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Characteristics of ChatGPT use by university students in African countries

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The emergence of ChatGPT has brought one of the latest surprises in artificial intelligence. This study examines how students use ChatGPT and whether usage patterns differ depending on the level of information and communication technology (ICT) development. A total of 2297 university students from nine African countries participated in an online survey, and the data were analyzed using descriptive statistics and structural equation modeling (SEM). The results show that although ICT development influences opinions about ChatGPT, actual usage levels do not differ significantly between more and less developed countries. Significant differences can be observed between genders and fields of study, and particularly in Zimbabwe, where students had extremely positive opinions. They primarily rate the importance of its use higher in their own field of study. It has a positive impact on analytical and problem-solving thinking, communication skills, and labor market changes. The study highlights the role of digital infrastructure and regulatory readiness in the spread of AI education and emphasizes the need for inclusive AI strategies in African higher education systems.

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Introduction

The history of artificial intelligence dates back to ancient times, although its development has not been uninterrupted: there have been ups and downs. The pace of development has lagged what we are seeing today. Due to space limitations, we will illustrate this development path with a summary diagram, (Fig. 1) which will serve as a basis for further discussion in this study.

ChatGPT is one of the best-known applications of artificial intelligence (AI), specialising in natural language processing (NLP) (Novak, 2025). It has been specifically optimized for interactive dialogue modeling and was made available to the public in November 2022 (Alawida et al., 2023; Fuchs, 2023). ChatGPT and similar language models are evolving at an incredibly fast pace and are already shaping the digital world in a major way (Ilieva et al., 2023). They are expected to continue to play a key role in the development of AI, dominating a wide range of applications and uses (Ausat, 2023). Users can choose from a wide range of solutions when looking for support for their work. Among the largest and most innovative language models are Copilot, Gemini, Grok, DeepSeek, and ChatGPT as AI assistants and chatbots. Copilot is an intelligent code writing support tool. Gemini aims to provide high-level language understanding and natural language generation while leveraging Google's vast database and search technologies. Grok is one of the newest AI models. It differs from other large language models in that it integrates social media data and user behaviour into the generation of responses. DeepSeek is unique in that it not only searches for information on the Web, but also performs deeper analysis and is capable of processing longer, more complex data. ChatGPT is a leading genMI application globally and in Europe, used by 79% of organizations in Europe (Novak, 2025). The market distribution according to Jaspreet (2025) research is illustrated in Fig. 2 below.

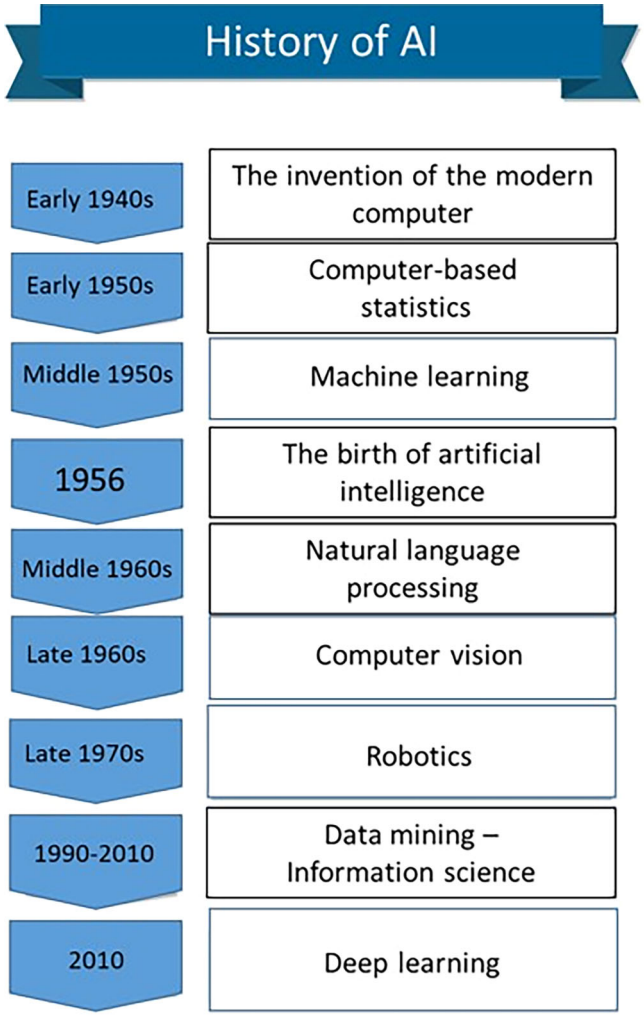


Fig. 1 History of AI. Source: own construction based on Toszegi, 2019.

The models mentioned above are capable of performing various tasks, but it is important to consider security and ethical issues as well as the specific task at hand when using them. According to recent research, a large number of European companies prohibit the use of Grok and several other artificial intelligence models. This is due to data protection and licensing concerns (Netskope Threat Labs Report, 2025; Bandhakavi, 2025). In addition to chatbots, text-to-image generative AI solutions (e.g., Stable Diffusion, Midjourney, DALL-E) also offer popular options. They generate images based on instructions provided by the user. Such systems typically use deep neural networks that are capable of learning the relationships between the input text and the output image (Bereczki, 2025). Text-to-video AI generators offer another possibility. Sora, for example, is capable of creating realistic videos based on a few words. They work on a similar principle to text-to-image solutions, only instead of images, they create short videos. The solutions offered by artificial intelligence are developing at such a pace that it is no longer possible to keep up with the publication of scientific research. As mentioned above, this research examines attitudes and practices related to the use of ChatGPT as the most popular generative model (Novak, 2025).

The emergence of ChatGPT will have a major impact on business, technology applications, creative industries, legal and financial advice, healthcare and scientific research (Yu and Liu, 2022). It is playing a prominent role globally, along with other AI-based tools at various levels of education, and its use by both students and educators is growing unstoppably (Deng and Lin, 2022; Dempere et al., 2023). Some regions stand out while others are lagging in terms of adoption, due to available infrastructure, technological development and educational reforms. The US, Canada, Western Europe, Japan, some Latin American countries and Oceania are leading the way in the use of ChatGPT in education (Thomas et al., 2021). Other regions lag in their use, mainly due to the lack of a legal and ethical environment and the availability of technical and technological conditions. China has not allowed ChatGPT to spread, but local alternatives (e.g., Baidu AI or Tencent developments) offer similar functionalities. Finland, China, and India are increasingly integrating AI into their teaching and learning toolkits, where the integration of digital infrastructure and AI allows for rapid and widespread uptake. Other regions are only beginning to explore its potential (van Dijk and van Deursen, 2014). There are some countries where ChatGPT is unavailable or restricted. Beyond China, Russia, Iran, North Korea, Cuba, Syria, Afghanistan, Bhutan, the Central African Republic, Chad, Eritrea, Eswatini (formerly Swaziland), Libya, South Sudan, Sudan, and Yemen also prohibit its use (Jaspreet, 2025).

Looking at African countries (where its use is not prohibited), the spread of ChatGPT and other artificial intelligence-based technologies depends on IT development (as is the case in other countries). African countries with more developed digital infrastructures, better internet access and stronger technology ecosystems are integrating AI into education and applying it more rapidly and widely in other areas. South Africa, Tunisia and Egypt, for example, are at the forefront of AI adoption thanks to their IT infrastructures. In African countries with a lower level of

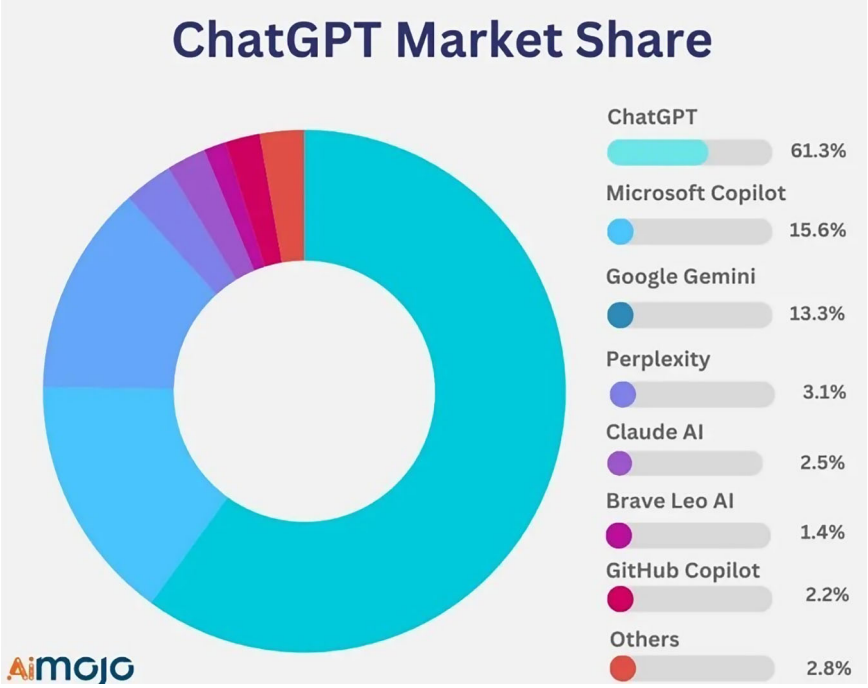


Fig. 2 ChatGPT market share. Source: Jaspreet, 2025.

IT development (Zambia, Zimbabwe, Cape Verde, etc.), the uptake of AI is slower due to poor internet connectivity, infrastructure problems and the digital divide. Furthermore, the use of AI, including ChatGPT, in African countries is significantly influenced by legal and ethical regulations, which in many cases are still evolving, lack institutional support, and are linked to technological developments, the social environment and alignment with international standards (Ademola et al., 2024; Chaka et al., 2024). The key to future development in these countries lies in data protection, thereby strengthening trust, implementing proactive measures, and developing ethical guidelines for use and international cooperation. The issue of institutional integrity is raised in several studies (Lancaster, 2025; Chukwuere and Handoko, 2024; Chukwuere, 2024). The recent publication by the African Union of the so-called White Paper provides guidance in this regard (Floyd and Goriola, 2024).

Academic research on the application of ChatGPT worldwide is still in its infancy, with most studies addressing the potential for applicability at a theoretical level (Alawida et al., 2023; Sekwatlakwatla and Malele, 2023; Wayi-Mgwebi and Wayi, 2024; Segooa et al., 2025). The most popular research focus is on ethical and legal implications (Yu and Liu, 2022). A few studies deal with the impact on education, which in this case are also stuck at the level of theory (Mhlanga, 2023). Some qualitative and case study-type research results are available, which focus primarily on the teaching and training tasks and opportunities of those involved (Tlili et al., 2023; Acquah et al., 2024; Opesemowo et al., 2024), while Ghanaian studies focus primarily on student characteristics and the attitudes of postgraduate students (Segbenya et al., 2023; Arthur et al., 2025; Sarfo et al., 2024; Opesemowo and Ndlovu, 2024). We can read about factors influencing students' behavioural intentions, perceptions of usefulness, social influence, innovation characteristics and the interactions between students' psychological needs (Ofosu-Ampong et al., 2023; Salifu et al., 2024). We did not find any specific research results on the opinions of young people, students and university students on the benefits of using ChatGPT, its contribution to their personal development and its impact on their job placement. The empirical studies reviewed do not address the question of how young people perceive models that can be applied in their practice, what the learning support opportunities offered by the models mean to them, the possible risks and future applications that may influence their labour market opportunities.

This research aims to investigate the extent to which university students' use of ChatGPT in African countries (more developed and less developed areas) depends on the level of information technology development and the existence of technical conditions. Research questions to be answered on the way to this goal:

- What are the experiences of university students in the African countries covered by this research regarding the use of ChatGPT?
- Is there a significant difference between the use of ChatGPT by university students in more developed and less developed areas?
- What do they think, can ChatGPT improve communication, analytical and problem-solving skills?
- What impact will using ChatGPT have on their future job opportunities?

In the following chapters, the literature review is followed by an analysis of the quantitative research data, a presentation of the results, and a discussion. The paper concludes with a chapter on conclusions.

Literature review

Characteristics of the African countries under study. As this paper presents a snapshot of the results from an international research study, which reflects the views of university students interviewed in 9 countries in the African region, it is necessary to briefly describe the countries and their education systems to facilitate the interpretation of the results and answer the questions.

Algeria is the tenth-largest nation in the world, with a population of 46 million (as of 2024), and the tenth most populous country in Africa. Its official languages are Arabic and Berber. In 2022, it had the 4th largest economy in Africa and the

9th highest standard of living in Africa. Algeria has 48 universities. Generally, students study for three years at the undergraduate level, two years at the master's level and three years at the doctoral level (Masri and Anderson, 2017). The country's first university was founded in Algiers in 1879. The Ministry of Higher Education and Scientific Research manages higher education.

Cape Verde, an island nation of Cape Verde, was discovered by Portuguese sailors in the 15th century. Cape Verde is an uninterrupted representative democracy, a developing economy since 2008 and one of the most advanced and democratic countries in Africa. Its location places it far from major economic markets. Cape Verde's higher education comprises university and upper-secondary vocational education. University education is provided at universities and non-integrated university schools. Universities and university institutes award bachelor's, master's and doctoral degrees, as well as higher vocational diplomas.

Egypt is a "Land of Opportunities" characterised by dynamic development, social transformation, opportunities and challenges. It is characterised by gigantic investments, a society in transition and huge economic development. Egypt is the fourth largest economy in Africa after DAK, Algeria and Nigeria. Its population has reached 107 million. Egypt's higher education system is extensive. Around 30% of Egyptians in the age group concerned attend university. However, only half of them obtain a degree. The Ministry of Higher Education oversees the level of higher education. The current education system comprises 27 (EgyptToday, 2023) public universities, 51 public non-university institutions, 27 private universities and 89 private higher education institutions. According to the Staff Writer, in 2019, the unemployment rate of university graduates reached 36.1%. Of this rate, men accounted for 25.1%, while women made up 53.2% (Staff Writer, 2020).

Ghana, a multi-ethnic country, has had one of the freest and most stable governments on the continent since 1993. It performs relatively well in health, economic growth and human development indicators. With nearly 35 million inhabitants, Ghana is the second most populous country in West Africa. Its economic plan is known as the "Ghana Vision 2020", which foresees Ghana becoming the first African country to become a developed country between 2020 and 2029 and a newly industrialised country between 2030 and 2039 (Ghana, 2020; West African Examinations Council, 2014). Upper secondary school lasts 3 years and leads to the West African Higher Secondary School Leaving Certificate, which is a prerequisite for enrolment in a university bachelor's degree. The Bachelor's degree requires four years of study. This can be followed by a one- or two-year Master's programme, followed by a PhD programme of at least three years (Independent Office of Evaluation of IFAD, 2012). The country currently has three recognised theological colleges, twenty university colleges, six teacher training colleges, ten polytechnics and nine universities, most of which are public institutions (Uzor, 2013). At the higher education level, the government provides more than 80% of the resources to public universities, polytechnics and teacher training colleges (Atuahene, Owusu-Ansah, 2013; Abdul-Jalilu, 2017).

Nigeria, the Federal Republic of Nigeria, is an independent country in West Africa. With a population of more than 220 million (Nigeria Population, 2023). Africa's most populous and the sixth most populous country on earth. Its economy is the largest in Africa. Because of its large population and economy, it is often referred to as the giant of Africa (Nigeria, 1959). Despite significant oil production, it is poor, ranks very low on the Human Development Index and is one of the most corrupt nations in the world. Nigeria has over 400 universities and colleges scattered across the country to make higher education easily accessible. Many of the universities are under federal control, and the language of instruction in all universities and colleges is English.

Tanzania, officially the United Republic of Tanzania, is located in East Africa, in the African Great Lakes region. The 2022 national census estimates its population at around 62 million, making it the most populous country entirely south of the equator. Despite its staggering poverty and basic agrarian nature, Tanzania is one of the African states that is undergoing slow but steady development. University education is the highest level of education in the country and includes undergraduate, graduate, postgraduate diploma, master's and doctoral degrees offered at public and private universities. To enrol in a university undergraduate programme, a prospective student needs to have completed upper secondary education or have a diploma in the relevant field. A bachelor's degree normally lasts at least 3 years, a master's degree 2 years and a doctorate at least 3 years. Despite the ICT investments made in the framework of the Science, Technology and Higher Education Project (STHEP) 2008–2014, the use of ICT in teaching and learning in higher education institutions is not adequate. However, investment in and capacity building in educational technologies is not in line with adoption (UNESCO, 2022).

Tunisia (Republic of Tunisia) is located in North Africa, part of the Maghreb region. It is known for its ancient architecture, souks, and blue beaches and has a population of 12.1 million. Tunisia is home to the northernmost point in Africa, Cape Angeles. Under its 2014 constitution, its political institutions operate under a 'semi-presidential' system. The president of the republic and the president of the government (prime minister) share executive power. Education is a top priority, accounting for 6% of GNP. The Tunisian higher education system has developed rapidly, and the number of students has more than tripled in the last 10 years. (The Global Competitiveness Report 2008–2009, 2010). According to the World Economic Forum Davos Report on ICT 2010–11, Tunisia ranks first among African countries. It has created its first technology park, El Ghazala des Technologies de la Communication (El Ghazala Communication Technology Pole). The park has a state-of-the-art infrastructure to meet the needs of companies in the leading ICT sectors. The ICT sector accounts for 11% of gross domestic product (GDP). With over 600 innovative companies, the sector is growing at an average annual rate of 8% (FIPA Invest in Tunisia, 2024).

Zambia, (Republic of Zambia) is an independent republic in South Africa. The former British colony became independent in 1964 but remains a member of the British-led Commonwealth. Population: 19.5 million in 2022. In the ten years to 2015, GDP growth averaged around 6.7% per year, making Zambia one of the fastest-growing economies in the world. A fall in the world price of copper (its main export) has held back economic growth. Despite economic growth, there is severe rural poverty and high unemployment education is provided at universities, polytechnics or colleges. Technical institutes and colleges offer various two-year certificate and three-year diploma programmes. At the university level, bachelor's courses usually last four years. Clinical (medical and veterinary) master's programmes are offered on a part-time basis, with a minimum of four years and a maximum of eight years (Moroz, 2016). The Higher Education Authority of Zambia (HEA) was established under the Higher Education Act No. 4 of 2013 to ensure quality assurance, regulate private and public higher education institutions and register private higher education institutions.

Zimbabwe, a country of approximately 15 million people in 2022, has sixteen official languages. It was once known as the 'jewel of Africa' for its prosperity. Today, it is characterised by a low-income sub-Saharan economy. Political instability and

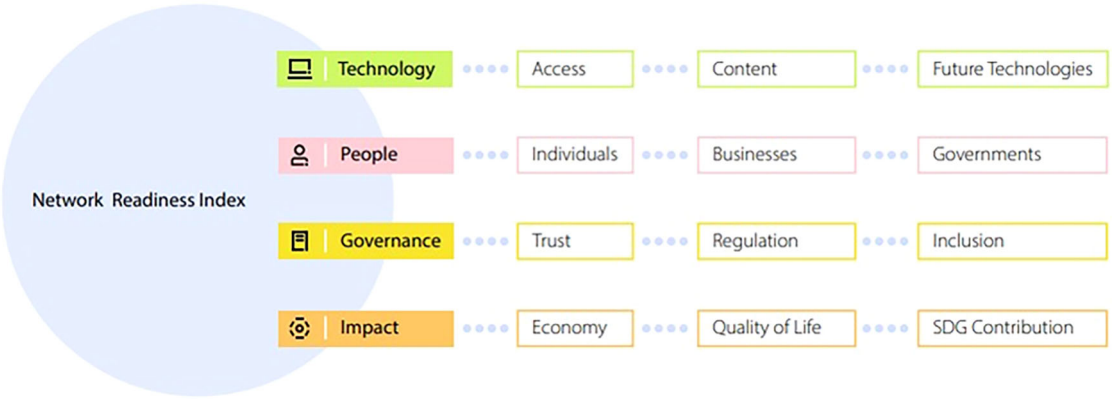


Fig. 3 Logical structure of NRI Index. Source: Portulans, 2024.

endemic corruption have prevented reforms and stalled debt restructuring. The issuance of the new Zimbabwe Gold (ZiG) currency is the latest effort to combat ongoing hyperinflation. Tertiary education in Zimbabwe comprises a wide range of programmes offered in different types of institutions, including technical and vocational colleges, teacher training colleges and universities. The duration of these programmes varies. In Zimbabwe, entry to university is usually open to those who have completed their school-leaving certificate. The duration of a bachelor's degree is usually three years, although there are programmes that last longer, such as applied sciences. A welcome development is the introduction of distance and open learning at the university level through the Open University of Zimbabwe (UNESCO, 2023; 2024). Following the description of the countries, indicators supporting the assessment of their level of development are presented.

Information technology skills, conditions and development. To make an appropriate assessment of the real situation in the countries under study (which mainly refers to the conditions that can determine/affect the use of ChatGPT), we can use indicators that express (usually) the ranking on a scale of 0–100 points, or the percentage of points achieved, in terms of technical and technological development, readiness, Internet access, etc., using complex calculation methods based on the measurement of several parameters. These include indicators of ICT development, mobile network structure, digital readiness, and internet accessibility. The results of international studies are reflected in these indicators, which are presented below.

The Network Readiness Index (NRI) focuses on the use and impact of digital technologies worldwide. It is a multidimensional indicator comprising four main pillars: technology, people, governance, and impact. Each pillar is divided into three sub-pillars, each with a different number of indicators (ranging from 4 to 6). The NRI consists of 54 indicators in total. Its logical structure is shown in Fig. 3.

The ***ITU ICT Development Index (IDI)*** measures the development of information and communication technologies (ITU, 2019; Sabri et al., 2023). The 2023 IDI ranks countries, while the 2024 statistics show the % of scores achieved, based on a different concept. The structure of the index is shown in Fig. 4 (Ayanso et al., 2011; Helsper, 2008; Nielsen, 2022).

GSMA Mobile Connectivity Index measures the availability and use of mobile networks. The GSMA Mobile Connectivity Index measures the performance of 173 countries—representing 99% of the world's population—on key drivers of mobile internet penetration: infrastructure, affordability, consumer readiness, content and services. This data can help the mobile industry and other stakeholders to understand where to focus action to increase mobile internet penetration (Jenny and Aker 2010). Figure 5 illustrates the areas where the coverage gap is greater than 10%, i.e. where there are serious gaps (GSMA, 2023). The map is an illustration of the directions of development needed (the current limit to consumer choice).

The ***Alliance for Affordable Internet (A4AI) Affordability Drivers Index*** looks at the affordability and accessibility of the Internet. The Affordability Index is a policy tool that assesses how well a country's policy, regulations and overall supply environment are working to reduce industry costs and ultimately create more affordable broadband access. Unfortunately, the values of the indicators are not fully available. Some countries are not always included in the surveys, and the production of indicators is sometimes not expressed in the same format due to conceptual changes. The number of ranked countries surveyed also varies. Summing up the values of each indicator (for the latest period available), Table 1 illustrates the differences between the countries covered by the survey.

If we aggregate the ranking positions and/or scores achieved by each country, it is clear that Tunisia and Egypt are in the lead, closely followed by Ghana and Algeria. Nigeria, Zambia and Tanzania are neck and neck in the middle, while Zimbabwe ranks last. Unfortunately, Cape Verde did not provide data in several cases, so no correct conclusion can be drawn. It is interesting to note that while Nigeria's internet access and affordability illustrate the best situation, their performance on other indicators is not in line. When looking at the scores for the other indicators, it can be seen that the leading countries perform better despite the difficulties of internet availability and affordability. It is also clear that Zimbabwe has not yet caught up in any of the areas represented by any of the indicators. For those indicators where data for consecutive years are available, progress is visible (albeit not to a great extent). The scores suggest that in the practice of countries with higher scores, where internet accessibility, affordability, mobile network coverage, ICT development and digital technology access are at a higher level, university students are more aware of and use ChatGPT more often. As a result, they have higher levels of communication skills, where differences in disciplines and gender differences are evident. In the following, the factors influenced by ChatGPT that became the focus of the research are presented.

ChatGPT influence on creative fields

Communication. Malik et al. (2024) collected information through semi-structured interviews with ten researchers from 10 countries (Australia, China, UK, Brazil, Pakistan, Bangladesh, Iran, Nigeria, Trinidad and Tobago, Turkey and the UK). The

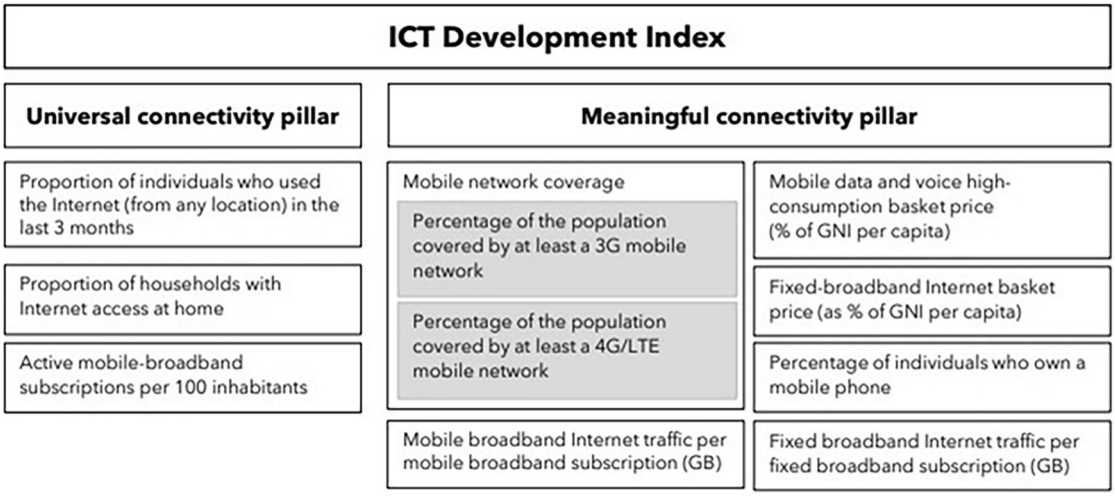


Fig. 4 Structure of ICT Development Index. Source: ITU, 2019.

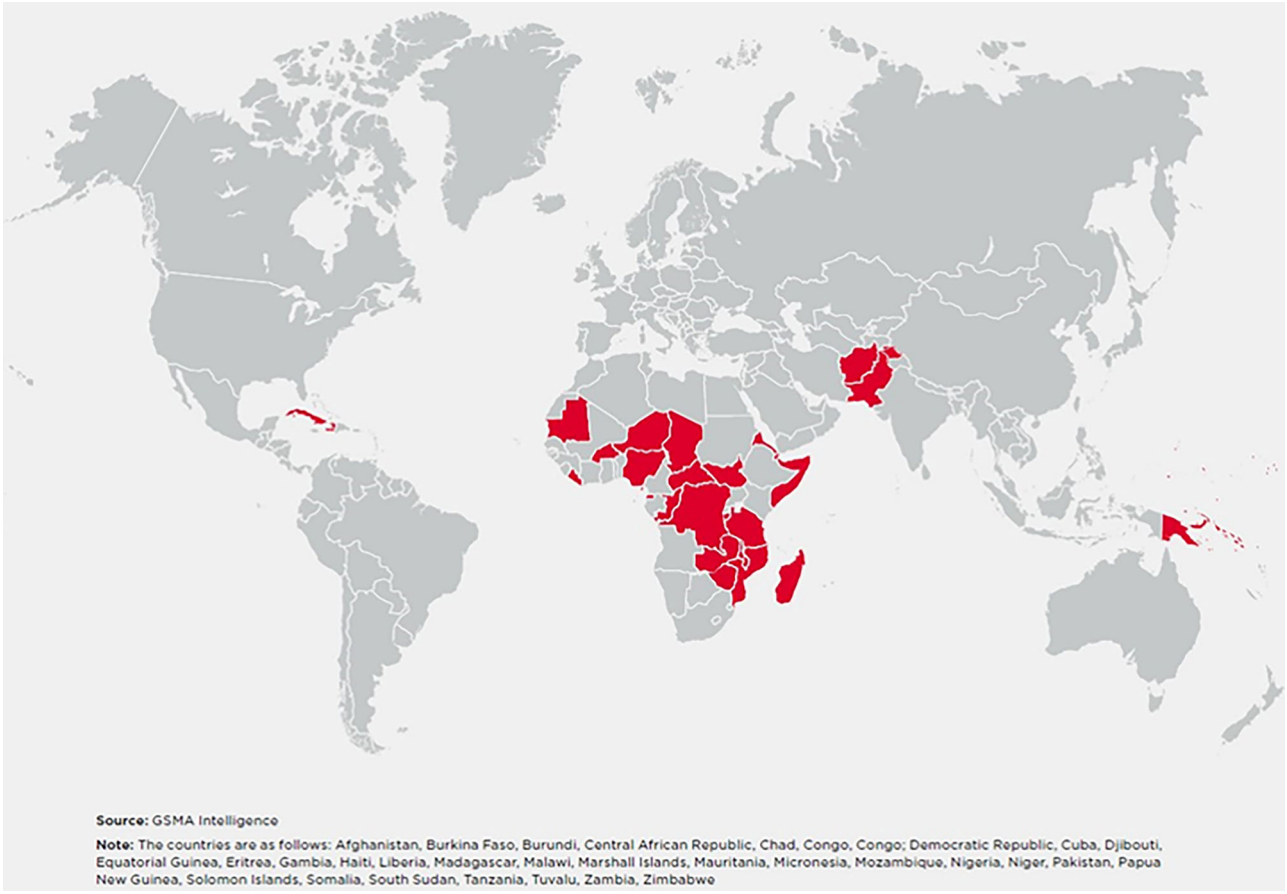


Fig. 5 Coverage gaps in mobile networks. Source: GSMA Intelligence.

results of the analysis conducted using NVivo show that the use of ChatGPT has a negative impact on academic and research writing practices, writing skills, and creativity. Ismael et al. (2022) found that over-reliance on technology adversely affects writing skills. The concern has been confirmed by researchers in several studies, especially concerning students (Hutson, 2022; Shidiq, 2023; Malik et al., 2024). From this point of view, the research results are similar. AlAfnan et al. (2023) in their study found that if ChatGPT used unethically by students, it can lead to a decline in human intelligence and learning. However, writing with the support of ChatGPT can save time and energy, allowing researchers and scholars to concentrate and spend more time focusing on critical, analytical, and creative aspects (Aljanabi et al., 2023; Malik et al., 2024). It can also help in language and grammar development (Koo, 2023). These results call for careful and considered application, highlighting ethical considerations and the impact on creativity. As Mikalef and Gupta (2021) also showed in their study, there is a correlation between the

Table 1 Characteristics of the countries covered by the digital development indicators.

Countries	NRI (ranking $n = 134$)		ICT ($n = 169$)		GSMA ($n = 170$)	A4AI ($n = 72$)
	2023	2024	2023 (ranking/scores)	2024 (scores)	2023 (ranking/scores)	2023 (ranking)
Algeria	109	100	109/77.8	80.9	95/54.5	34
Cape Verde		98	/68.1	69.1	/55.6	
Egypt	84	85	100/75.8	76.8	90/66.6	36
Ghana	100	87	116/65.9	66.2	100/55.1	23
Nigeria	112	112	123/44.2	46.9	105/52.6	19
Tanzania	123		134/37.2	43.1	115/43.9	41
Tunisia	71	96	95/75.4	77.2	91/63.3	24
Zambia	128	115	129/49.5	55.6	110/44.8	48
Zimbabwe	130	121	137/42.7	47.7	120/41.5	55

Source: own construction, based on The Global Competitiveness Report 2008–2009. 2008; Ayanso et al. 2011; ITU, 2019; AUC/OECD, 2021; UNESCO, 2023; African Union, 2024; FIPA Invest in Tunisia, 2024).

capabilities of artificial intelligence and organisational creativity. According to the study, the use of artificial intelligence-based chatbots and platforms improved organisational creativity and productivity.

The differences are striking in the field of education. According to a study by Keane et al. (2025), male students use ChatGPT much more actively and purposefully, while female students are more sceptical and lack confidence in the information they receive. Similar patterns were described by Adams et al. (2025), who analysed the social acceptance of generative AI among disadvantaged groups.

Oktradiksa et al. (2021) found that ChatGPT can accelerate the generation of new ideas and concepts. AlZaabi et al. (2023) found that ChatGPT changes academic writing, work habits, and styles. In his study, Shidiq (2023) expressed his concern that ChatGPT may negatively affect some basic skills, such as writing. Research by Niloy and colleagues (2024) found a negative association between ChatGPT and students' academic achievement. This is mainly evident in terms of writing skills. Most research results show a positive effect in the area of creativity, but a negative effect in other communication skills, especially writing skills.

Some experts refer to GenAI use as "writing without thinking" (Chayka, 2024). Researchers believe that as the practice becomes more widespread, education must respond to the acquisition and assessment of traditional writing skills. One option for the future is to focus on the learning/teaching of literacy skills (UNESCO, 2023).

Based on the results illustrated by the indicators in Table 1 and the research presented, the following hypothesis can be formulated.

H1: The use of ChatGPT has a significant positive effect on different areas of communication skills in the sample.

H1a: There is a significant difference by gender of participants,

H1b: There is a significant difference for students studying in different disciplines,

H1c: There is a significant difference for the countries analysed.

Analytical and problem-solving thinking. The introduction of ChatGPT in the educational setting has shown several positive effects on the teaching-learning process (Urban et al., 2024; Tayan et al., 2023). This requires the introduction of qualified young people into higher education and then into the labour market who have the appropriate competences and can use digital technology. This need is reinforced by a study by the African Union (2024), which argues that Africa should develop AI skills in higher education. This requires the integration of AI into computer science and mathematics education and the launch of advanced research in various areas of AI (Opesemowo et al., 2024).

Fauzi Tuhuteru and colleagues (2023) analysed changes in effectiveness indicators through a qualitative study. The research showed that ChatGPT can significantly contribute to improving the quality of student activities. It helps students with useful information and resources, develops language skills, and promotes collaboration and performance efficiency.

Aristovnik et al., (2023) researched the perceptions of ChatGPT among public administration students. Their results show that ChatGPT is an attractive platform for public administration students, who rate its use positively. However, students perceive it as less effective in developing critical thinking and creativity. This finding contradicts the research results of Oktradiksa et al., (2021). Strzelecki (2024) investigated predictors of the adoption and use of ChatGPT among university students. The quantitative research was based on self-report data from 534 students at a Polish public university. The dominant determinant of ChatGPT usage behaviour was "behavioural intention", followed by personal innovativeness. "Habit" was found to be a predictor of "behavioural intention" (with a significant relationship confirmed), followed by "performance expectancy" and "hedonic motivation". The research suggested the need for further studies. The research did not yield clear results, therefore, further studies were recommended.

In their research, Kuhail et al. (2022) and Lo (2023) found that ChatGPT offers several possibilities. It helps scientists, researchers, and students develop concepts, explore new ideas, and solve academic problems. According to Boden (2004), since creativity is the ability to generate unique ideas, ChatGPT improves problem-solving for fresh and unusual problems and helps to use these skills more effectively. These studies point to a close link between creativity and problem solving, which is positively influenced by the use of ChatGPT.

However, Shidiq (2023) points out the negative effects of using ChatGPT. According to him, learning requires direct interaction (emotional contact) and the learning process is facilitated by modelling and/or examples. ChatGPT does not do this. Learning requires creativity to develop new ideas and innovations. ChatGPT does not have the creativity of humans. ChatGPT is not able to respond to students' learning styles, which are different for each individual. If we rely too much on ChatGPT, individuals will slowly drift away from their social environment and from social networking. Overuse of ChatGPT weakens individuals' critical thinking, so that when problems arise in

everyday life, individuals (users) will find it difficult to solve them. This result represents an interesting approach in light of previous research. He recognises the positive impact of ChatGPT in the world of education and learning, but points out that it does not always positively impact the development of learners' different learning skills. These contradictory research results call for further investigation. Based on the above, the following hypothesis can be formulated.

H2: For the sample under study, analytical and problem-solving thinking are positively affected by the use of ChatGPT.

H2a: There is a significant difference by gender of participants,

H2b: There is a significant difference for students from different disciplines,

H2c: There is a significant difference for the countries analysed.

Labour market opportunities. A few studies have examined the impact of ChatGPT on the labour market. Several chapters in Mahamat and Gurría (2021) Africa's Development Dynamics address challenges that project the consequences of technological advances, digitalisation and the development of artificial intelligence in a way that is specific to Africa (Foster et al., 2017; Abrego et al., 2020; Mishra et al., 2024). According to Bhorat et al. (2023), the concept of digitalization and the digital economy in Africa needs to be understood within a broader concept of structural transformation of the economy. Recent evidence suggests that many countries, particularly in sub-Saharan Africa, are following a different development trajectory than developed countries (Matthess and Kunkel, 2020). Digitalisation—and digital transformation—offer an opportunity for developing countries as a new form of economic growth (Johnson, 2018).

According to the International Monetary Fund (2024), there are currently two main limitations to research on the labour market effects of AI. First, there is a paucity of reliable data, especially up-to-date, micro-level data on AI adoption. Second, the direction of technological change in AI is rapid and highly uncertain. This uncertainty challenges researchers (Nakamura and Steinsson, 2018). Rakotondrazaka's (2024) study investigated the impact of digital trade on employment in Africa, to understand the employment potential of digital trade. The study processed data from 30 African countries for the period 2009–2020. The results show that although digital trade does not uniformly improve overall employment, it significantly and positively impacts employment within the manufacturing and services sectors (Kere and Zongo, 2023).

Banga (2022) takes a strong stance on the development path of African countries. He argues that digital skills are more important now than ever, which requires African countries to proactively approach digital transformation on the demand and supply side, effectively leveraging the African Continental Free Trade Area (AfCFTA) agreement. In his study, O'Connor (2024) examined the question of whether AI can alleviate or exacerbate labour market problems. David Autor, professor of economics at MIT, argues that to use a tool well to raise skills, you first need a foundation. Without this, people with poor literacy skills "become naïve consumers of prefabricated content". In other words, without a solid set of skills of their own, they will only be supported by and/or at the mercy of the machine. All research highlights the need to develop skills required for digitalisation and artificial intelligence, while also drawing attention to the dangers of inadequate preparatory education.

The hypothesis put forward to confirm or refute previous research regarding the previous two hypotheses can be formulated as follows.

H3: For the sample under study, changing competences and users' experiences with ChatGPT as a result of ChatGPT use have an impact on negative and positive phenomena in the labour market.

H3a: Significant positive effects are found in written and other communication competencies.

H3b: Significant positive effects are found problem solving skills

H3c*: Significant positive effects are found user experience of ChatGPT users.*

Research method

To assess the impact of ChatGPT on student life, the Faculty of Public Administration, University of Ljubljana (in collaboration with international partners) launched a large-scale online survey worldwide (between October and December 2023). (As this study is part of an international research project involving several countries, the ethics committees of universities in several countries have approved the research. Some of these include: National Bioethics Committee of Cyprus No. Nbc/2023.01.318; Espol Escuela Superior—Guayaquil-Ecuador Code-22; Ethical Committee of the Department of Human Sciences University di Verona, Code 2023_25; Yamanashi Gakuin University Ethics Review Committee, Code 23-010; Ethics Review Panel of the University of Luxembourg, ERP 23-101 StuPer ChatGPT; Institutional Review Board Imam Abdulrahman Bin Faisal University, IRB: 2024-10-316; University of East London Ethics and Integrity Sub-Committee, ID: ETH2324-0028, etc.).

The primary goal of the project was to explore the impact of ChatGPT on students' learning experiences, academic performance, and attitudes towards artificial intelligence. By collecting data from various student populations, the project assessed the effectiveness of ChatGPT as a learning tool and students' preferences regarding AI-assisted learning. During the research, the organisers also had to take into account that there are countries where ChatGPT is not available or has limited use, such as China, Russia, Iran, North Korea, Cuba, Syria, Afghanistan, Bhutan, the Central African Republic, Chad, Eritrea, Eswatini (formerly Swaziland), Libya, South Sudan, Sudan and Yemen (Jaspreet, 2025). The research was conducted following the scientific practices outlined in the Vancouver Protocol, which guided the research organisers and the institutions involved in the study. The organisers shared the questionnaire on an online platform in several languages (English, Italian, Spanish, Turkish, Japanese, Arabic and Hebrew). In all countries covered by this study, the questionnaires were completed, and the data were summarised and analysed in English. The organisers conducted the survey using the 1KA (One Click Survey; https://www.1ka.si/d/en) web application, which complies with the General Data Protection Regulation (GDPR). 109 countries across five continents participated in the global survey. In each country, students from participating institutions could complete the questionnaire in a variety of ways (e.g., during or outside class). A total of 23,218 students responded to the online questions anonymously and voluntarily. This study analyses the responses from the African continent. It presents the opinions of university students from nine countries on this continent in relation to some of the questions in the survey. From more than 20 African countries, those states were selected for the study where a sample could be evaluated in terms of sample size and content. The analysis includes responses from respondents who have used ChatGPT either in their private lives or in their studies. The analysis was based on responses that could be evaluated. After cleaning the data, 2,297 responses were included in the analysis. Respondents came from the following countries: Algeria, Cape Verde, Egypt, Ghana, Nigeria, Tanzania, Tunisia, Zambia, and Zimbabwe.

The questionnaire was available to respondents via the internet. The questionnaire was first validated with Slovenian students

Table 2 The groups of questions covered by the analysis.

Descriptive characteristics of the sample	Using ChatGPT	Effects of ChatGPT
Gender of respondents? Age of respondents? What level of education are the respondents at? How do respondents see their chances of finding a job after completing their studies?	Have you ever used ChatGPT? Which version did you use? To what extent have you used ChatGPT? How do you rate your experience with ChatGPT?	How does ChatGPT affect communication skills? How does ChatGPT affect analytical and problem-solving skills? What impact will ChatGPT have on the world of work?

Source: own construction.

Table 3 Specification of respondents ($N = 2297$).

	N	%
Gender of respondents	Male: 1092 Female: 1205	Men: 47.5 Female: 52.5
Countries	Algeria: 81 Cape Verde: 61 Egypt: 544 Ghana: 316 Nigeria: 120 Tanzania: 492 Tunisia: 365 Zambia: 221 Zimbabwe: 97	Algeria: 3.5 Cape Verde: 2.7 Egypt: 23.7 Ghana: 13.8 Nigeria: 5.2 Tanzania: 21.4 Tunisia: 15.9 Zambia: 9.6 Zimbabwe: 4.2
Main field of study	Arts and Humanities: 375 Social sciences: 638 Applied sciences: 948 Natural and life sciences: 336	Arts and humanities: 16.3 Social sciences: 27.8 Applied sciences: 41.3 Natural and life sciences: 14.6
To what extent do you use ChatGPT?	Rarely: 277 Per occasion: 664 Moderate: 814 Significantly: 376 Coverage: 157	Rarely: 12.1 Per occasion: 29.0 Moderate: 35.6 Significantly: 16.4 Extensive: 6.9

Source: own construction.

(Aristovnik et al., 2023), and the final version was refined based on feedback to improve reliability. There were 42 questions, of which 6 were open-ended, and the rest were closed-ended. The complete questionnaire covered the following areas: characteristics of ChatGPT use, ChatGPT capabilities, ethical rules related to ChatGPT use, satisfaction with ChatGPT, ChatGPT in learning, skill development, and its role in the labour market. The groups of questions covered by the analysis are shown in Table 2.

The researchers examined the reliability of the questions in the questionnaire. This was analysed using the split-half method. The Spearman-Brown coefficient ranged from 0.742 to 0.876 across the question groups, which is acceptable (Brown, 1910; Spearman, 1910).

Before evaluating the hypotheses, the sample specification is shown in Table 3.

The proportion of women by country was as follows. Algeria 51.9%, Cape Verde 68.9%, Egypt 46.9%, Ghana 35.1%, Nigeria 65%, Tanzania 57.5%, Tunisia 67.7%, Zambia 49.8% and Zimbabwe 38.1%. The proportion of males was 48.1% in Algeria, 31.1% in Cape Verde, 53.1% in Egypt, 64.9% in Ghana, 35% in Nigeria, 42.5% in Tanzania, 32.3% in Tunisia, 50.2% in Zambia, 61.9% in Zimbabwe.

19.8% of women were studying arts and humanities, 24.7% were studying social sciences, 41.5% were studying applied computer science, and 14% were studying natural and life sciences.

12.5% of men were students in arts and humanities, 31.1% in social sciences, 41% in applied computer science and 15.3% in natural and life sciences. 23.3% of respondents typically use ChatGPT very often, and only 12.1% rarely.

Research results

The results of the research are presented primarily through the verification of hypotheses, which also provide answers to the research questions.

To test the first hypothesis, respondents were asked to give their opinion on whether they think ChatGPT improves their communication skills. On a five-point Likert scale, a one was a definite no, and a five was a definite yes.

The researchers also analysed whether there were differences in responses by gender, by students in the subject area and by country. This analysis was carried out using an independent samples *T*-test and One-way ANOVA. The significant difference and the highest mean value are shown in Table 4.

The first column of Table 4 shows the different areas of communication skills. These have subsequently been grouped into two clusters. The first is literacy, the second is other communication skills. The first cluster includes the variables related to literacy, scientific literacy, professional literacy, and typing literacy. The second cluster includes other communication attributes such as mother tongue skills, foreign language skills, interpersonal communication skills, digital communication skills, information literacy skills, digital content creation skills. The second column contains the codes for the variables that were used later in the analysis.

The effect of using ChatGPT on the literacy variables was almost the same, i.e. it more or less improves these non-verbal communication features. The standard deviations also showed almost similar values, and their low value demonstrated that the respondents had similar opinions on this issue.

Among the skills in the other group, ChatGPT has the least positive effect on native language skills (M: 3.25), while it has the most positive effect on digital communication skills (M: 3.67), due to its digital nature. In particular, the values of the variance were low for the digitalisation-related skills, i.e. the sample was almost homogeneous in terms of responses.

The authors examined whether there were differences of opinion on the impact of ChatGPT in different areas of communication. Based on gender, they found that only digital content creation skills showed significant differences. Men rated the impact of ChatGPT as stronger than women on this variable (men M: 3.68, women M: 3.57).

Significant differences were identified in terms of mother tongue knowledge and foreign language proficiency, based on who was studying in which discipline. In the case of mother tongue knowledge, students in the arts and humanities were the most likely to rate the ChatGPT as having a positive effect (M: 3.43), while students in the applied sciences were the least likely to rate it as having a good effect (M: 3.09).

Table 4 Perception of the impact of ChatGPT on communication skills by gender, by discipline studied and by country ($p = 0.05$).

The Chat GPT improves	Code	*M*	SD	No	Science area	Countries
				T-test	One-way ANOVA	One-way ANOVA
Scientific literacy	W1	3.57	0.884	No diff.	No diff.	No diff.
Professional writing skills	W2	3.58	0.878	No diff.	No diff.	No diff.
Typing skills	W3	3.55	0.888	No diff.	No diff.	No diff.
Digital communication skills	OK1	3.67	0.851	No diff.	No diff.	F: 4.792 szign.: 0.000 Zimbabwe (M: 3.83) η^2:0.022
Interpersonal communication skills	OK2	3.45	0.922	No diff.	No diff.	F: 13.992 szign.: 0.000 Egypt (M: 3.66) η^2:0.062
Information literacy skills	OK3	3.65	0.830	No diff.	No diff.	F: 6.932 szign.: 0.000 Zimbabwe (M: 3.88) η^2:0.032
Digital content creation skills	OK4	3.62	0.825	t: 2.608. szign.: 0.000 Male (M: 3.68) Cohen's d:0.126	No diff.	F:5.073 szign.: 0.000 Zimbabwe (M: 3.83) η^2:0.023
Knowledge of the mother tongue	OK5	3.25	0.999	No diff.	F: 9.697 szign.: 0.000 Arts and Humanities (M: 3.43) η^2:0.017	F:19.993 szign.: 0.000 Egypt (M: 3.61) η^2:0.087
Knowledge of foreign languages	OK6	3.55	0.924	No diff.	F: 7.691 szign.: 0.000 Arts and Humanities (M: 3.72) η^2:0.013	No diff.

Source: own construction, No diff. - no significant difference of opinion.

Also, for foreign language skills, students in the arts and humanities had the highest scores (M: 3.72), while the lowest average was for natural and life sciences (M: 3.39).

Significant differences were also identified across countries for several skills: mother tongue skills, interpersonal communication, digital communication, information literacy and digital content creation. In each of the cells where a difference could be demonstrated, the country with the highest average was indicated in the table. But, interestingly, other countries are worth mentioning. Thus, in terms of digital communication skills, Zimbabwe (3.83) is followed by Nigeria with a high average of 3.78, then Egypt with 3.75; in terms of interpersonal communication skills, Egypt is the highest rated with 3.66, followed closely by Zimbabwe with 3.58 and Tanzania with 3.56. In terms of information literacy skills, Zimbabwe is followed by Nigeria (3.74) and Tanzania (3.74), while Zimbabwe also leads in digital content creation skills, followed by Nigeria (3.78) and Tanzania (3.74). In terms of mother tongue skills, Egypt (3.61) is followed by Zambia (3.30) and Zimbabwe (3.18). Typically, Zimbabwe rated the impact as strongest in three skills, while Egypt did so in two skills. Nigeria and Tanzania are also close behind in the impact assessment.

Overall, it can be concluded that respondents believe that using ChatGPT has a positive impact on individuals' communication skills and improves them, but more significant differences in opinion were only identified between respondents from different countries. There is one significant difference in terms of gender and two significant differences in terms of the fields of study examined.

Hence, hypothesis *H1* can be accepted. *H1a* and *H1b* cannot be accepted, *H1c* can be considered justified.

The proof of hypothesis 2 was done using a similar method as for the first hypothesis. In this set of questions, respondents were asked to answer whether using ChatGPT improves their analytical and problem-solving skills. Also, on a Likert scale of five, respondents had to decide on a scale ranging from none (this was a value of one) to full (this was a value of five) how these skills were affected by ChatGPT. Here again, the researchers conducted a difference-in-difference analysis, using the dimension of the independent variables used earlier. The statistical method used was the independent samples *T*-test and One-way ANOVA. The results are summarised in Table 5.

The first column of Table 5 listed the analytical and problem-solving skills for which respondents were asked to rate whether they were improved by the use of ChatGPT. These skills were classified into two groups for subsequent analysis. The first included analytical skills such as numeracy skills, data analysis skills, programming skills, and artificial intelligence skills. The second included problem-solving skills, i.e., problem-solving skills, decision-making skills, critical thinking and creativity. The second column here also indicates the code of skills for later analysis. The mean scores showed that the analytical thinking skills were perceived by respondents to be more strongly positively influenced by ChatGPT than the problem-solving skills. For both groups, the standard deviations suggest that respondents agreed.

The studies also looked at whether differences in respondents' views could be identified by gender, discipline and country. The gender analysis revealed significant differences in problem solving, decision making, analytical and programming skills, and knowledge of artificial intelligence, with men assuming in all cases that these skills had a stronger developmental impact on them than on women.

The authors identified significant differences between different disciplines in terms of problem-solving skills, decision-making skills, critical thinking, and numeracy and programming skills. Except for programming skills, the highest average scores were obtained in the humanities and social sciences.

Table 5 Perception of the impact of ChatGPT on decision-making and analytical skills by gender, discipline studied and country ($p = 0.05$).

ChatGPT improves	Code	*M*	SD	No *T*-test	Science area One-was ANOVA	Countries One-was ANOVA
Problem-solving skills	P1	3.52	0.932	t: 1.772 sig.: 0.038 Male (M: 3.56) Cohen's d:0.086	F: 4.198 sig.: 0.006 Arts and humanities (M: 3.60) η^2:0.07	F: 11.212 sig.: 0.000 Zimbabwe (M:3.88) η^2:0.051
Decision-making skills	P2	3.34	0.947	t: 2.105 sig.: 0.018 Male (M: 3.39) Cohen's d:0.102	F: 10.919 sig.:000 Arts and humanities Social sciences (M: 3.47) η^2:0.019	F: 15.063 sig: 0.000 Zimbabwe (M: 3.70) η^2:0.067
Critical thinking skills	P3	3.43	0.962	No diff.	F: 5.432 sig.: 0.000 Social sciences (M:3.52) η^2:0.01	F: 11.095 sig: 0.000 Zimbabwe (M: 3.77) η^2:0.062
Creativity	P4	3.51	0.957	No diff.	No diff.	No diff.
Numeracy	A1	3.32	0.886	No diff.	F: 7.473 sig.: 0.000 Social sciences (M:3.45) η^2:0.013	No diff.
Data analysis skills	A2	3.57	0.886	t: 2.759 sign.: 0.003 Male (M: 3.43) Cohen's d:0.134	No diff.	F: 8.86 Signed: 0.000 Zimbabwe (M: 3.89) η^2:0.040
Programming skills	A3	3.56	0.906	No diff.	F: 2.889 sig.: 0.034 Applied sciences (M: 3.61) η^2:0.005	F6.342 Signed: 0.000 Zimbabwe (M: 4.05) η^2:0.029
The artificial intelligence literacy	A4	3.68	0.888	t: 3.280 sign.: 0.000 Male (M: 3.64) Cohen's d:0.159	No diff.	F: 6.752 Sign: 000 Zimbabwe (M: 3.96) η^2:0.031

Source: own construction, No diff. - no significant difference of opinion.

Table 6 Impact of ChatGPT on the labour market (M, SD).

The ChatGPT	Code	*M*	SD
Reduces the number of jobs.	LN1	3.04	1.059
Increases inequalities between younger and older workers.	LN2	3.33	0.984
Changes the nature of jobs.	LN3	3.53	0.940
Workers have to learn new skills.	LN4	3.59	0.880
Improve worker productivity.	LP1	3.66	0.869
Improves employee innovation.	LP2	3.61	0.914
Facilitates teleworking.	LP3	3.69	0.871
Reduces the workload of employees.	LP4	3.65	0.906
Strengthen the link between higher education and society in the labour market.	LP5	3.49	0.888

Source: own construction.

Across countries, except for two skills (creativity and numeracy), there were significant differences in perceptions of impact, with the highest mean scores in Zimbabwe analysis (in approximately 6 cases). The average scores for Tanzania and Egypt were also high in these cases.

In conclusion, the use of ChatGPT has a positive effect on analytical and problem-solving thinking in the sample studied, and in most cases, the influence of ChatGPT differs significantly between genders, countries analysed and students studying different disciplines. This implies that hypotheses *H2, H2a, H2b*, and *H2c* can be confirmed.

To prove hypothesis 3, a model was developed using the variables used and tested in Tables 4 and 5, and new variables were included in the model.

In the survey, respondents were asked to rate ChatGPT's impact on the labour market on a scale of one to five, based on how much they agreed with the statement. A one indicated strongly disagree, and a five indicated strongly agree. Table 6 shows the mean and standard deviation of responses.

The first column of the table lists the different possible impacts. There are two separate groups of variables. In one group, those phenomena that could be considered positive are grouped, while the other group collects rather negative impacts. The positive events are the improvement of workers' productivity, the increase of employee innovation, the facilitation of teleworking, the reduction of the burden on employees, the strengthening of the link between higher education and society in the labour market. On the negative side, the number of jobs is shrinking, inequalities between younger and older workers are increasing, the nature of jobs is changing, and new skills are being acquired. The latter implies additional work invested by the worker. Column 2 contains the impact codes.

The average figures in the table show that respondents agree less with the negative impacts, while expectations of positive impacts are rated higher. The standard deviation values also show that the sample was more homogeneous in its views on positive impacts than on negative impacts. The highest level of acceptance was that using ChatGPT facilitates teleworking (M: 3.69), and the lowest level was that it reduces the number of jobs (M: 3.04).

These two most positive and negative variables were also correlated with each other (r: 0.205, p: 0.000), i.e., the more accepted the respondents were that ChatGPT facilitates teleworking, the less they believed that it reduces the number of jobs.

To further prove the hypothesis, the authors examined how changes in the skills under study might be related to and affect changes in the labour market. To answer this question, the researchers have developed a structural equation model (SEM) for modelling latent variables, called variance-based analysis (PLS-analysis). The model consists of latent variables that are based on indicators (Fornell and Larcker, 1981).

The SEM model consists of two parts: the measurement model and the structural model. In the measurement model, the authors investigated the relationship between the latent and the indicators, while in the structural model, the relationships between the latent variables were investigated.

The independent latent variable is called the explanatory variable, and the dependent variable is called the explained variable. The Kolmogorov–Smirnov test showed that none of the items was normally distributed.

The latent variables included in the model were: analytical thinking (skills coded A1-A4), problem-solving (skills coded P1-P4), literacy (skills coded W1-W3, other communication (skills coded OK1-OK6), positive phenomena in the labour market (phenomena coded LP1-LP5), negative phenomena in the labour market (phenomena coded LN2-LN4). In addition, the authors included in the model two predictor variables, which were dummy variables. The original variable asked about the respondent's experience with ChatGPT. The values of the three-valued categorical variables were: not good, neutral and good. 1.8% of respondents reported that their experience with ChatGPT was not good, 22.1% reported a neutral experience, and 76.1% reported a good experience. 74.5% of women and 77.8% of men reported a pleasant experience. By discipline, 73.5% of Arts and Humanities students, 78.6% of Social Science students, 75.2% of Computer Science students and 76.6% of Science and Life Science students rated their experience with ChatGPT as good. Across countries, the highest proportion of students in Ghana rated their experience as pleasant (82.9%), while the lowest proportion of students in Tanzania rated it as so (69.1%).

From these three variables, the authors created three dummy variables. In the model, the reference variable was the variable with the non-good value, and the researchers compared the good and neutral values to it.

The presentation of the model starts with an analysis of the structure of the measurement model. In the measurement model, the relationships between latent variables and items are examined. Table 7 summarises the latent variables and the correspondence between the items that construct them. The items are denoted by codes, the meaning of which is already given in Tables 3–5.

Table 7 includes the standardised factor weights, which are good if they are above 0.5 (Hair et al., 2011). The VIF value is used for the multicollinearity of indicators, which is acceptable if it is below 5. For the reliability testing of latent variables, there are several indicators. The Cronbach's Alpha indicator is acceptable if it is above 0.7 (Hair et al., 2011). Another indicator is the CR (composite reliability) value, which should also be above 0.7 (Fawad, 2023). The AVE (average variance extracted) indicator is used to measure convergence validity and is acceptable if it is above 0.5 (Fawad, 2023). Several methods can be used to analyse the discriminant validity of measurement models. An example is the Heterotrait-Monotrait Correlation Ratio (HTMT). The recommended acceptable level of discriminant validity should be less than 0.90. Another way of testing the validity of discriminant validity is cross-loading, where items can express content more strongly in their latent variable than in another. In the case of cross-loading, if an item has a difference of less than 0.1 during cross-loading, then that item should be removed from the model (Fawad, 2023).

Table 7 Constructs and items (VIF, CR, AVE, Cronbach's Alpha).

Construct	Code	Factor weight	VIF	CR	AVE	Cronbach
Writing	W1	0.873	2.343	0.904	0.758	0.840
	W2	0.903	2.510			
	W3	0.835	1.648			
Other communication	OK1	0.831	2.306	0.897	0.593	0.862
	OK2	0.779	1.971			
	OK3	0.822	2.179			
	OK4	0.788	1.875			
	OK5	0.650	1.576			
	OK6	0.738	1.632			
Analytical thinking	A1	0.723	1.443	0.889	0.667	0.833
	A2	0.833	2.001			
	A3	0.858	2.220			
	A4	0.846	1.913			
Problem-solving thinking	P1	0.834	2.029	0.906	0.708	0.862
	P2	0.846	2.137			
	P3	0.853	2.237			
	P4	0.832	2.023			
Labour market positive	LP1	0.835	2.225	0.884	0.605	0.836
	LP2	0.801	1.901			
	LP3	0.775	1.808			
	LP4	0.763	1.846			
	LP5	0.708	1.387			
Labour market negative	LN2	0.601	1.209	0.802	0.579	0.649
	LN3	0.812	1.386			
	LN4	0.846	1.285			

Source: own construction.

The analysis of the validity of discrimination based on the results of HTMT criterion is shown in Table 8. Both on this basis and based on cross-loading, the measurement model was appropriate, but for reasons of space, the results of the latter are not reported. Values that do not meet the requirements summarised above are indicated in grey in Table 7.

As can be seen in Table 7, one variable is missing that refers to the number of jobs that are declining. It was omitted because the factor weight of the variable was very low and negatively affected the other test values. A goodness of fit test of the measurement model shows that one construct had a Cronbach's alpha lower than 0.7. However, the difference between the actual value and the expected value was very small, so this latent variable was not removed from the model by the authors.

Once the measurement model was appropriate, the structured model was analysed. The significance of the path coefficients was tested using bootstrap sampling. The subsample number was 5000, and the *p*-value was 0.05. The authors interpreted the significant effect of the independent variables on the dependent variables. The study examined the beta coefficient, which assesses the effect of one variable on another variable. They also analysed *R*-squared values, which are the magnitude of the change in the endogenous variable that is determined by the exogenous variables. The model is shown in Fig. 6.

One of the two numbers in the arrows is the significance level p, and the other is the β value. The predictive categorical variables, i.e., the experience with ChatGPT, are related to the explained variables. The overall effect between variables is summarized in Table 9, which includes the beta value, *T*-statistic and significance level. The value of the *T* statistic is appropriate when the value is above 1.96 (Fawad, 2023). If the p-significance level

Table 8 HTMT.

	Labour market positive	Analytical thinking	Labour market negative	Other communication	Problem-solving thinking	Writing
Labour market positive						
Analytical thinking	0.594					
Labour market negative	0.824	0.394				
Other communication	0.634	0.796	0.446			
Problem-solving thinking	0.533	0.883	0.319	0.764		
Writing	0.560	0.653	0.402	0.813	0.624	
Good experience	0.154	0.151	0.119	0.138	0.146	1.185
Good experience 1	0.154	0.151	0.119	0.138	0.146	1.185
Neutral experience	0.147	0.138	0.123	0.133	0.139	0.162
Neutral experience 1	0.147	0.138	0.123	0.133	0.139	0.162

Source: own construction.

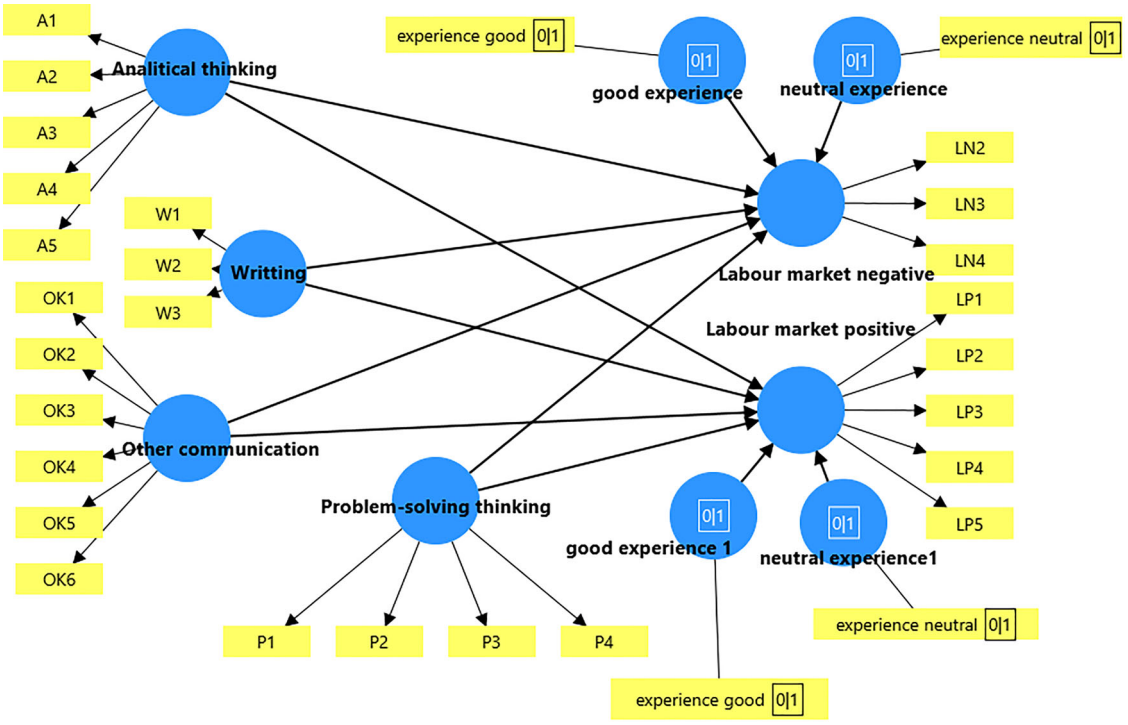


Fig. 6 SEM result. Source: own construction.

value is below 0.05, it confirms a significant relationship between the variables.

Where no significant relationship could be demonstrated, the table row is highlighted in grey. There was evidence of a significant effect of changes in analytical reasoning skills, other communication skills, and literacy skills on changes in labour force participation as a result of ChatGPT. However, the perception of these changes was not affected by the respondent's experience with ChatGPT. Furthermore, these variables with significant effects explained 34.8% of the positive phenomena occurring in the labour market, based on the R-squared values, compared to 15.1% for the negative phenomena.

The results show that, in the sample studied, written and other communication, analytical thinking and analytical thinking are the competences that change with the use of ChatGPT and have a positive, significant effect on negative and positive phenomena in the labour market. Problem-solving skills and user experience do not show such a correlation. Overall, the results of the test of hypothesis *H3* show an effect of using ChatGPT. Hypothesis *H3a* is considered to be confirmed, as written and other communication and analytical thinking have significant positive effects. The effects formulated in hypotheses *H3b* and *H3c* were not confirmed by the analysis. Based on the analyses, the following findings can be made (see Table 10).

Based on the results of the research, the answers to the research questions are summarised below.

(1) The majority of university students in the African countries covered by the research have good experience of using ChatGPT. 1.8% of respondents had an unpleasant experience, 22.1% gave a neutral opinion, and 76.1% reported a good experience. 74.5% of women and 77.8% of men reported a pleasant experience.
(2) In the areas detailed above, significant differences were found between the use of ChatGPT by university students in more and less developed areas and the positive impact in each area. The views of students in Zimbabwe stand out in this respect.

Table 9 Overall effect ($p = 0.05$).

	(β)	Sample mean (M)	Standard deviation	*T* statistics	*P* values
Analytical thinking -> Labour market positive	0.191	0.191	0.036	5.330	0.000
Analytical thinking -> Labour market negative	0.142	0.142	0.040	3.551	0.000
Good experience -> Labour market negative	−0.097	−0.094	0.155	0.627	0.531
Good experience 1 -> Labour market positive	0.019	0.018	0.137	0.139	0.890
Neutral experience -> Labour market negative	−0.201	−0.199	0.160	1.261	0.207
Neutral experience1 -> Labour market positive	−0.101	−0.101	0.141	0.717	0.474
Other communication -> Labour market positive	0.282	0.283	0.037	7.605	0.000
Other communication -> Labour market negative	0.224	0.224	0.041	5.447	0.000
Problem-solving thinking -> Labour market positive	0.053	0.054	0.035	1.536	0.124
Problem-solving thinking -> Labour market negative	−0.054	−0.054	0.041	1.331	0.183
Writing -> Labour market positive	0.138	0.138	0.029	4.721	0.000
Writing -> Labour market negative	0.108	0.108	0.036	2.996	0.003

Source: own construction.

Table 10 Findings.

Hypothesis	Result	Findings
H1	Confirmed	For the sample studied, the use of ChatGPT has a positive impact on different areas of communication skills. There is no significant difference between the gender of the participants and the students studying in different disciplines. The use of ChatGPT shows significant differences in practice across the countries analysed in the study sample.
H1a	Not Confirmed	
H1b	Not Confirmed	
H1c	Confirmed	
H2	Confirmed	In the sample analysed, analytical and problem-solving thinking is positively affected by the use of ChatGPT, with significant differences for the gender of the participants, the students studying in different disciplines and the countries of practice analysed.
H2a	Confirmed	
H2b	Confirmed	
H2c	Confirmed	
H3	Confirmed	For the sample under study, changing written and other communication competences and users' experiences with ChatGPT as a result of ChatGPT use have an impact on negative and positive phenomena in the labour market. User experiences do not show a significant positive effect and problem-solving skills, which change as a result of ChatGPT use, do not have a significant positive effect on positive and negative phenomena in the labour market.
H3a	Confirmed	
H3b	Not Confirmed	
H3c	Not Confirmed	

Source: own construction.

(3) The impact of ChatGPT on communication, analytical and problem-solving skills is also detailed above (by gender, discipline and country).
(4) In terms of using ChatGPT, respondents tend to have a positive image of the job opportunities that will shape their future. They see the use of ChatGPT as an opportunity to develop their competences, which facilitates rather than hinders their job prospects.

Discussion

The research has produced several interesting results. Unfortunately, the results of the specific statistical analysis are difficult to compare with the results of previous research, as there are few studies with similar objectives in the international literature (Chaudhry et al., 2023; Ajlouni et al., 2023). The results of these studies are confirmed by our research. Most of the studies reviewed discuss the potential and risks of using ChatGPT at a theoretical level (Sekwatlakwatla and Malele, 2023; Wayi-Mgwebi and Wayi, 2024; Chukwuere, 2024; Segooa et al., 2025). Some qualitative research findings highlight the potential for instructors in terms of speed and ease of teacher administration (AlAfnan et al. 2023; Chukwuere and Handoko, 2024), issues not addressed in the present research. Several studies have been conducted on the positive and negative effects of ChatGPT on literacy skills (Bouteraa et al., 2024; Menon and Shilpa, 2023; Su et al., 2023), the results of which are mainly positive. In terms of ChatGPT's impact on communication (including writing and reading), there is no significant difference in student assessment based on gender. The exception is digital content creation, where men rated the positive impact of ChatGPT higher. This result is consistent with the findings of Keane et al. (2025) and Adams et al. (2025). In their research, they identified women's restraint, scepticism and lack of self-confidence. The results of our research are also consistent with those of several other studies, which confirm students' positive opinions about the use of ChatGPT (Ofosu-Ampong et al., 2023) and their behavioural intentions, as well as the relationship between interactivity and trust (Salifu et al., 2024).

The results by field of study show that female students in the arts and humanities gave significantly higher ratings for the positive impact on native and foreign language skills. The same skills were rated as least useful by applied science students concerning ChatGPT support. Presumably, their opinions were influenced by their field of study; they value most what helps them learn and develop. Similar results were found in studies of public administration students by Ravšelj et al. (2024; 2025) and Aristovnik et al. (2023). An interesting result was obtained as a result of the comparison by country. Regardless of their level of development, there is no significant difference in opinion between the respondents. Salifu and colleagues (2024) surveyed economics students about their use of ChatGPT, their motivations, and their behavioural intentions. Their findings indicate that hedonic motivation is the most dominant among students, while, surprisingly, ethics did not influence technological trust. In addition to hedonic motivation, performance expectations, effort expectations, and social influence are also significant in the research of Arthur et al. (2025).

However, respondents from countries at the two extremes of development show a different emphasis on different areas. Zimbabwean students, for whom the availability, affordability, accessibility, etc. of IT facilities is significantly lower, rate the positive impact of using ChatGPT significantly higher, especially in terms of digital communication, digital content production and IT literacy, than other students in a better position. Those with a higher level of availability and accessibility, and presumably therefore greater experience, feel less positive impact. A similar finding was made by Ravselj et al. (2024) in their research. This suggests that those who are less aware of the potential of ChatGPT may find it more difficult to access, possibly overestimating its positive impact. That said, in the case of Egypt, which has the most opportunities, students perceive it to be significantly more useful in the areas of interpersonal communication and the use of the mother tongue. Presumably, this is a consequence of the more frequent access and experience provided by their opportunities.

This result can also be interpreted from a psychological perspective, based on psychological theories of scarcity. According to the scarcity principle, people tend to place greater value on resources that are limited in availability (Cialdini, 2001). In Zimbabwe, where educational infrastructure and access to information are weak at the systemic level, an advanced artificial intelligence tool such as ChatGPT is not merely a study aid, but potentially a lever for equal learning opportunities. The relative novelty of the technology and the cognitive and informational support it offers can trigger a strong contrast effect in students, leading to a subjective overestimation of the technology's significance. This interpretation is consistent with the theories of psychological reactance (Brehm, 1966) and contrast effect cognitive bias (Cialdini, 2001), which suggest that limited or no access to a desired tool can increase its perceived value.

The study of analytical and problem-solving thinking also produced useful results. Here again, the positive influence of ChatGPT was demonstrated. Male students felt a stronger supportive influence in the areas of analytical skills, programming skills and AI knowledge. An interesting finding is that, across disciplines, students in Arts and Humanities feel the positive influence of ChatGPT significantly stronger in problem-solving and decision-making than respondents in other disciplines. Social science students also found the support significantly more useful in decision-making, critical thinking and numeracy skills. In applied science, students rated programming skills as the most important. Here again, the finding that students presumably use ChatGPT most in their field of study is true, and therefore prefer these areas in terms of usefulness (Arisovnik et al., 2023; Ravselj et al., 2025).

Again, when examining the difference by country, Zimbabwe showed significant differences in scores in almost all areas (except creativity and numeracy). A similar assumption can be made as for the first hypothesis. Students who have the least access to ChatGPT will have a higher (possibly overestimated) importance (developmental impact) of the ChatGPT. Urban et al. (2024) investigated its impact on complex problem-solving performance in their study, and their results confirm the findings of the present study. Their results showed that the use of ChatGPT significantly improved self-efficacy in problem-solving and improved the quality and elaboration of solutions, but did not make problem-solving more interesting.

In terms of labour market influence, there is no doubt that MI, and thus ChatGPT, has an impact on the market developments. Previous research in this area has also demonstrated this influence in Africa. Although the results are not positive, the phenomenon cannot be denied (Mishra et al., 2024). In many cases, research projects a threatening future or negative consequences for the workforce (Chen et al., 2023), while others shed light on its usefulness (Wach et al., 2023). The results of the present research, based on student opinions, tend to support a positive view. Among the competences that change/develop as a result of using ChatGPT, written and other communication and analytical thinking have significant positive effects on negative and positive phenomena in the labour market. The responses suggest that positive events are more likely to be a vision for students.

Das and Madhusudan (2024) came to similar conclusions to the above findings. The university students who participated in their research gave positive opinions about the scientific applications, benefits, limitations, acceptance factors and ethical concerns of ChatGPT. The students' opinions about ChatGPT use were not significantly influenced by gender, academic programs, or majors.

To sum up the results, we can say that we are in the early stages of using ChatGPT, where opinions are divided, and experiences do not yet show clear trends. That said, young people tend to have a positive view of this development and its impact on their future.

Conclusions

The paper presents an extract from a global comprehensive research (Ravselj et al., 2024) that asked African university students about their opinions, experiences, opinions and vision of ChatGPT use. The survey included respondents from countries at different levels of development. The research objective was met. The extent to which the use of ChatGPT by university students in more developed and less developed areas of African countries depends on the level of information technology development and the availability of technical facilities.

The results confirmed that although different levels of information technology development influence respondents' opinions, there is no dominant difference between them, i.e., there is no significant difference between the use of ChatGPT by students in more developed and less developed countries. In some cases, the opinions of women and men, and students from different disciplines, differ in terms of the positive impact of ChatGPT use. The only dominant difference was observed in Zimbabwe, which was considered the least developed country among the respondents. This is presumably the reason why students in Zimbabwe rate the positive impact of ChatGPT higher (even overestimate it). But it is also possible that those who access and use it despite the difficulties perceive it as a significantly greater improvement over their previous opportunities and preparedness.

The research and its results make a theoretical contribution to the field, as previous theoretical studies have been supplemented by empirical findings that have been little explored to date. The African region is a particularly neglected area of research, so any new findings are valuable information, not only for researchers studying ChatGPT.

Limitations of the research. African countries are not among the preferred areas for IT and economic research. A global survey always faces problems with respondent willingness to respond, even if the topic is of particular interest and relevance to the respondents. The online questionnaire survey does not provide a representative sample, and less active students digitally were more likely to be excluded, which may distort the results. The online questionnaire could have been completed in different environments, which may have influenced the quality of the responses.

As the research is based on self-reported data, certain biases must be taken into account. The questionnaire included several demographic dimensions, but the students' place of residence, place of study, academic performance and other parameters that could influence the final findings were not analysed.

The literature is limited, especially concerning the African region. This makes it difficult to formulate a correct discussion and evaluate the results. The lack of data previously provided by African countries and their reliability make it difficult to form a fair opinion. Since we used a cross-sectional research design, a single questionnaire survey does not allow for a comprehensive exploration of causal relationships. The limitations of the study do not allow for a more detailed discussion of the background and results.

Practical utilisation. The responsible use of AI raises many critical issues worldwide, but is particularly relevant in Africa. Building public trust and transparency, lack of reliable data, data management frameworks and regulatory oversight are particular challenges in this region. Most African countries lack comprehensive AI strategies and data protection laws. These gaps need to be focused on. Cybersecurity is very weak, and abuses and a lack of ethical rules make it difficult to increase digital literacy and harness the potential of AI data. Innovation opportunities remain scarce, especially for less developed countries. To reach them, African policymakers should try to balance integrated economic considerations with multi-stakeholder participation, academic organisations, civil society and affected communities. Dialogue and mutual understanding of the needs of individual communities are necessary, where the creation of material conditions must be a common goal. Digital education, integrating the use of artificial intelligence into education systems, should be an integral part of this. Teachers must first and foremost be prepared and, rather than prohibiting, integrate ChatGPT into the teaching of individual subjects and the tasks set. This naturally requires the creation of additional conditions, such as the establishment and observance of ethical principles, conditions for the safe operation of technical equipment, and continuous self-training. If more slowly than in developed economies, this path could be a breakthrough for them (African Union, 2024).

Future research directions. As this study focused on the African region, it would be worthwhile to conduct a comparative analysis with the results from other regions. It may also be interesting to conduct a longitudinal study, taking into account the pace of development. A comparative study could also be conducted using other options available besides ChatGPT (Copilot, Gemini, Grok, DeepSeek, etc.). These results could be compared with the results of further developments in text-to-image and text-to-video generative AI solutions. The research could be supplemented with research on teachers, which would reveal interesting phenomena in the use of ChatGPT on both sides.

Data availability

The authors are unable to share the database because it contains personal information. The international website for the research is available at the following link: https://www.covidsoclab.org/global-student-survey/global-database/.

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Author contributions

All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by T.J. and A.B. The first draft of the manuscript was written by A.B., and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Competing interests

The authors declare no competing interests.

Ethical approval

Name: Wekerle International University, Budapest, Hungary. The research was conducted under the applicable guidelines/regulations for human participants (all requirements set out in the Declaration of Helsinki were complied with). Since there was no Research Ethics Committee at the Wekerle International University at the time of the research, permission and approval were only issued retrospectively by the vice-rector for science. (Budapest, December 4, 2025). This required submitting a comprehensive research plan after the fact. It contained all the necessary information: the purpose of the research, the research method, information about the research participants, sampling, and the method of evaluating and using the results.

Informed consent

The questionnaire survey was anonymous. Before completing the questionnaire, respondents were provided with full information about the survey's purpose, the methods used, and how the results would be used. The questions only asked for opinions/evaluations of specific statements on a 5-point scale. The questionnaire was completed voluntarily by the respondents. The responses were evaluated only in aggregate form, and the participants' responses were not used in any form. By voluntarily participating in the questionnaire and understanding the purpose and process of the research, all participants consented to the anonymous aggregation of their responses. The researchers complied with all requirements of the General Data Protection Regulation (GDPR) at all stages of the research.

Additional information

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