but as its language understanding improves, it can also create a scenario based on a given topic and answer personal questions from its users. This will help not only in terms of the thesis or text-based work but also the sentiment analysis that relates to human emotions. ChatGPT can quickly brainstorm ideas, whether for essays, projects, or creative writing. By providing a wide range of suggestions in seconds, it reduces the time spent on the ideation process and helps users focus on executing their plans. As ChatGPT continues to grow and gain

worldwide acceptance, it will create new job opportunities such as AI development, content moderation, prompt engineering, and training AI models.

While ChatGPT gives a lot of opportunities, there's also few threats that come from using ChatGPT such as security violations because these applications are used widely therefore the information that was recklessly put on the applications could be stolen by any hackers. They could use the information to impersonate other people or create fake news. Furthermore, because ChatGPT can generate essays, answer any question including test questions and solve problems, this can be used to cheat which violates the integrity of academic evaluations. Not to mention, over reliance on ChatGPT makes the users less diligent in doing their assignments or work which will produce less authentic work. This led to the declining in the critical skills of individuals.

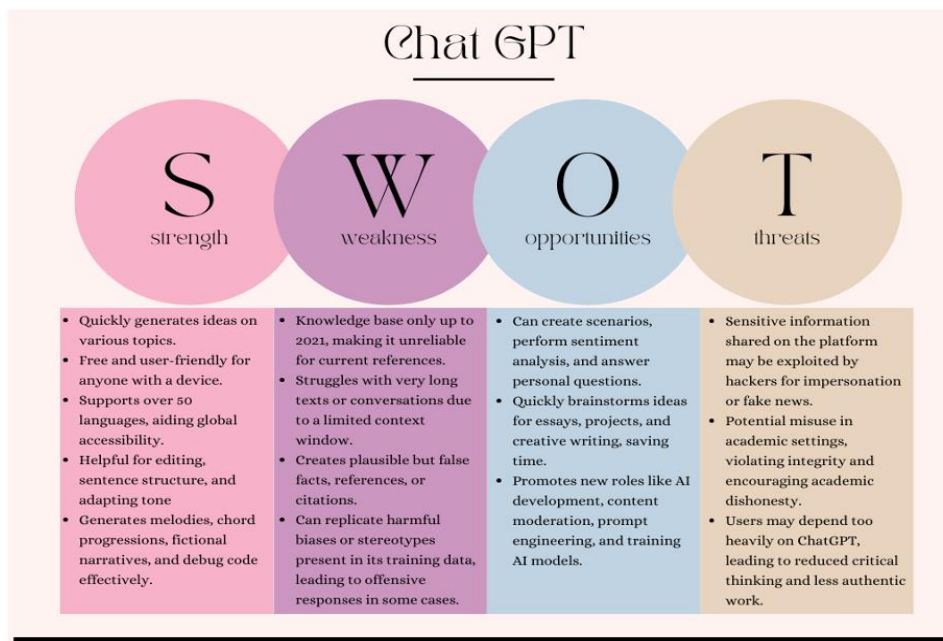


Figure 1: ChatGPT SWOT Analysis Summary

RECOMMENDATIONS FOR CHATGPT

There are a few recommendations for ChatGPT to stay convenient in the industry such as regularly updating their information in order to provide accurate information for each subject or issue. This could widen their knowledge on topics or questions asked by users. ChatGPT also needs to integrate the verifications system which means that they need to ensure that any article, news or information that they provide is true and not a made up one. This is to ensure that users can have authentic and accurate references for the topics they are searching which makes ChatGPT more reliable in fact. The need to establish clear guidelines for ethical uses is important especially for academic purposes to avoid plagiarism and cheating for online tests. ChatGPT needs to create a track system of blocking pasting format from websites or applications that is put under education apps. This would heighten academic integrity.

In conclusion, to ensure the long-term sustainability of ChatGPT, OpenAI needs to focus on innovations and improvements of the information and the backup system of ChatGPT. OpenAI needs to continue to update ChatGPT to promote competitiveness and relevance in the market between other Artificial Intelligence applications. By the fact that ChatGPT is a tool that complements human capabilities and speech, this could lead to a bigger positive impact in education or working environment if used appropriately. Ultimately, the sustainability of ChatGPT lies in its ability to adapt,

innovate, and address the challenges identified in its SWOT analysis while maintaining ethical and user-focused practices.

OVERVIEW OF SIRI, DIGITAL ASSISTANT

Siri is a virtual assistant for Apple which supports software such as iOS, macOS, tvOS and watchOS devices that works mainly using voice recognition and is powered by artificial intelligence. It was first started in 2011 for iPhone 11s which put it as the first widely accessible virtual assistant. People can start their request by calling its name which is “Hey Siri” or simply “Siri. Siri can navigate not only the question for work or school but is specialized in navigating the user's everyday lives. People can talk to Siri and ask it to do things as if it was a real person. Siri can create notes, make appointments, text someone, answer facts, create ideas and go as far as calling other people as per requested. According to these specific features, the usage of Siri extends to the accessibility even to the people with disabilities who find it difficult to write or type.

THE SIRI SWOT ANALYSIS

Siri comes with multiple strengths or pros such as an excellent communicator, capable of handling a wide range of tasks such as setting appointments, creating reminders, and sending messages using voice commands. This makes it easier for people to control their lives while doing something else like driving. Siri can even be connected to a third party for security purposes. The newest feature was to contact emergency services

whenever there is a sudden drop or increase in heartbeat or sudden impacts on the devices. Siri can grasp any topic, and it can explain it far into what it can reach online. The scope of time for Siri is as recent as the seconds before opening Siri which is because Siri is connected to Safari which is one of the fastest browsers and it can cover up to 20 languages.

However, there are a few weaknesses that people go through while using Siri such as the inefficient use of different dialects. Due to Siri being created in the United States, the dialect or pronunciation used by users can be different from Siri which make it difficult for Siri to catch up sometimes especially if users carry strong accents. This has become a great barrier for people that have Apple devices but do not speak English. Other than that, despite having a password on the devices, Siri can be used simply by using the home button. Therefore, all the features such as sending messages can be done without permissions. This can lead to false alarms or scammers whenever the phone or any devices are out of reach of the owner. Siri also operates depending on the region the devices are currently in, which indicates that sometimes Siri can only provide information limited to that region.

Siri opportunities involve expanding Siri's presence in the smart home market and partnering with more smart home device manufacturers to improve compatibility, ensuring users can seamlessly control a wide range of devices like lights, thermostats, and security systems. By utilising the Matter

protocol which allows smart devices to communicate across different ecosystems, Siri can strengthen the multiplatform functionality and become competitive against other powerful virtual assistants such as Google Assistant or Alexa. Among them, Other than that, improvement of accessibility features like enhanced voice control and increasing the number of languages plus accent employed in the speeches can make Siri more disabled friendly which increase independence and usability of all. Not to mention, active application of AI and machine learning can improve Siri natural language understanding capabilities which enable it to recognize any version of a language more, the focus context and provide more relevant and natural speech. This makes Siri more flexible in answering the question posed and interpreting the context.

As for the threats for Siri, with the home button unlocked Siri can still be used which poses dangers of leaked personal privacy for example contacts and social media infringement exists. However, privacy is not the only concern for users, Siri itself poses some challenges. The General Data Protection or similar laws and status have made things difficult for Siri. These legal requirements come at a cost in that they limit Siri capabilities from the restriction of the laws to Siri data collection, processing as well as storage abilities. Also, due to Siri being limited to the Apple ecosystem, it is unable to reach far like its competitor such as Google Assistant.

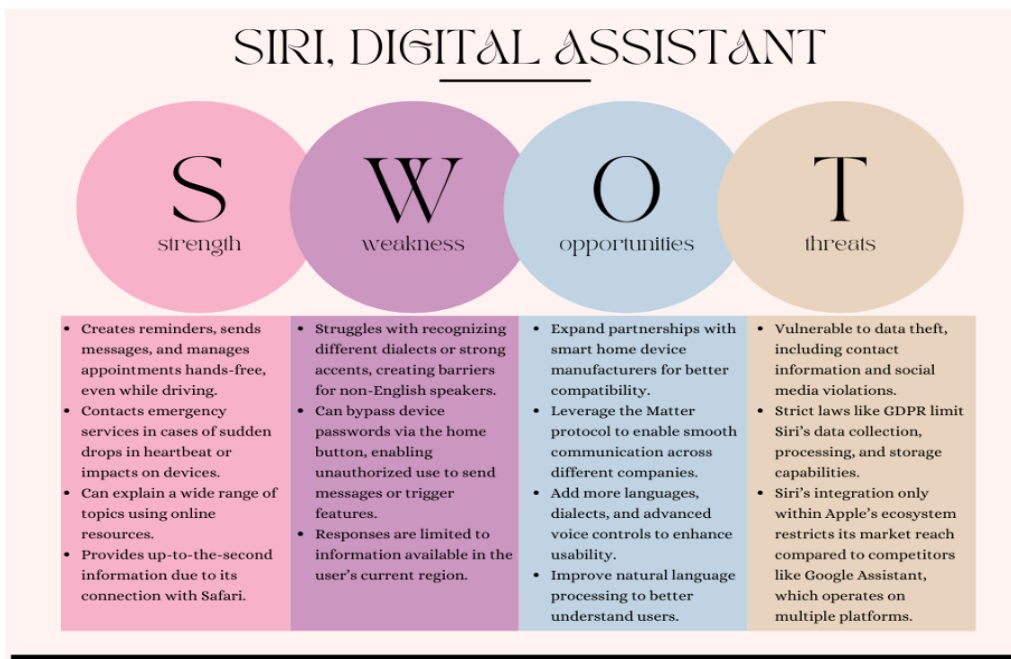


Figure 2: Siri SWOT Analysis Summary

RECOMMENDATIONS FOR SIRI

Recommendations for Siri improvement such as enhancing Siri natural language processing capabilities which is critical for improving its ability to understand diverse accents, dialects and languages. Apple needs to widen the scope for Siri languages for more than 20 languages to have more acceptability worldwide. Strengthening data privacy and security is essential to address vulnerabilities such as unauthorized access messages. Apple needs to make a voice verification passcode whenever Siri is used when the device is locked. Additionally, Apple needs to expand its Siri platform by introducing limited versions for non-Apple devices which allows Siri to be used even outside of the Apple ecosystem. This helps bring more audience and makes Siri an effective digital assistant like Google Assistance and Alexa.

To ensure Siri long term sustainability, Apple must continue to invest in Ai and machine learning technologies to maintain competitive capabilities. Emphasizing user's privacy and compliance with evolving data protection regulations will be crucial in building trust and retaining users/Furthermore, expanding Siri's global reach by improving regional adaptability and integrating with its brother smart home ecosystem will make it a dynamic and essential virtual assistant. By addressing its weaknesses and investing in growing opportunities, Siri can be in the top position for AI powered virtual assistants while fostering innovation and inclusivity for a diverse global audience.

OVERALL SUMMARY

Siri and ChatGPT have different purposes, hence their usefulness depends on the context of the use. While Siri has proven great with reminding, calling, sending messages and giving up to date resources. That it seamlessly integrates into Apple's ecosystem makes it ideal for Apple's products users while its accessibility features are

particularly appealing to those who would like to rely on their voices or need handsfree assistance. On the other hand, ChatGPT is a strong tool for content creation in ways such as essay writing, music composition and idea brainstorming. Its accessibility can be reached by multiple platforms. And it doesn't rely on a specific ecosystem. This makes it versatile to use for a wider audience. Furthermore, ChatGPT supports more languages and tones as compared to Siri. Although both are good, they specialised in different sectors.

In conclusion, a better tool that can be utilised is Siri, as it is not only capable of giving examples and suggestions with current references but also it also can go as far as to help users navigate their days or lives. Siri can make user's lives so much easier with only voice recognition and commands. Siri can also be used by different levels of age and a different setting like workers and students, elders and youngsters. This shows that Siri is much more accessible and varied compared to Chat GPT.

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IMPROVING CONCEPTUAL UNDERSTANDING OF TOPICS IN CALCULUS VIA V-CCMPEDIA

SHAMSATUN NAHAR AHMAD, ERNY ARNIZA AHMAD,
RUSNANI MOHAMAD KHALID, MUHAMMAD YASSAR YUSRI

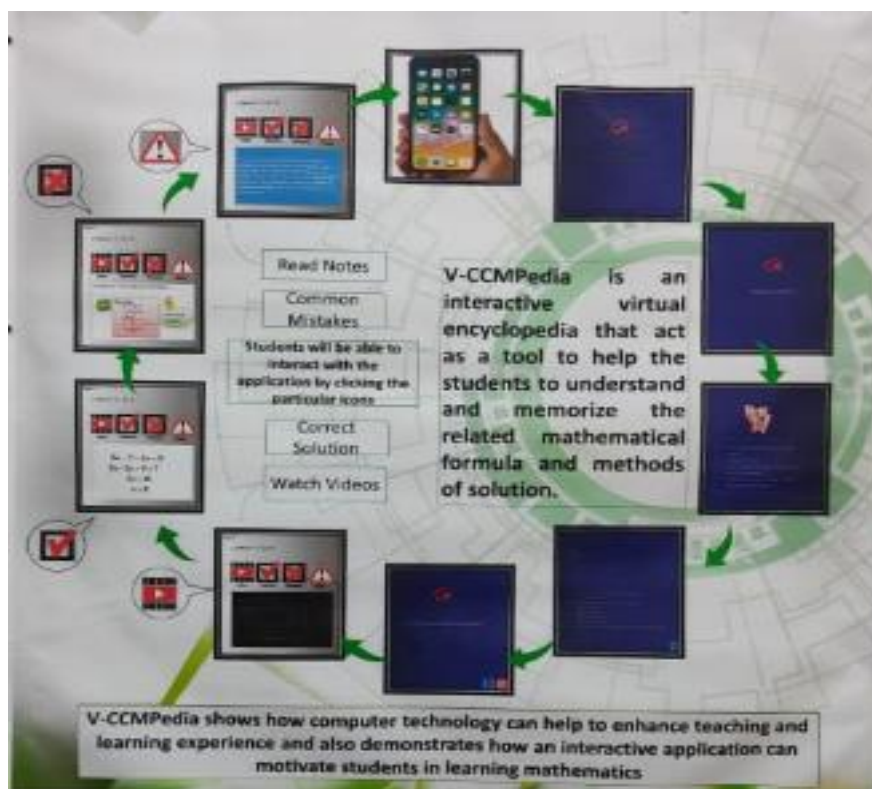


Figure 1. Cycle of V-CCMPedia

INTRODUCTION

There are certain reasons why new technologies are significant in the domain of the education nowadays, i.e. to offer the utilities of new types of interaction, to avail the learning in a much more absolute free form that towards more supercharged digital learning (Rahman & Zain, 2021). Although technological innovation does not have a value of its own, it can only be meaningful when it is the methodology in the tutorial and educational process (Marzano et al., 2013).

might be beneficial to the students in terms of self-learning. The provision of digital pedagogical training on the subject matter will help teachers to overcome the scope of basic technological replacement

One of the new technologies that has been implemented as a teaching tool in the learning and teaching of mathematics over the years are called the virtual manipulatives. According to the definition of virtual manipulatives that was presented by Patricia et al. (2016), it was an interactive and

technology-enhanced visualisation of a dynamical object in mathematics and all programmable aspects of the object that could provide the potential of developing mathematical constructive knowledge. Consequently, Farra et al. (2024) interviewed how virtual and concrete manipulatives are used in teaching fractions to students with positive learning gains in mathematical performance. Furthermore, just recently Sara Ahmad and Hans-Stefan Siller (2024) studied the effect of a mixed combination of virtual and concrete ones on the performance of the fifth grades students with exceptional abilities. The cumulative intervention was great in improving the math levels of low achievers, average and high achievers at high position in comparison to other ordinary techniques of instruction.

Anderson-Pence (2017) reported that when learning mathematical concepts with technology, students have access to multiple modalities of mathematical representations. Therefore, technology enhances the communication of

mathematical ideas and supports students' learning of mathematical concepts.

Calculus is one of the mathematical courses which is a well-known course for the students of Science, Technology, Engineering and Mathematics at the tertiary level. Many educators integrated applying tools in their method of teaching Calculus for students to gain a better understanding on the topics. However, students seem to repeat the same common mistakes. This is a serious problem that is still unsolved due to lack of understanding and focus on the related topics.

A serious effort to design a virtual encyclopaedia was made to compile the common mistakes that always occur while marking students' homework, assignments, quizzes, tests and final exams. The development of V-CCMPedia is mainly to assist the students in understanding related topics and avoiding repeating mistakes. It is also to provide the students with an interactive tool that can help them to understand and memorise the related mathematical formula and methods.

CONTENT DEVELOPMENT

Students are finding virtual books very useful and online education has become more interesting, convenient and affordable (Cohen et al., 2003). But, in online education, they occasionally experience some connectivity and network problems. Consequently, we are interested in the offline service of our interactive mathematical documents.

V-CCMPedia is a virtual interactive encyclopaedia, which is a teaching aid that allows students to learn and create mental maps of the associated mathematical formula and technique of solution. It is easily accessible and not disrupting the internet line. By clicking on the specific icons, students will have a possibility to watch revision videos, read notes, study examples of exercises with their correct answers and learn about the most common errors in solving some specific equations. This product is highly convenient to every user especially students and teachers.

The following are the benefits of V-CCMPedia as shown in Figure 1:

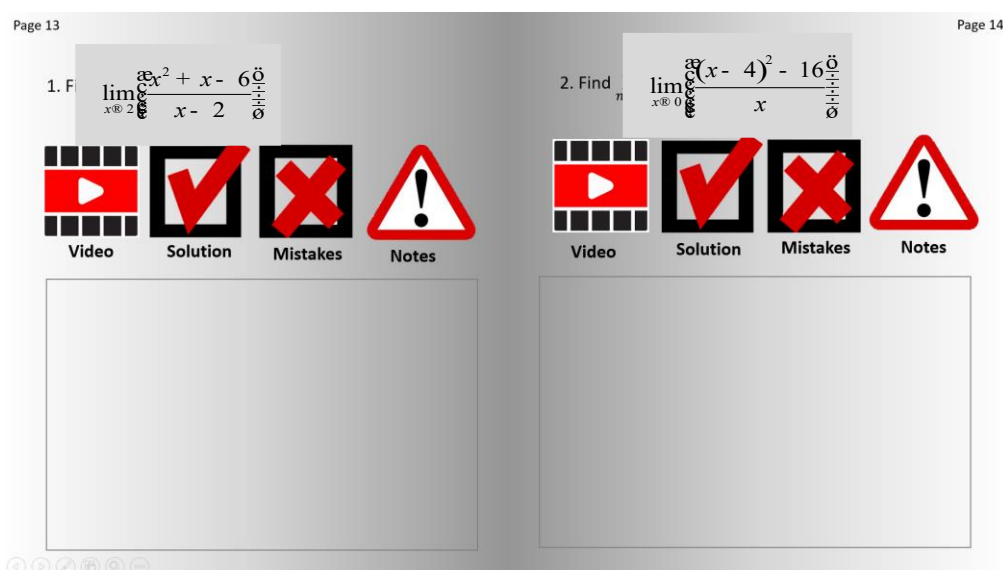
1. V-CCMPedia has an interactive link to the list of topics, which allows students to quickly jump to the page containing the intended content.
2. Since it is an electronic document, students can simply download and use it without internet connection.
3. Students can interact with the application at their own convenience. Mobile devices are common to students. Therefore, the portability of V-CCMPedia allows students to refer to their notes and their course materials at anytime from anywhere.
4. V-CCMPedia contributes active learning process for Calculus course.

Demonstration of V-CCMPedia

1. Table of Content. Students are free to choose the topic.




2. Four options for navigation: video, correct solution, common mistake, notes





3. Option for video


Page 13
Page 14

1. Find $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x - 2}$


Video


Solution


Mistakes


Notes

Finding limits algebraically


① Factoring


$$\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x - 2} = \lim_{x \rightarrow 2} \frac{(x+3)(x-2)}{x-2}$$


$$= \lim_{x \rightarrow 2} (x+3)$$


$$= 5$$

2. Find $\lim_{x \rightarrow 0} \frac{(x-4)^2 - 16}{x}$


Video


Solution


Mistakes


Notes

② Expanding Terms

$$\lim_{x \rightarrow 0} \frac{(x-4)^2 - 16}{x} = \lim_{x \rightarrow 0} \frac{(x^2 - 8x + 16) - 16}{x}$$

$$= \lim_{x \rightarrow 0} \frac{x^2 - 8x}{x}$$

$$= \lim_{x \rightarrow 0} x - 8$$

$$= 0 - 8$$

$$= -8$$

CONCLUSION

This product is to introduce the interactive application to assist students in understanding some common mistakes made while writing the solutions of certain topics in Calculus. Bringing technology into classrooms has had a positive impact on the quality of education delivered. Mathematics lecturers in UiTM Segamat campus unanimously agree upon the benefits of using V-CCMPedia in learning Calculus for some topics. V-CCMPedia shows how computer technology can help to enhance teaching and learning experience and also demonstrates how an interactive application can motivate students in learning Calculus.

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AI TOOLS THAT “WOW” YOUR STUDENTS FOR BETTER ENGAGEMENT IN THE CLASSROOM

RASHIDAH MOKHTAR, NUR HUDA JAAFAR

Introduction

This article explores the transformative potential of Artificial Intelligence (AI) in enhancing student engagement within classroom environments. It provides an overview of AI tools that facilitate interactive learning, streamline assessments, and promote creativity in educational contexts. By categorising AI tools into presentation, content creation, and engagement platforms, the study highlights their role in enhancing instructional delivery, student participation, and assessment practices. The discussion further examines future trends, such as microlearning, personalized learning, and immersive technologies, emphasizing AI’s role in supporting lifelong learning. The article concludes that thoughtful integration of AI enhances teaching efficiency and empowers students to become active participants in their own learning journeys. In the evolving landscape of education, student engagement has become a cornerstone of effective teaching and learning. Traditional lecture-based approaches, while foundational, often fall short in maintaining learners’ attention and motivation. The emergence of AI provides educators with innovative tools that enhance interactivity, personalise learning experiences, and enable efficient content delivery. AI allows educators to design adaptive, data-informed, and dynamic learning environments that align with students’ preferences and capabilities.

The learning environment

Malaysian education system has evolved through multiple waves of reform, from teacher-centred instruction to student-centred, technology-integrated learning. Initiatives such as the Smart School Project and the Malaysia Education Blueprint (2013–2025) have laid the foundation for Education 4.0, emphasizing digital literacy and self-directed learning. The COVID-19 pandemic accelerated digital adoption, exposing disparities in infrastructure and highlighting the importance of AI-driven solutions that support inclusive learning. Within this context, AI emerges as a key enabler for reimagining classroom engagement and assessment practices. AI tools that enhance classroom engagement can be categorised into three primary types: dynamic presentation tools, content creation tools, and engagement platforms. Each serves a distinct purpose in enriching teaching and learning experiences.

Dynamic presentation tools

Dynamic presentation tools help educators design visually appealing and interactive lesson materials. Tools such as Gamma AI, Alayna + Google Slides, and Canva AI simplify design while enabling real-time interaction. These applications assist teachers in creating slides, visual stories, and quizzes that captivate student attention.

The table below compares the AI presentation tools and their main features:

Gamma AI	Alayna + Google Slides	Canva AI
AI-powered content generation	Automated summarisation of text and data	AI-powered image generation

Easy presentation outline generation Customisable templates	Customisable templates and design options Integration with Google Slides for seamless workflow	Text-to-design capabilities Automated layout suggestions
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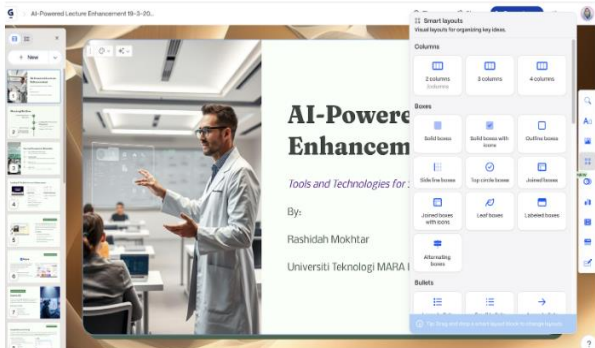


Figure 1: Gamma app GUI

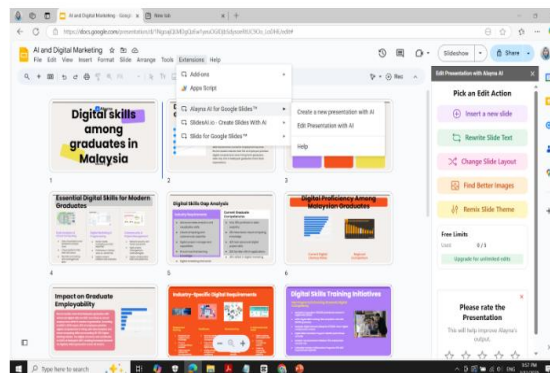


Figure 2: Google Slides and Alayna GUI

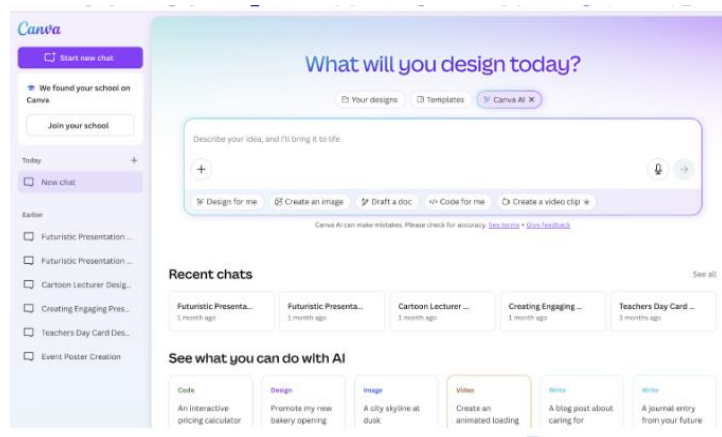


Figure 3: of Canva GUI

Content creation tools

AI-powered content creation tools such as GitMind, InVideo, ElevenLabs, and Napkin.ai empower educators to generate mind maps, videos, audio, and visual notes efficiently. These tools reduce preparation time and encourage creativity among both teachers and learners.

The Table below compares AI Content Creation tools and their main features.:

GitMind	InVideo	ElevenLabs
<ul style="list-style-type: none"> • Collaborative mind mapping • Real-time brainstorming • Templates for various use cases • Customisable themes and styles • Export to multiple formats 	<ul style="list-style-type: none"> • Extensive library of customisable video templates • Drag-and-drop interface for easy video editing • AI-powered video creation tools • Royalty-free music and stock footage • Direct sharing to social media platforms 	<ul style="list-style-type: none"> • Realistic text-to-speech generation • Voice cloning technology • Customisable voice parameters (pitch, speed, etc.) • Support for multiple languages • API for integration with other applications

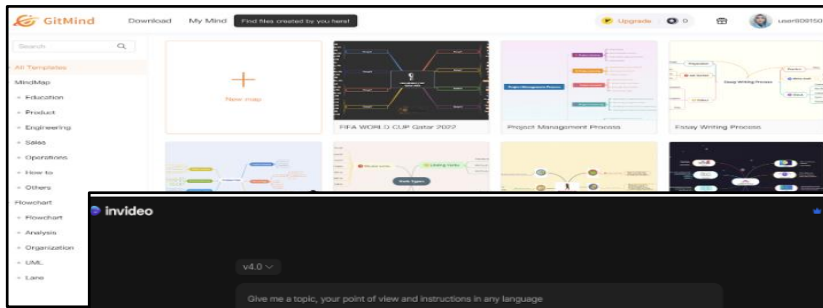


Figure 4: GitMind GUI

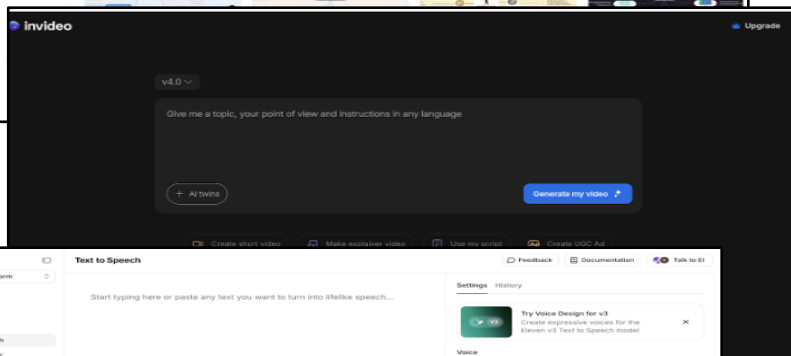


Figure 5: InVideo GUI

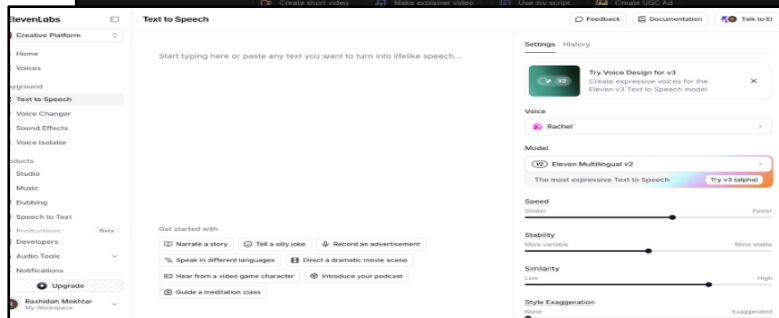


Figure 6: ElevenLabs GUI

Engagement and interaction tools

Interactive learning platforms such as Eduaide.ai, Perplexity AI, and Educaplay encourage collaboration, real-time feedback, and gamification in learning. These tools transform passive classrooms into active learning spaces through quizzes, polls, and multimedia activities.

The following table compares the AI engagement tools for student motivation and their main features :

Eduaide.ai:	Perplexity AI	Educaplay
<p>Interactive Quizzes and Polls: Integrates real-time quizzes and polls to keep students actively involved during lectures.</p> <p>Collaborative Whiteboards: Offers shared digital whiteboards for group problem-solving and brainstorming activities.</p> <p>Personalised Feedback: Provides instant, AI-driven feedback to students understand and improve their performance.</p>	<p>AI-Powered Answers: Provides direct answers to questions using AI, rather than just listing links.</p> <p>Source Citations: Includes citations to show the sources of the information provided, enhancing trust and verification.</p> <p>Follow-Up Questions: Suggests follow-up questions to help users explore topics in more depth.</p>	<p>Activity Creation: Design various types of interactive activities easily.</p> <p>Multimedia Integration: Incorporates images, audio, and video into activities.</p> <p>Customisation : Adapts activities to specific learning objectives and student needs..</p>

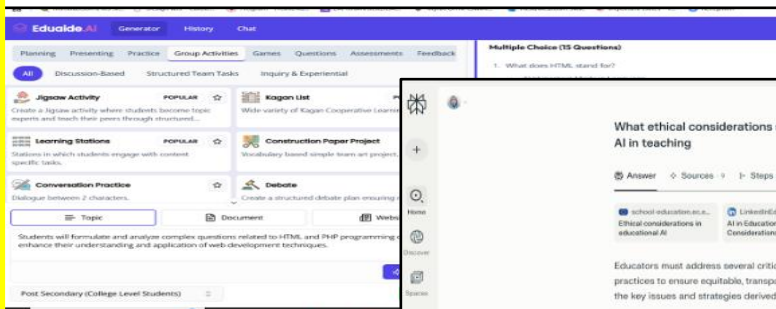


Figure 8: Eduaide.ai GUI

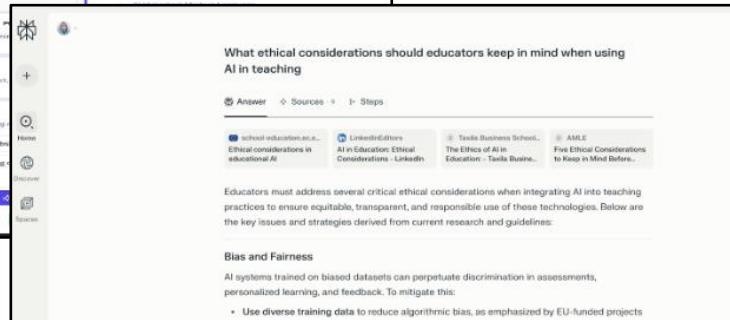


Figure 9: Perplexity GUI

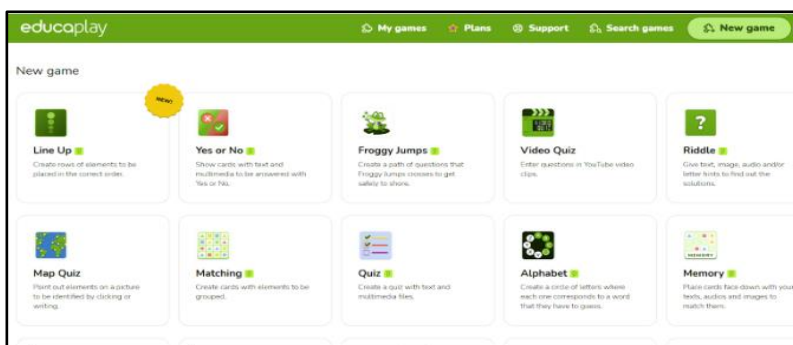


Figure 10: Educaplay GUI

AI Question Generator

AI technologies help educators in many ways. The AI tools help educators in generating questions which can be cumbersome, especially when the educator lacks new ideas. Nowadays, many AI tools can solve this problem. With AI tools, educators can generate a wide range of questions, including multiple-choice questions (MCQs), short-answer questions, and essay-based assessments. However, they need to know the strategies to generate assessments. Tools like ChatGPT and Quillionz assist educators in creating diverse assessment formats.

The following table compares the AI Question Generators and their main features :

ChatGPT	Quillionz
<p>Natural language understanding: Responds in human-like, coherent text.</p> <p>Customisable output: Generates questions, summaries, explanations, and examples based on the educator's instructions.</p> <p>Adaptive complexity: Can simplify or deepen content depending on learners' levels.</p> <p>Creativity and variety: Provides multiple formats such as open-</p>	<ul style="list-style-type: none"> • Automatic question generation: Creates questions directly from input text. • Multiple question formats: Supports MCQs, short-answer, and higher-order thinking questions. • Customisation : Educators can edit, refine, and adjust generated questions.

<p>ended, multiple-choice, or problem-solving questions. Efficiency: Saves time in preparing learning materials.</p>	<ul style="list-style-type: none"> ● Time-saving: Reduces the effort in preparing quizzes and assessments. ● Content alignment – ensures questions are directly tied to the material provided.
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AI in Assessment: Smarter Feedback and Greater Engagement

With the AI tools, it can also save time and reduce educators' burden in gradings and giving feedback on students' assessment performance. Moreover, AI tools can also help educators ensure that students consistently demonstrate high integrity in their assessments. AI tools can also help educators transform assessments into fun, game-based, and interactive activities that can indirectly boost student motivation to explore learning subjects more deeply. Gradescope and CoGrader streamline help in grading and feedback processes.

The following table compares the AI assessment tools and their main features:

Gradescope	CoGrader
<ul style="list-style-type: none"> ● AI-assisted grading: Automatically groups similar answers for faster marking. ● Multiple formats: Supports paper-based, online, and programming assignments. ● Customisable rubrics: Has dynamic and reusable grading criteria. ● Time efficiency: Reduces grading time significantly for large classes. ● Detailed analytics: Provides insights into student performance and question difficulty. ● Fairness and consistency: Can Ensures uniform grading across all responses. 	<ul style="list-style-type: none"> ● AI-Powered Feedback Generation: Quickly produces draft grades and detailed feedback, saving significant time. ● Consistent, Equitable Grading: Has objective, rubric-based scoring that helps reduce human bias. ● Classroom Insights & Analytics: Gives reports on student performance trends, helping target instruction and planning. ● Academic Integrity Tools: Detects AI-generated content and plagiarism to maintain honesty. ● Human-in-the-Loop Design: While AI assists, teachers always have the final say on grades and comments. ● Privacy & Ethics Focused: Anonymises data and does not use student submissions to train AI.

Future Trends and Implications

The integration of AI in education is closely linked to emerging trends such as microlearning, AI-personalised learning, immersive technologies (VR/AR), and lifelong learning. Microlearning allows bite-sized knowledge delivery, while AI-personalised platforms tailor lessons to individual learner profiles. Immersive technologies enhance experiential learning through simulation, and lifelong learning initiatives are strengthened through AI-driven recommendations and flexible content access. Together, these trends indicate a shift toward more adaptive, continuous, and learner-centric education ecosystems. Artificial Intelligence is reshaping education by empowering teachers with tools that enhance engagement, efficiency, and equity. The fusion of AI technologies into classroom practices supports dynamic content delivery, creative content production, and authentic assessment. Future educators must embrace AI not as a replacement, but as a collaborator that amplifies teaching capabilities and inspires lifelong learning.

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COMPUTER TIPS AND TRICKS: HOW TO MAKE YOUR PC RUN FASTER

ISMA ISHAK

Introduction

A sluggish computer can be frustrating, especially when you are trying to complete important tasks. Many users often assume that when a PC becomes slow, it is time for a new one. However, before considering an upgrade, there are several methods you can apply to dramatically improve your computer's speed and overall performance. These methods involve optimizing system settings, managing resources more efficiently, and cleaning out digital clutter without purchasing any additional software. In this article, you will learn a variety of practical tips to boost your PC's performance using built-in Windows tools and simple system adjustments.

Tips 1: Optimizing System Settings

One of the most effective ways to speed up a computer is by adjusting its visual settings to prioritize performance over appearance. Windows includes many visual effects such as fading menus, animations, and transparent windows that may look aesthetically pleasing but often consume significant memory and processing power. To enhance performance, these effects can be disabled. This can be done by accessing the System Properties window, navigating to the Performance Settings under the Advanced tab, and selecting the option to adjust for best performance. Once this change is applied, the system will turn off all unnecessary graphical effects, allowing more system resources to focus on speed and efficiency.

Another overlooked solution is simply restarting the computer. Restarting helps clear temporary files and cached data from the system's memory, offering a quick refresh that redistributes workload between the CPU and GPU. In systems with dedicated graphics cards, certain processes will be redirected to the GPU, which is often more efficient at handling visual tasks. This shift reduces the burden on the central processor and allows the system to perform better overall.

Tips 2: Managing Startup and Disk Cleanup

A common cause of slow startup times is the presence of too many programs launching when the system boots. Each startup application consumes memory and processing power, delaying access to the desktop and making the system less responsive. By opening the Task Manager and reviewing the Startup tab, users can identify which applications are automatically starting and disable those that are unnecessary. Disabling unused apps from startup can significantly reduce boot time and free up resources for other tasks.

Cleaning the hard drive is another critical step. Over time, the system accumulates temporary files, cache data, logs, and other unnecessary files. These not only occupy valuable disk space but also slow down system operations, especially on hard disk drives (HDDs). Windows provides built-in tools like Disk Cleanup, which allows users

to select and delete redundant files safely. On systems using traditional HDDs, running the Disk Defragmenter helps reorganize fragmented files, enabling faster data access. While defragmentation is unnecessary for SSDs, freeing up space remains essential regardless of the storage type.

In addition to cleaning clutter, users should perform routine scans for malicious software. Windows includes the Malicious Software Removal Tool (MRT), which scans for and removes specific threats. Running a quick scan using this tool can detect hidden malware that may be secretly using system resources, contributing to overall sluggishness.

Tips 3: Deleting Junk and Temporary Files

Temporary and cached files accumulate each time applications are opened or tasks are completed. Although these files help speed up access in the short term, they can pile up over time, leading to storage issues and slower performance. Clearing these files periodically helps maintain a cleaner and faster system.

The %temp% folder contains temporary files created by various applications. By accessing this folder using the Run command and deleting its contents, users can recover storage and reduce background load. Another similar folder named temp also stores temporary data. These two directories are safe to clean regularly, and Windows will recreate necessary files when needed.

The Prefetch folder operates a bit differently. It stores data about frequently used applications to help them load faster in the future. However, this folder can become bloated over time, especially if many applications are installed or uninstalled. While deleting prefetch files may slightly delay app loading initially, it can improve general system responsiveness by eliminating old or broken cache entries. Cleaning this folder is optional but beneficial if your system is running low on storage or feels unusually sluggish.

Tips 4: Power Settings and Disk Space Awareness

Windows laptops and desktops often use a balanced or power saver plan to reduce energy consumption. While this is helpful for extending battery life, it can also limit performance by slowing down the CPU. Users looking to maximize their system's responsiveness can change the power settings to High Performance. This plan allows the hardware to operate at full capacity without throttling speeds for energy savings. To change the power plan, users can access the Power Options from the Control Panel or the quick-access Power menu by pressing Windows + X. Choosing the "Best Performance" mode ensures that the processor and other components are allowed to run at their optimal levels.

Monitoring available disk space is another key factor in maintaining speed. When the primary drive is nearly full, the system struggles to store virtual memory, update applications, or cache data efficiently. By going into the Storage settings in the System menu, users can review how space is being used and identify large files or folders to remove. Keeping at least 15% of disk space free is a good rule of thumb to prevent bottlenecks in system performance.

Tips 5: System Integrity, Hardware Upgrades, and Extras

Even with optimal settings and cleanup, performance issues may persist due to corrupted system files. Windows provides a powerful command-line tool known as the System File Checker (SFC). Running this tool via the Command Prompt checks the integrity of all protected Windows files and replaces corrupted ones with a cached copy. The command `sfc /scannow` can resolve many hidden problems that affect system stability and speed. It is especially useful after system crashes or failed updates.

For users still experiencing performance issues, hardware upgrades may offer the most dramatic improvement. Replacing a traditional hard drive with a solid-state drive (SSD) can significantly reduce boot times and application load times. SSDs read and write data much faster than HDDs, making them one of the best upgrades for any aging computer. Similarly, increasing the RAM (random access memory) enhances the computer's ability to multitask. With more RAM, the system can keep more applications open simultaneously without slowing down.

Lastly, there are some interesting and fun tricks for customizing your computer. Creating a slide-to-shutdown shortcut adds a sleek shutdown method to your desktop. Applications like TranslucentTB and Lively Wallpaper from the Microsoft Store can enhance the look of your taskbar and desktop with transparency effects and animated backgrounds. Although these do not directly improve performance, they offer a more enjoyable user experience, especially after system optimizations are completed.

Tips 6: Keep Drivers and Windows Up to Date

Keeping your device drivers and Windows OS up to date is crucial for maintaining peak performance. Hardware manufacturers often release driver updates to fix bugs, improve compatibility, and enhance performance. Similarly, Microsoft regularly provides system updates that patch vulnerabilities and optimize system efficiency. To update drivers, users can go to the Device Manager, select the device, and check for updates. For Windows updates, navigating to Settings > Update & Security and clicking 'Check for updates' ensures your system is running with the latest patches and features. An outdated system can lead to crashes, slowdowns, and security issues.

Tips 7: Manage Background Apps and Services

Windows often runs various background apps and services that may not be essential to your workflow. These background processes can quietly consume valuable CPU, memory, and network bandwidth. To manage them, open the Task Manager and check the Processes and Services tabs for unnecessary applications. Additionally, go to Settings > Privacy > Background apps and disable apps that do not need to run in the background. Reducing background activity can noticeably enhance responsiveness and free up system resources for the tasks that matter.

Tips 8: Use Storage Sense for Automatic Cleanup

Windows 10 and 11 include a feature called Storage Sense, which can automatically free up space by deleting unnecessary files like temporary data, items in the Recycle Bin, and previous versions of Windows updates. This tool helps users maintain a cleaner, more efficient storage environment without manual intervention. To enable Storage Sense, go to Settings > System > Storage and toggle the feature on. You can also customize its behavior by setting cleanup schedules and file deletion rules. Regular use of Storage Sense ensures the system does not become bogged down with redundant files.

Tips 9: Optimize Browser Usage

Web browsers are often among the most resource-intensive applications on a computer. Multiple open tabs, extensions, and cached data can slow down not just the browser, but the entire system. Users should regularly clear browsing data, limit the number of open tabs, and remove unused extensions. Many browsers offer a Task Manager (e.g., Chrome's Shift + Esc) to see which tabs or extensions are consuming the most resources. Switching to a more lightweight browser or using Reader Mode can also improve performance during web browsing.

Tips 10: Disable Visual Animations in Windows Settings

Aside from the 'Adjust for Best Performance' setting in the System Properties, users can fine-tune individual visual effects within the Windows Settings menu. By going to Settings > Accessibility > Visual effects (or Display in older versions), users can turn off animations, transparency, and other motion effects that consume processing power. Disabling these settings makes the user interface feel more snappy and responsive, especially on older machines or devices with limited hardware capabilities.

Tips 11: Turn Off Search Indexing for Low-End PCs

Search indexing is a built-in Windows feature that speeds up the search function by creating a constantly updated index of files and folders. While beneficial for quick access, it can consume a significant amount of CPU and disk usage, especially on systems with limited processing power or hard disk drives. Disabling search indexing can free up resources and improve system responsiveness. To do this, open the Services app (services.msc), find "Windows Search," and set it to "Disabled." Additionally, you can go to "Control Panel > Indexing Options" to exclude folders that don't need to be indexed.

Tips 12: Disable Windows Tips and Suggestions

Windows provides tips and suggestions via notifications based on your usage. Although helpful to some, they run background services that can slow down your PC. These notifications also disrupt your workflow with pop-ups. You can disable them by going to "Settings > System > Notifications & actions" and toggling off the option

labeled "Get tips, tricks, and suggestions as you use Windows." This improves both focus and system performance by reducing the load on system resources.

Tips 13: Adjust Virtual Memory Settings

Virtual memory allows your PC to use a portion of your hard drive as if it were RAM. This paging file helps maintain system stability when physical RAM is full, but if configured improperly, it can hinder performance. To manually adjust virtual memory, go to "Control Panel > System > Advanced system settings > Performance Settings > Advanced > Virtual Memory." Uncheck "Automatically manage paging file size for all drives" and set a custom size, ideally 1.5 to 3 times your actual RAM. Proper configuration ensures smoother multitasking, especially on systems with low RAM.

Tips 14: Regularly Restart Your Router

Sometimes, perceived computer slowness is actually due to a weak or unstable internet connection. Restarting your router helps refresh the network connection, apply updates, and clear internal caches. This is especially important in environments with multiple devices or high internet traffic. A weekly router restart can improve streaming, video calls, downloads, and overall online performance — making your computing experience smoother even if your device is working fine.

Tips 15: Use Lightweight Alternatives for Software

Heavy software can slow down your system, especially if you are using an older PC. Opting for lightweight alternatives reduces the strain on RAM and CPU. For example, replace Microsoft Office with LibreOffice or Google Docs, and use VLC Media Player instead of heavy multimedia suites. Lightweight apps are optimized for minimal system impact and are often open-source, making them both efficient and cost-effective.

Conclusion

Improving the performance of your computer does not always require expensive upgrades or professional help. With the right combination of system adjustments, regular maintenance, and selective hardware enhancements, you can extend the life of your PC and restore its speed. This guide has outlined the essential steps — from adjusting power settings and cleaning files to running integrity checks and upgrading components — to help your computer run as fast and efficiently as possible.

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EASYMATH2U: LEARNING MATHEMATICS BEYOND THE CLASSROOM

NOOR SYAZANA NGARISAN, SHAFARUNIZA MAHADI,
 FARAH SURAYA MD. NASRUDIN,
 NURUL 'AINI HARUN, MOHD LEZAM LEHAT

Gaining proficiency in the Mathematics subject necessitates ongoing practice and is aimed at achieving a more profound comprehension of a concept or method. This implies that learners must consistently revisit their studies to enhance their mathematical abilities. Nevertheless, the majority of students struggle to achieve this, as they typically rely on their teachers, peers, and family members for inspiration, feedback, or clarification on answers. In

addition, students frequently depend on various learning resources such as notes, textbooks, and tutorials, which can be daunting and complicate their ability to absorb and understand all the knowledge. In line with the passage of time and the current generation, teachers need to think of more flexible and appealing techniques or methods to attract students to try more questions and not just rely on pen and paper.

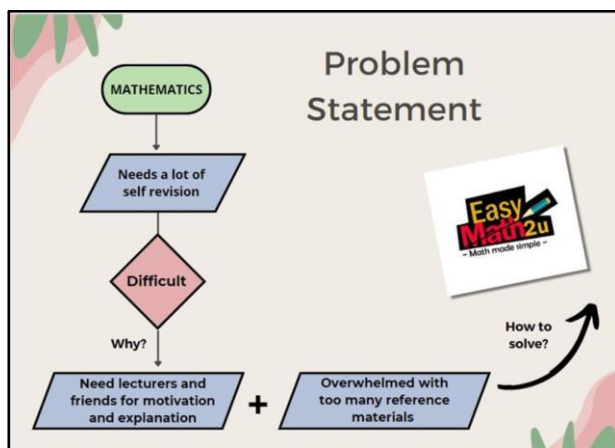


Figure 1: Problem statement of EASYMATH2U.

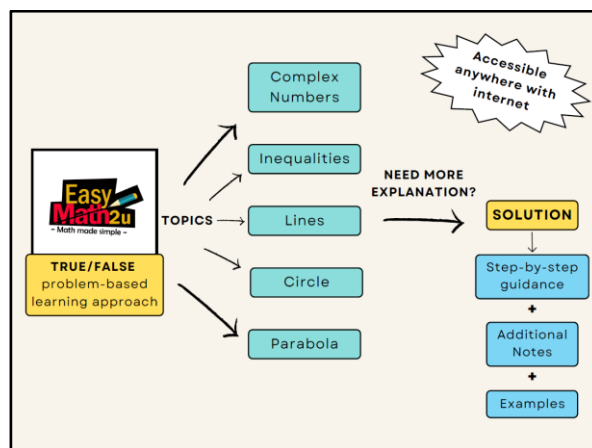


Figure 2: The summary of EASYMATH2U.

The inspiration for EASYMATH2U comes as a solution to cater to these common issues and problems. EASYMATH2U is a TRUE or FALSE game covering five essential topics from Pre-Calculus that adopts the concept of self-learning and applies student-centered mechanisms. The main objective is to make it easier for students to do mathematics exercises using mobile devices wherever they are with the availability of an internet connection, which makes it more convenient. This can motivate the students to learn on their own without needing immediate help from the teachers and also aid students in grasping an understanding of a topic without having to rely on multiple resources simultaneously. Each question includes a detailed breakdown of the solution, extra examples, and straightforward notes to help students understand the problems independently. The explanations are crafted to be clear, preventing any misunderstanding during the learning experiences. The layout of EASYMATH2U is simple and easy to navigate, allowing users to focus on the key aspects of a particular

subject of interest. The game concludes with an option to restart, encouraging repeated practice for mastery.

Nowadays, technology is playing a more significant role in learning and teaching. This innovation is an exceptional initiative and applies to other subjects or other suitable matters. The earlier development phase of this game used simple Microsoft PowerPoint. Later, to make it available online, the materials were transferred to Google Slides for easier access. Anyone with little technology literacy can take on the same idea, make some improvements, and develop an even better online learning resource. Additionally, it is projected that students will spend less on using this game compared to the costs involved in purchasing a reference book.

EASYMATH2U offers various benefits and contributions to the students' learning experiences. This digital game can improve students' study revision by delivering a more effective and engaging educational encounter. Furthermore, it promotes a sense of independence and self-sufficiency among learners. Students can participate in EASYMATH2U activities on their own or collaboratively, enhancing their interest in the learning process. This game also aids in developing critical thinking and problem-solving abilities in students.

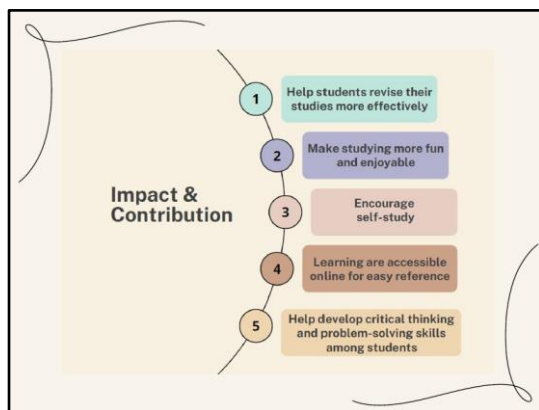


Figure 3: Impact and contribution of EASYMATH2U.

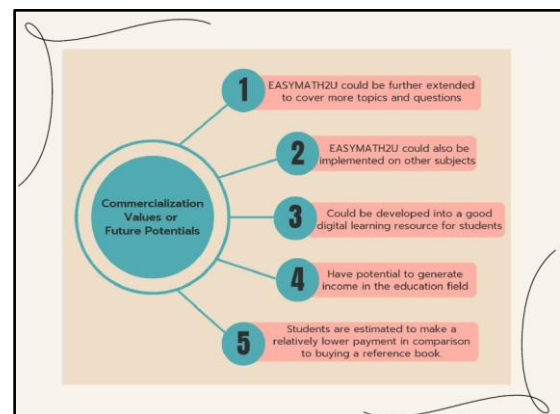


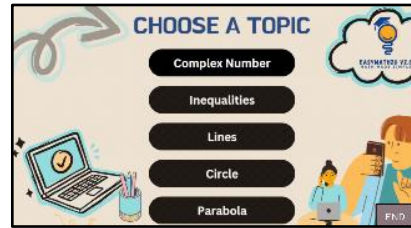
Figure 4: Commercialization values or future potential of EASYMATH2U.

Currently, there are 40 mathematics practice questions from 5 topics in EASYMATH2U. Each topic has two sets of questions, starting from lower difficulty to advanced. In the future, this game can be expanded to include a wider range of subjects and questions. It is also estimated that with some improvement, EASYMATH2U can evolve into a high-quality digital educational tool for students. In modern times, where technology is assuming a more prominent and influential position in education, educational games such as EASYMATH2U can be beneficial for students and an attractive source of revenue in education. The responses from students following their experiences with the game are favorable, which is promising for the ongoing development and integration of this educational game into their lessons.

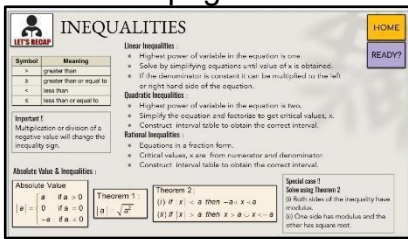
Table 1: Flowchart of EASYMATH2U demonstration.



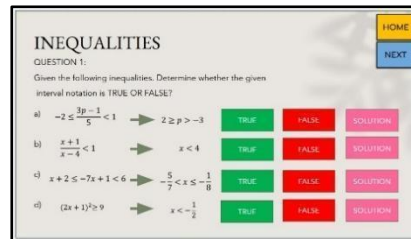
The front cover of EASYMATH2U includes the introduction. Users may start the game by clicking the "CLICK HERE" button, which leads to the topic selection page.



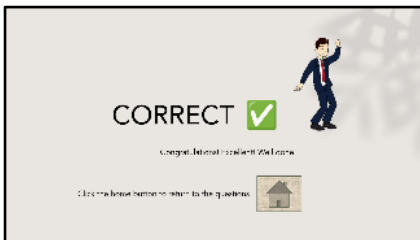
The navigation page with the list of available topics. Users can click on any one of the topics of their preference. To terminate the game, users can click on the "END" button.



A sample of a note page from the topic "Inequalities." Users can click on the "READY" button to start answering some questions after a quick revision here, or click the "HOME" button to return to the navigation page.



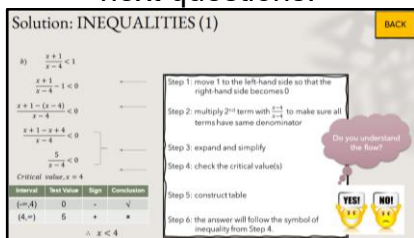
A sample of a question page. Users can select either "TRUE" or "FALSE" in response to each question. A "SOLUTION" button will show the answer to the question, while the "HOME" button will redirect users to the navigation page, and the "NEXT" button will take users to more questions.



The page here displays the "CORRECT" notification when the question is answered correctly. Then the users can click the "HOME" button to answer the next questions.



The page here displays the "WRONG" notification when the question is answered incorrectly. Then the users can click the "HOME" button to answer the next questions.



A sample of a solution page is shown when users click on the "SOLUTION" button to review a detailed step-by-step answer to the question.



The game has reached its conclusion. Users can replay the game by clicking the "CLICK HERE TO START OVER" button. It will redirect them to the navigation page.

EASYMATH2U was registered with the reserved copyright certification at the Intellectual Property Corporation of Malaysia dated 18 August 2023. Since its introduction, EASYMATH2U has achieved remarkable recognition. It has participated in three innovation competitions by far. In November 2023, EASYMATH2U was awarded the Gold Award at the International Competition on Sustainable Education (SUSED 2023). The year 2024 shows EASYMATH2U again crowned the Gold Medal at the Virtual Innovation Competition (VIC 2024). In July of the same year, EASYMATH2U received a Silver Award in the International Teaching Competition (iTAC 2024) and published one e-proceeding entitled “EASYMATH2U: Interactive Learning for Mathematics Education”. These accolades affirm the value and potential impact of this innovation in advancing digital education.



Figure 5: Certificate of SUSED 2023.



Figure 6: Certificate of VIC 2024.



Figure 7: Certificate of iTAC 2024.



Figure 8: Link to access EASYMATH2U.

EASYMATH2U is the beginning of something more amazing, especially if it can adopt AI technology. In the future, the game could be improved by including more topics and questions. Future enhancements could also include integrating artificial intelligence for personalized feedback and expanding the content to cover a broader range of subjects and difficulty levels. Furthermore, EASYMATH2U can also be enhanced by including a video demonstration or a simulation, which can further help students to understand a certain topic and be a digital teacher or tutor to facilitate the students. Looking ahead, EASYMATH2U can evolve further to meet the growing demand for advanced learning tools. With these improvements, EASYMATH2U could become a comprehensive digital platform that not only supports independent learning

but also serves as an effective teaching aid. Hopefully, this noble effort will benefit all involved and achieve the targeted objectives.

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THE ROLE OF ARTIFICIAL INTELLIGENCE (AI) IN CYBERSECURITY: THREATS AND DEFENSES

PALANIAPPAN SHAMALA, MURUGA CHINNIAH

Introduction to AI in Cybersecurity

Artificial intelligence (AI) is changing cybersecurity by making both attack and defence tactics stronger. Cybercriminals take advantage of AI to come up with smarter threats. Industries are deploying AI-powered security tools to discover threats, prevent them, and respond to them. To protect systems and lower hacking risks, AI plays an important role. We could say it is now more important than ever to protect against these risks.

Cyber-attacks are increasingly smarter and more harmful to people. In view of this, it's hard for us to rely on old-fashioned security measures to remain up. This highlights the requirement of AI-powered systems for real-time threat detection and response. AI improves safety by automating important tasks, lowering human error, and using machine and deep learning to find threats more accurately. AI can look at huge amounts of data to predict attacks. This prowess plays a big role in helping organizations strengthen their defences before any breach occurs.

AI-Driven Cyber Threats

AI is involved in all sophisticated attacks today. Attackers use AI to find new ways to attack, and in that sense, AI has undoubtedly made cyber threats more sophisticated. However, what about the threats that AI itself creates? Alas, even within the topic of AI-driven attacks, some experts see them mainly to automate killing in cyberspace. For instance, with or without AI, some automated programs scan the entire Internet looking for weak systems; when they find them, they alert other automated programs to make up a bot army that can take down the targeted system.

Attacks based on advanced artificial intelligence, such as Deep Locker, show the risk potential of highly targeted and evasive threats. To protect against these evolving threats, organisations must invest in AI-powered cybersecurity solutions that can make sense of the large amount of data we throw at them, identify the chatter in our data which means something bad is about to happen, and do it all in real time if we expect to stop tomorrow's threats today. Despite the discussions over the years, AI is not the answer, or the only answer, to all our cybersecurity problems. Here are some keyways AI is being used maliciously against us.

I. Automated Attacks

Hackers are using AI to create phony emails that have the appearance of genuine emails, thereby making them more difficult to identify. AI-driven malware is not just smarter, but is also working in tandem with the bad actors it was created for. These "smart" malware programs are learning how to evade normal cybersecurity measures and are getting better at doing so. This permits hackers the audacity to carry out complex attacks with far less effort than they used to have to expend.

Table 1: Summarising Five Major Types of Automated Cyberattacks

Attack Type	Description	Problem Caused
AI-Powered Phishing	AI generates personalised phishing emails that mimic human communication styles.	Increases the success rate of phishing attacks, leading to unauthorised access to sensitive information.
Deepfake Impersonation	AI creates realistic fake audio or video to impersonate trusted individuals.	Facilitates fraudulent activities and unauthorised disclosure of confidential information.
AI-Enabled Malware	Malware uses AI to adapt and evade traditional security measures.	Compromises systems by avoiding detection, leading to prolonged breaches and data theft.
Supply Chain Attacks	Cyberattacks target vulnerabilities in third-party vendors to infiltrate larger networks.	Breaches through trusted partners compromise multiple organizations, causing widespread data breaches.
Bad Bots & Review Bombing	Automated bots perform malicious activities like posting fake reviews to damage reputations.	Undermines trust in online platforms and manipulates public opinion, leading to reputational damage.

II. Deepfakes

AI can successfully impersonate anyone, making fake video and voice recordings of them. These recordings can - and are - being used to defraud people into making fake payments or giving them private information. They are used to pull off phone scams, trying to get people to do things they would not do if they knew who they were really talking to. They also make fake video conferences that look like the real time. Businesses are taking on more risk as deepfake technology gets better. To stop this, companies need to make their protection better. They should use strict name verification and more than one way to prove who they are.

Table 2: Summarising Five Major Types of Deepfake Attacks

Attack Type	Description	Problem Caused
Audio Deepfake Fraud	AI-generated voice mimics individuals to deceive victims into transferring money.	Leads to financial losses due to fraudulent transactions.
Attack Type	Description	Problem Caused
Fake Job Interview Scams	Deepfakes are used to impersonate job candidates or employers in video calls.	Misleads employers or applicants, leading to identity theft or hiring fraud.

Political Disinformation	Deepfakes depict politicians saying or doing things they never did.	Erodes public trust and undermines democratic processes.
Corporate Impersonation	Deepfake videos or audios impersonate executives to authorise fraudulent activities.	Results in significant financial and reputational damage to organisations.
Cyberbullying via Deepfakes	Manipulated media is used to harass or embarrass individuals online.	Leads to emotional trauma and social withdrawal among victims.

III. Social Engineering

Criminals use AI to sift through the public profiles of social media users. They take the time to understand the users and their unrivalled personal details. They then proceed to make custom-fit digital cons that are indistinguishable from reality and that use the kind of language, inside jokes, or references that only the users and their close friends would understand. If you have ever considered that your Facebook page is too revealing, you are beginning to understand the implications.

Table 3: Summarising Five Major Types of Social Engineering Attacks

Attack Type	Description	Problem Caused
Phishing	Attackers send deceptive emails to trick users into revealing sensitive information.	Leads to unauthorised access to personal and financial data, causing identity theft and financial loss.
Pretexting	Attackers create a fabricated scenario to persuade victims to divulge information.	Compromises confidential information, leading to data breaches and privacy violations.
Baiting	Attackers offer something enticing to lure victims into a trap.	Results in malware infections and unauthorised access to systems.
Tailgating	Unauthorised individuals gain access to restricted areas by following authorised personnel.	Leads to physical security breaches and potential theft of sensitive information.
Quid Pro Quo	Attackers promise a benefit in exchange for information or access.	Exploits human curiosity or greed, leading to compromised systems and data loss.

AI in Défense Strategies

AI is transforming cybersecurity works by making it simpler for experts to discover threats, fix problems, and minimise risks. Artificial intelligence (AI) is transforming cybersecurity by finding threats quicker and more accurately, automating responses, and making risk management better across digital infrastructures. AI technologies such as machine learning, deep learning, and natural language processing can analyse vast amounts of data in real time, identifying subtle patterns and anomalies

that may indicate cyber threats, including advanced persistent threats, zero-day vulnerabilities, and phishing attacks. These capabilities allow security teams to proactively address issues and adapt to evolving attack methods, often outperforming traditional security measures. AI-driven systems also support automated incident response and behavioural analysis, reducing the burden on human analysts and enhancing overall security posture. Here's how AI is changing safety today:

I. Threat Detection and Predictive Analysis

Artificial intelligence helps to identify cyber dangers by looking at data for unusual trends and managing to accurately estimate the likelihood of assaults. Machine learning improves its capability to handle new hazards. Artificial intelligence also reduces false alarms and double-checks data to ensure it is correct. Real-time tracking helps prevent intrusions by identifying and reporting unusual activity. Organisation that employs AI to safeguard critical platforms in Malaysia are CyberSecurity Malaysia, TM, and MCMC.

Table 4: Examples of Threat Detection and Predictive Analysis initiatives in Malaysia

Initiative	Description
Cybersecurity Malaysia's Tableau-Powered SOC	Utilises Tableau analytics to swiftly identify cyberattack patterns and profile threat actors across various industries.
AI-Driven Threat Detection for Critical Infrastructure	Implements AI systems to monitor and protect essential services like power grids and water supply from cyber threats.
Coordinated Malware Eradication and Remediation Platform (CMERP)	A national system developed to automatically detect and alert organisations about malware threats.
Zero Trust Architecture with AI Integration	Combines Zero Trust security models with AI to continuously verify and monitor access, enhancing predictive threat detection.
CyberSecurity Malaysia's Threat Intelligence Dashboards	Employs data visualisation tools to analyse threat patterns and predict potential cyberattacks across sectors.

II. Incident Response and Automated Security Systems

AI is very important for quickly and effectively reacting to cyber threats because it automates security actions to limit damage. AI-powered incident response and automated security systems leverage artificial intelligence and machine learning to speed up threat detection, analysis, and response, minimising human intervention and improving security posture. These systems analyse vast amounts of data, identify patterns, and automate predefined actions to contain and mitigate incidents. AI enhances incident response automation by reducing human intervention, increasing response speed, and improving accuracy.

Table 5: Examples of AI Incident Response and Automated Security Systems

Initiative	Description
Automated Response Systems (ARS)	It can immediately isolate compromised systems, block malicious IPs, and alert cybersecurity teams, preventing threats from spreading.
AI-driven forensic analysis	It examines attack patterns, helping security teams understand the nature of a breach and improve future defences.
Automated threat mitigation	It allows AI to take instant action, such as quarantining infected files, revoking access to compromised accounts, or forcing password resets.
Self-learning AI security frameworks	constantly evolve by analysing new cyber threats, ensuring they can respond to emerging attacks in real time.

Challenges and Ethical Considerations

AI presents both exciting opportunities and significant ethical challenges. Key concerns include bias in algorithms, privacy violations, lack of transparency, and the potential for misuse. Ethical frameworks and responsible development practices are crucial to mitigate these risks and ensure AI benefits society as a whole. Despite AI's countless advantages to cybersecurity, it does come with certain threats that businesses must mitigate to make sure it is used ethically and productively.

Table 6: Challenges and Considerations

Challenges	Description
Bias in AI Models	Training data teaches artificial intelligence systems. AI can aggravate data prejudices. This can misinterpret user actions as threats. Unfixed bias makes AI discriminatory and untrustworthy. Companies must use various data, assess AI decisions, and update models to stay away from this.
Privacy Concerns	AI security monitors user activity for threats, but it also poses privacy concerns. Tracking may become unethical in the absence of transparency. Clear policies and privacy-focused technologies, such as encryption and anonymisation, assist in the reconciliation of individual rights and security.
Lack of Transparency	Many AI algorithms are complex and difficult to interpret, making it hard to understand how they make decisions and identify potential biases or errors.
Accountability	Determining who is responsible when AI systems cause harm or make mistakes is a complex issue.

Misinformation and Manipulation	AI can be used to generate fake news and manipulate public opinion, potentially exacerbating social divisions and interfering with elections.
Job Displacement	Automation driven by AI can lead to job losses in certain sectors, requiring workforce adaptation and retraining initiatives.

Case Studies and Real-World Applications

AI is playing a crucial role in strengthening cybersecurity, which is being used by several companies to detect and prevent threats, improving cybersecurity.

Table 7: AI implementation by several companies

AI in cybersecurity	Description
Darktrace	Uses self-learning AI to detect and respond to cyber threats autonomously. Monitors network activity in real-time and adapts to emerging threats.
Microsoft's AI for Cybersecurity	Scans 6.5 trillion signals daily to detect and block cyber threats. Integrates AI-driven threat intelligence to enhance global security.
AI-Generated Phishing	Cybercriminals use AI to create highly convincing phishing emails. These emails mimic human writing, making them harder to detect.

Conclusion

AI is transforming cybersecurity by enabling both advanced threats and stronger defences. Organisations must integrate AI to protect systems, data, and users. AI's real-time threat detection and response help contain cyber incidents quickly. However, continuous updates and ethical use are key to staying ahead of evolving risks. AI-driven technologies, such as threat detection, automated response systems, and predictive intelligence, allow security professionals to stay ahead of evolving threats and create a safer digital environment.

AI is a transformative technology that will continue to reshape our world, offering numerous opportunities and challenges across various fields. Its integration into education, business, and research has the potential to enhance efficiency, personalise experiences, and address complex problems. However, responsible development, ethical considerations, and on-going engagement are crucial to ensure that AI benefits society as a whole and minimises potential negative impacts.

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BIG DATA HARMONISATION FOR ENHANCED EFFICIENCY IN REAL-WORLD APPLICATIONS

SITI HAJAR BAHARIN, SITI NUR SHAHIRA DAHARI,
NURFAIZAH KAMARUDDIN, RABIATUL ADAWIYAH KAMARULZAMAN

Introduction

Over four hundred million terabytes of data are generated daily. In the modern era, managing information from various sources poses a challenge because of its scale and speed (Marr, 2016; IDC, 2021; Muhammad, 2025). In 2024, for instance, there were roughly 5.9 million Google searches, 16,000 TikTok videos uploaded, and over 3.4 million YouTube views per minute, according to Eaves (2025). This sets new boundaries for businesses given the amount of semi-structured, unstructured, or structured data gathered from social platforms, machines, or transaction-based systems using traditional tools. Paying via apps, airline check-ins, and even medical record-keeping enable Internet of Things (IoT) devices such as smartwatches to gather valuable stream data online. The biggest blocker in such cases is the heterogeneity that big data presents because it includes numerous frameworks where standards, along with their accompanying qualities, are disparate. When experts are provided with vast amounts of fragmented information due to gaps created by silos or incompatible formats within data separated into chunks without any relation to each other's reference system, they become "blind and deaf".

Without harmonisation, huge unexplored datasets lose their potential insights and analysis due to fragmentation alongside inconsistency problems which arise when attempting to combine differing standards or extracts of sets sharing no relations with one another but claiming to hold value without comparability. Therefore, this paper focuses on exploring core capabilities of big data by unlocking extra layers of everyday applications through proper implementation which gradually unfolds when advanced techniques are applied for turning raw datasets ready to be processed into priceless treasures exhibiting knowledge (SAP, 2023). Intelligent and tailored functions of everyday domains such as fitness coaching, smart transportation, entertainment streaming, and online shopping recommendations are examples of where synergised big data is applied. Big data harmonization issues include differing data formats, integration difficulties, inconsistent data quality, and concerns over privacy. This paper outlines strategies detail best practices that address these challenges and still reach the conclusion that big data harmonisation will persist as a cornerstone process in the artificial intelligence (AI) and big data era, enabling more effective data-driven applications.

Big Data: Definition and Sources

Big data indicates data sets which are extensive, intricate, and diverse. They pose significant challenges to traditional tools used for their storage, retrieval, and processing. Expanding on the understanding of big data resulted in increasing the number of its "Vs", describing its composed features from 42 Vs (Shafer, 2017) to 51

Vs (Khan et al., 2019), with its additional ones being: veracity, variability, visualisation, value, and viability, accentuating its importance concerning its impact around a given organisational structure. Understanding big data requires identifying its primary sources which include:

- *Participation of Users and Social Platforms:* User participation through social applications like Facebook and Instagram creates vast repositories of unstructured information as a result of user engagement, thus creating high-volume bulk data while also accelerating (velocity) trends that underpin behaviours.
- *Transactional Data:* This encompasses information contained within traditional/online transactions such as banking systems or e-commerce websites which hold paramount importance towards business analytics, revealing economic trends alongside purchasing patterns.
- *IoT and Machine-Generated Data:* Classification of machine-generated data has become rampant owing to internet-inclined devices, culminating to collection of incessant streams of useful information which greatly contributes towards big data across sectors.
- *Media, Communications, along with Metadata Telecommunication companies* aided through large-scale user-financed telecasting services coupled with telecom companies gathering metadata, have greatly contributed towards the making of (Internet) big /large data through streaming file outputs creating meta reports retrievable by analysing datasets brimming in size. (This bulleted point is not using the same structure as the other 4 bulleted points where for the other 4 the structure is a phrase + colon (example: Open Data and Public Records:))
- *Open Data and Public Records:* Government and scientific organisations provide public datasets that can be combined with commercial data for insights, such as predicting traffic patterns using weather data.

Combining privately held information with publicly available datasets released by government agencies or scientific bodies offers valuable analytical insights (Patrizio, 2018). A commercial dataset, for instance, might allow estimation of traffic congestion by integrating weather conditions. The increasing adoption of IoT devices will lead to the generation of copious amounts of data. It is estimated that the global datasphere will increase substantially in size. Much of this data is heterogeneous and unstructured, resulting in challenges when attempting conventional analyses. In the next section, we will define big data harmonisation and discuss why organisations need it to gain actionable insights. In the absence of appropriate harmonisation techniques, an organisation could risk having plenty of data but little insight (Davenport, 2014)

The Big Data Harmonisation Concept and Its Significance

The procedure of aligning, standardising, and integrating data from different sources into a coherent dataset with a unified format and meaning is referred to as big data harmonisation. Disparate data is transformed into a "single version of truth" that can be examined analytically (Katal et al., 2013; Muhammad, 2025). This often entails merging datasets with regard to their historical context, cleaning and validating the data, reconciling units or terms discrepancies, and mapping disparate schemas into one canonical schema. In other words, data harmonisation creates reproducible processes concerning diverse datasets. Decades-old concepts in data warehousing such as Extract, Transform and Load (ETL) are still relevant today – though, because

of the colossal scope in our era's 'big data,' there is an unparalleled need for meshing disparate systems (Inmon, 2005; Kimball & Caserta, 2011).

Data harmonisation is often described as a prerequisite for organisations that wish to gain anything substantive from big data. By normalising formats and clarifying overlapping terminology, the process stifles inconsistency at its source and yields an analytics-ready dataset. Once the data is attended to in this way, dissimilar streams can be fused without the usual mismatch headaches, giving analysts a single canvas from which actionable insights emerge. An additional dividend is the lift that harmonised data gives to decision-making quality. When disparate sets are meshed correctly, predictive models benefit from a fuller picture, resulting in forecasts that command greater managerial confidence. Efficiency also improves because teams spend less time on cleanup and can redirect that time toward interpretation or strategy. Modern applications – including AI-driven content curation and instant fraud alerts – demand data sets that align flawlessly. Harmonised repositories let scientists launch machine-learning pipelines or visualisation dashboards without pausing to fix column names or bridge timestamp gaps, a chore that otherwise steals time from experimentation (IBM, 2023). This seamless infrastructure underwrites breakthrough uses such as risk forecasting in healthcare and individualised marketing nudges that respond to shifting user behaviours in real time. In brief, data harmonisation reconverts the disorder of raw input into a structured, trustworthy resource, opening the door for deeper insights and quicker action across research, operations, and strategies. When firms standardise and weave together data drawn from disparate streams, they protect the integrity of their numbers and still sharpen both decision-making and the performance of artificial-intelligence models. The resulting pool of harmonised big data turns into a powerful asset that, in everyday use, energises creative thinking, boosts productivity, and enables finely tuned customisation.

Applications in Daily Life Enabled by Big Data Harmonization

Big data harmonisation has fundamentally changed the way information is shared and exploited across disciplines as diverse as retail, medicine, urban transport, and streaming culture. By pooling and dissecting enormous, often heterogeneous volumes of incoming data, contemporary platforms can customise their offerings for single users while still scaling to millions of accounts. The world of online retail provides a conspicuous illustration of this trend. Companies such as Amazon, Shopee, and TikTok Shop harvest minute-by-minute logs of clicks, cart additions, and checkout completions, then shove that ocean of behaviour into recommendation engines designed to surface the products each shopper is most likely to love.

Another layer of complexity enters when marketers leverage the same unified datasets for customer segmentation. Activity recorded on a website, appended to a Customer Relationship Management (CRM) profile, and sometimes even observed in a brick-and-mortar store can be rapidly blended, after which algorithms scour the hybrid dataset and automatically generate messages like “you might adore these sneakers, since you picked up similar one’s last month” (McKinsey, 2013). Those tailored nudges can appear as personalised subject lines in email, fresh hero images on a homepage, or even dynamic signage beside the cash register.

In recent years, mobile health- and activity-monitoring software has become almost ubiquitous, thanks in no small part to the popularity of wrist-worn fitness trackers and

smartwatches. Each of these devices records an array of personal data: daily steps, walking distance, caloric expenditure, resting heart rate, length and quality of sleep, exercise logs, food intake, and any weight fluctuations, thereby allowing the wearer to view nearly every facet of their lifestyle at one glance. A growing number of smartphone applications themselves, whether developed for iOS or Android, now pull and standardise this information through frameworks such as HealthKit or Google Fit, which let users see a unified snapshot even when the raw data originates from different gadgets.

By aggregating timestamps, location information, and biometric readings next to electronic medical files, the software has enough context to offer actionable recommendations customised for an individual. When, for instance, the system notices someone has neglected to meet a self-set step goal for five consecutive days, it may send a friendly reminder or nudge telling them to take a brief stroll, thereby turning raw numbers into tangible encouragement. Another recurrent practice in contemporary fitness software is the historical personalisation of exercise targets. An individual who declares an intention to shed pounds might be presented with a bespoke caloric deficit after the app surveys months or even years of logged steps, workouts, and food intake. Such a retrospective framing is demonstrably more productive than the cliché one-size-fits-all menu, chiefly because the advice feels timely rather than generic. The recommendation lives inside the user's biography, quietly recalibrating as new entries arrive.

Population-scale datasets permit health tech firms to spot collective rhythms hidden beneath thousands of private journals. Engineers harvest signals that reveal when most people run, when they drift into light sleep by age group, and how chilly winter air nudges activity levels downward around mid-January. Those emergent patterns then redirect algorithmic engines, so community-wide challenges land in participants' inboxes precisely when they are most inclined to play. Wearables maintain the pulsing drumbeat of vigilance, chirping warnings when erratic heart behaviour suggests that a brief medical check may no longer be optional.

Incorporating personal health information into mobile technology routinely empowers individuals to make evidence-based lifestyle choices. Many contemporary fitness platforms assume the role of a behavioural coach, adapting workouts to the rhythms of daily life and personal growth. Analyses consistently demonstrate that feedback tailored to a user's unique journey correlates with higher engagement, steadier exercise habits, and statistically significant gains in health markers. Parallels exist in the transportation sector, where applications such as Google Maps and Waze form the public face of big data integration. These services collate location signals, historical congestion patterns, and crowd-sourced incidents to recommend the quickest available route. The same datasets enable moment-to-moment re-routing suggestions that sidestep newly reported jams that would otherwise ensnare drivers. Such real-time adaptability emerges only when robust datasets are matched with automated vehicle controls that permit instantaneous route adjustments.

Researchers have long experimented with mash-ups of transit data to streamline the end-to-end journey. A rider might first drive to a suburban park-and-ride lot, then board a rail service whose timetable is mixed with updated road and platform conditions. An app such as Moovit – or even the more familiar Google Maps – will display the next bus, live tracks, and the odds of missing a connection, because each draw from GPS beacons, dispatcher feeds, and third-party partners that most users never see. The big data overlay alters everyday commuting in plain sight. Smartphones coach drivers

around trouble spots and shave minutes off fuel bills, which offers immediate gratification from the user. When a critical mass of motorists follows that guidance, the ripple effect can unclog arterial streets, even when the original road footprint remains fixed. Planners also benefit: anonymised bid-data packets that Google dispatches back to municipal traffic managers highlight persistent bottlenecks, nudging engineers toward timely interventions.

App-based taxi and courier platforms frequently rely on big data harmonisation to operate effectively. Companies such as Uber and Grab continuously ingest location pings from their drivers, incoming requests from passengers, live traffic feeds, and user star ratings in order to gauge the best possible driver-passenger pairing at any given moment. By blending that geospatial output with stored customer profiles and earlier trip histories, dispatch systems can refine routing, trim average wait times, and balance supply-and-demand pressures. Put simply, the transportation sector's embrace of these data integrations has given rise to what is often called smart mobility, an arrangement that empowers travellers to reach their destinations more directly while prompting platforms to respond to demand spikes with unusual agility.

Streaming platforms have become the public face of big data in daily life. Netflix, YouTube, and Spotify quietly harvest what you watch, how long you linger, and even what you skip in order to nudge a fresh recommendation onto your screen. Netflix, for example, quietly logs every pause and rewind, every click that hovers just long enough to light up a title card. Those individual moves are stitched together with genre tags, actor lists, and thematic keywords already attached to the film or show. The system then compares your profile with the profiles of thousands of viewers who share similar habits – a look-alike clusters – and arrives at the next watch that feels both novel and eerily familiar.

In addition, Netflix often displays multiple thumbnail images for the same film, and which one appears first can depend on whether you usually queue light-hearted rom-coms or weightier period dramas. The company credits these small nudges to its analytics engine, estimating that automated suggestions, not user searches, account for roughly 75 to 80 percent of what people wind up watching. Many music platforms repeat the playbook in sound. Spotify and Apple Music, for instance, log every track you play, skip, or save, then flag the time of day and playlist genre to predict your next listen. Meanwhile, YouTube composes its autoplay line-up from a symphony of personal and collective data, weighing Terms of Service, likes, dislikes, watch time, and the viewing habits of millions in real time. The next video that loads is not random; it reflects a global memory bank that has, for better or worse, learned exactly what tends to hold a specific account in place. TikTok's For You feed operates under much the same logic; whenever the user pauses, swipes, or rewinds, those tiny signals are swept into an internal model that assembles the following clip with almost frantic precision.

Issues and Suggestions

Large-scale data-gathering enterprises constantly stumble over the absence of an agreed-upon framework, a shortfall that forces analysts to wrestle with the messy job of aligning widely scattered information. In everyday practice, mismatched schemas, divergent semantic interpretations, and tightening ethical mandates stack the odds against seamless integration. Experts recommend starting with a ranked domain hierarchy that lays out a single logical model for the material in hand because doing

so creates obvious way-points for capture controls and clarifies the paths between raw source records and the destination dataset.

Artificial-intelligence routines provide another line of attack by dynamically adjusting dependency allowances wherever fields go missing, a trick that adds surprising flexibility and broadens usability. Between any two systems, quick-turn statistical recipes, machine-learned retrievals, and self-tuning semantic frames can form a scaffolding that keeps processing afloat. Tightening practical uniformity also hinges on small details: everyone gains when date-time stamps, measurement units, and code vocabularies settle into agreed formats. Pairing those habits with a living data dictionary and a sturdy Master Data Management layer gives routine inconsistencies a much smaller target. Finally, bringing all original data authors into the conversation up front and asking them to follow shared rules can slash the variety of problems originating before the data ever leaves their source.

Quality-related data issues

Large datasets are often plagued by hidden quality problems, such as typos, duplicates, and rogue outliers. Even a few bad entries can trick experts into drawing misleading conclusions. One way to catch these lapses up front is to build multi-step pipelines that automatically harmonise and validate the incoming data. Rule-based flags, including regular-expression checks, will signal empty fields or unexpected formats. Machine-learning routines can add a second layer by spotlighting values that simply don't belong. Documenting where each data set comes from and what paired with a distributed Not only Structured Query Language (NoSQL) store on the cloud. That elastic architecture lets teams beef up processing power during traffic spikes and dial it back when the rush fades. In a widely distributed environment, mismatched copies of the same record can snowball into full-blown consistency crises. Techniques like two-phase commit, idempotent updates, and aggressive retry handling act as safety nets. Investing in scalable integration layers that absorb incoming volumes smoothly pays dividends in long-term stability.

Anytime identifiers cross systems, the risk of leaking personal information rises. Harmonising

transformations it has undergone allows analysts to weed out any tainted batches. In practice, keeping validation thresholds a bit loose tends to raise the overall reliability of reported numbers.

Real-time data streams pour in at odd hours and in unpredictable volumes, so working with them can chew through hardware and network limits quickly. The classic ETL grind slows to a crawl when update windows shrink to seconds instead of hours. Frameworks such as Hadoop MapReduce or Apache Spark help, especially when schemas and aggregating profiles may expose more than analysts intended, sparking both legal and ethical alarms. Strong encryption and strict access controls must run alongside the technical measures to protect the individuals behind the numbers. Laws such as the General Data Protection Regulation (GDPR) in Europe and Health Insurance Portability and Accountability Act (HIPAA) in the United States impose tight restrictions on how organisations collect, store, and share personal data. To remain compliant, many firms now bulk-up governance policies, lock down user permissions, and use encryption to mask data while it is in use. Before any two databases are joined, privacy-impact assessments force architects to

confirm that existing consents still cover the new purpose. Layering data, anonymising names, and keeping detailed logs of every transformation step help create an auditable trail, while federated analysis lets researchers compare algorithms without moving the original data out of its home system.

Many organisations get stuck because departmental silos keep engineers, analysts, and compliance officers from speaking the same vocabulary. Training programmes that boost digital literacy and short-term hires who build prototype pipelines can break that logjam. Senior stewardship teams then have to rally the groups around a shared vision, push user-friendly tooling, and keep technical jargon to a minimum. Giving everyone permission to treat information through a single corporate lens, even staff with limited SQL experience, reduces the friction that often slows projects. Data landscapes do not remain still for long; fresh feeds, updated schemas, and changed Application Programming

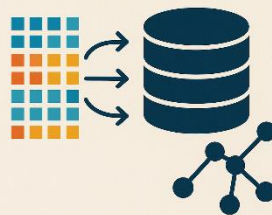
Interface (APIs) arrive in weeks, even days.

Institutions committed to responsive data stewardship tend to draft explicit maintenance protocols paired with visual release notes that signal consumers about schema updates.

Automated daemons then sift through each data river, comparing live flows against established baselines and sounding alerts when stray patterns disrupt normalcy. Modular architectures let developers bolt on new features without gutting older components, yet the ground rules that unite these modules – namely, those governing quality, privacy, and security – demand

regular reassessment to stay relevant. When these practices align, disparate data sets can pool in a single store with surprisingly little human intervention, clearing the way for robust analytics, machine-learning experiment, and the day-to-day decision-making that keeps the enterprise nimble.

BIG DATA HARMONISATION FOR ENHANCED EFFICIENCY IN REAL-WORLD APPLICATIONS



Conclusion

As previously mentioned, the processes necessary for big data integration are restructuring disparate, unorganized big datasets into useful information. Integration and synchronisation of separate datasets is crucial in order for different organisations to gain recognition through improved dealings with customers. These advancements are supported by AI systems extended over the Internet, with social media data helping to refine enterprises' technologies. When incorporated into a business, better data-driven insight leads to better decisions that allow innovation to flourish, which will eventually give a competitive edge when harnessed properly. It can allow a huge shift in added value from one business to many other participants, enabling the appropriate allocation of economic resources. This also impacts overall marketing operations, thus optimally rendering services where they are most needed and useful without value distortion. This process refines customer satisfaction through faster billing, a better gauge on usage pattern and the establishment of integrated responsive systems

This paper examines the persistent obstacles surrounding big data harmonisation, focusing in particular on data quality, system scalability, and privacy. It argues that uniform data standards, paired with robust ETL processes and machine-learning

techniques, can cleanse and merge disparate datasets; strong governance frameworks, backed by advanced security measures, are equally vital to safeguarding sensitive information. Meeting these hurdles is not an afterthought; organisations must allocate resources up front to tools, qualified personnel, and clear policy roadmaps if they hope to capture enduring value. Personalisation sits at the heart of any responsive application, allowing systems to ingest real-world signals and adjust behaviour almost in real time. As new waves of technology – the Internet of Things, smart cities, and generative artificial intelligence – pour ever larger volumes of data into the mix, the case for harmonisation grows increasingly clear. Seamless integration enriches everyday life, offering context-aware nudges, instant insights, and predictions that feel both timely and relevant. When executed with care, the harmonisation project does more than streamline workflows; it becomes an engine for innovation, unlocking latent value while still honouring privacy and quality standards.

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