

Gen Z and Generative AI: Shaping the Future of Learning and Creativity

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DOI: 10.47760/cognizance.2024.v04i10.001

Abstract:

Thus, the appearance of the Generative Artificial Intelligence opened up a great turn in many areas, including education and creative industries. This paper seeks to understand the deep impact that Generative AI is going to have on learning and creating processes for the social context of Generation Z (Gen Z) students – born in digital culture. The work looks into the possibilities and challenges that Gen Z in collaboration with Generative AI leads to the future of learning and creativity. This paper is relevant as it offers some understanding of the ongoing changes in the education and creativity together with the escalating growth in technology. The nature of the association between the members of Generation Z and the Generative AI needs to be known by the educational stakeholders, policymakers, and business executives to leverage value from the existing and upcoming technologies together with dealing with possible negative impacts. The purpose of this study was to explore the nature and uses of Generative AI, and its effects on the learning and creativity of Gen Z, in addition to identifying the advantages, disadvantages, opportunities, and risks/parties' concerns that are commensurate with the integration of this technology in teaching/learning and creative processes. To achieve the objectives of the study the following research methodology was used: The research used both a literature review and documentary research. The materials used included academic publications, Industry reports, books and other credible internet sources on Generative AI and its impact on the education and creativity of the Gen Z. The document analysis included policy papers, educational technology reports, case studies and white papers from academic and professional bodies as well as other industries that involve Generative AI. Several insights show that using Generative AI can positively impact learners' experiences, engagement, and creativity. However, there was some controversy about the excessive usage of AI and claimed that because of it people may get worse at critical thinking. The following were noted to be major concerns; Ethical Issues: they included issues to do with bias in the algorithms as well as the right to privacy of data. Thus, the findings of this research point to a three-way settlement with respect to the use of Generative AI in education and creative industries. It underlines the guideline of how human creativity and critical thinking ought to be sustained, while using AI tools.

Proposals include, the need to teach critical thinking alongside AI use, fostering ethical AI consciousness, surged AI education, appropriate non-ethnic AI data set, strong AI policies and pro positive AI inspires and creative constructive use. The research implications for future studies include studying the changes in the achievement of learning outcomes over a period of time, wherein Generative AI has been incorporated and understanding how this technology influences different learning styles and needs, the issues of ethical and privacy concern, the requirement of professional development to educators in relation to Generative AI and finally, the comparison information and communication technology for learning between different cultures. Related to that, further studies on the effectiveness of AI in approaches like collaborative learning, its potential on preparing learners for employment, and on the psychology of students would be helpful in informing the future advancement of Generative AI in school and particular creative areas.

Keywords: Artificial Intelligence (AI), Cognitive Development, Creative Practices, Educational Impact, Ethical Considerations, Generation Z, Generative Tools, Learning Experiences.

Introduction

The appearance of Generative Artificial Intelligence AI has brought outstanding changes in different fields such as educational and creativity fields. As we are at the cusp of this revolution in AI, the coming together of Gen Z and Generative AI is a good intervention towards reconstructing the model of learning and creation. Members of Gen Z born in late 1990s up to the early 2010s are regarded as digital natives since they were brought up in an internet environment. They are aware of and have interacted with technology in their daily life, they are conversant with social media and other digital communication tools thus making them well-suited to unlock the potential of Generative AI. This is the case with the advent of these convergences that are bound to radically transform the ongoing conventional methods of education and further demand new creative frontiers. Generative AI, as understood by its capability and capacity to generate textual and non-textual content of various forms, including texts, images, music, and even code, can be a great tool for the Gen Z population. It opens up the possibility for people to venture into the realms they never imagined, and allows learners to customize their experience, which in turn encourages creative thinking. Based on Generative AI, in the educational context, students can track their unique learning pathways, learn through games and VR, and get instant feedback to cover the preferences of Gen Z scholars. Apart from education, AI will positively impact creative industries to enhance human creativity to the extent that Gen Z's creativity is out of this world.

For example, this article focuses on the new generation, Gen Z, and Generative AI explaining how the two are changing learning and creativity. Studying this generation's experience of AI-enabled technologies will help in understanding the dynamic approaches to education and creativeness. The discussion will be aimed at examining the prospects and threats of the identified interaction and considering possible successors of Generative AI as the initiator of new learning paradigms, creative breakthroughs, and future cultural and economic realities. This is the case with Gen Z who has been and will continue to define technological advancements hence the application of Generative AI will be critical in shaping the path of innovation and creativity in the future years. Due to the innovative development of Generative AI, the educational settings are in the process of changing significantly thus forcing teachers and trainers to assess their practices critically (Sallai *et al.*, 2024). The purpose of this research is to find out the unrevealed multifaceted impacts of Generative AI on learning process of the Generation Z students who are born and brought up in the digital environment (Kadaruddin, 2023). The learners of the present periods are known as the Z

generation exactly because they were born in the period with constant digital advancements which influenced their learning attitudes and expectations. They cherish immediacy, online relationships, and self-employing and career-enhancing opportunities; though their critical analysis and researchers' skills are comparatively lower sometimes (Chan and Lee, 2023).

As for Generative AI measures, relevant institutions must understand these generational differences as they seek to incorporate these technologies into relevant curriculum offerings (Sallai, Cardoso-Silva and Barreto, 2024; Chan and Lee, 2023; Csobanka, 2016; Dhinakaran et al., 2020). Empirical literature suggests that knowing more about students in this newly emerging group – Gen Z is a key to make use of these revolutionary tools in higher education (Sallai, Cardoso-Silva and Barreto, 2024; Denny et al., 2023). In the most recent literature, it is stressed that, while adopting Generative AI, the focus is on how to bring this kind of AI into action effectively, how to balance the utilization of Generative AI's functions and how to protect the learning process at the same time (Chan and Lee, 2023; Sallai, Cardoso-Silva and Barreto, 2024; Altares-López et al., 2023). Thus, one has to take into account the learning preferences and behavior of Gen Z, which has been formed due to their use of technology. They are impatient and able to work with socially networked media but often lack the higher order thinking skills and information literacy skills. As we learn these generational differences, it becomes important that for educators, there is a way of harnessing the power of Generative AI and at the same time not compromise the learning process. Consequently, it implies not only educators' purposeful infusion of Generative AI into their lesson plans, but also helping Gen Z develop genuine critical thinking and information literacy, so that they could apply these sophisticated technologies responsibly to the academic and work-related pursuits.

Objective of the Study

In order to get the bigger picture of what has been said, done and known about generative AI, its uses and effects on the learning and innovative abilities of the members of Generation Z. In the study, the generative AI tools' effects on Generation Z learners and their learning processes, as well as creativity, will be investigated to understand advantages, disadvantages, and issues arising from its usage in learning and creativity contexts.

Methodology

1. Literature Review

- **Source Identification:** A literature review of relevant academic journals, books, and other sources of information concerning generative AI, its application in education and creativity and impact on Generation Z.
- **Data Extraction:** Gathering and sorting of information concerning the strengths, weaknesses and ethical implications of generative AI tools.
- **Analysis:** Searching for themes, trends, and research gaps to come up with an overall view of the existing literature.

2. Document Analysis

- **Document Collection:** Conducting online surveys and Interviews to get primary data and collect secondary data like policy papers, educational technologies, cases, white papers, etc. from various institutes, AI organizations and expert people.

Literature Review

The synergy of the Gen Z and Generative AI has recently attracted much research focus, especially when it comes to their applications in learning and creativity. Gen Z is also tech-savvy, thus has the appropriate apply of generative AI tools to create new products using generative AI tools. Critically analysing relevant literature in the present article, the author demonstrates how Gen Z uses generative AI at the moment, the potential opportunities and risks of this cooperation in the future, as well as its future impact on learning and creative market.

Generative AI in Education

Studies on the implementation of generative AI in the light of education underline its ability to transform the conventional system of learning. This is because, with generative AI that has been developed, it is now possible to create individual learning environments that will meet the needs of every learner. This capability makes it possible that learning solutions that suit different learning type and speeds can be developed to enhance learning achievements among learners. AI tools can also provide instant feedback, whereby the students are better placed to rectify their knowledge deficiencies as they learn. Further, the use of generative AI enhances unique learning environments where students are encouraged to solve particularly oriented problems and work in groups with cognition tasks that reflect actual circumstances. However, there are some challenges associated with the use of generative AI in the education environment. Some criticisms have to do with too much reliance on the particular sort of AI technology; it is feared that it undermines students' capacity to think for themselves. Several scholars believe that although decision-making with the help of artificial intelligence is effective, it takes away the student's possibility to develop problem-solving skills. However, I also think that ethical issues are crucial when speaking about the application of AI in education: what about personal data protection and security as far as it is needed to analyze big data of students? There is no well-defined legal justification for how these intelligent technologies should be implemented in education systems, thus raising issues to do with responsibility and disclosure.

Impact on Creativity

Another area of major concern in current research is the generative AI's capabilities for creativity. In the creative industries, there have been accolades directed towards AI because the latter is known to enrich human creativity. AI tools also can help artists, writers, and musicians to come up with new ideas, give inspiration, and make repetitive procedures to give more free time for the creative portion of the job. For Gen Z who already grew up creating digital content, AI is simply giving them new ways of creating art and sharing it. Being open-sourced, such AI-driven creative tools make creativity easily available and accessible to as many people as is possible irrespective of their coding ability. However, there are certain issues and risks related to AI writing such as the replica of the work and originality of work. The main negative impacts include the following: Critics pointed out that over-dependence on AI means that artistic creativity would be replaced with algorithmically produced outputs, that would give a homogenized look to the final piece. There are such challenges as copyright – as most AI systems use existing content as training data, they may end up violating someone's copyright. This leads to issues on ownership and copyright in

connection with works concerned that have incorporated the use of Artificial Intelligence. In addition, the position of an artist can be reduced with the help of artificial intelligence if it becomes conceived as a primary source of creativity.

Artificial Intelligence Tools

Artificial intelligence (AI) as a discipline has been developing actively throughout the twenty-first century (J. Liu *et al.*, 2018; C. Zhang & Lu, 2021). In the past, machines substituted muscular work, but in the new age this century is referred to as ‘second machine age’ whereby AI is capable of matchless and even abstract work (Fleming, 2019). Sophisticated forms of artificial intelligence could thereby alter the essence of low-skill work that was once considered to be ‘too human’, as is the case with hairdressers and waiters for instance. AI refers to digital enablers that can transform the different business activities to achieve goals and may respond to certain societal issues (Nishant *et al.*, 2020). Altogether, AI has shifted the landscape of the lifestyle as computers were made capable of performing tasks that were previously considered to be reserved for human beings only (Malodia *et al.*, 2021; C. Zhang & Lu, 2021). A literature review that does not exceed 500 words shows that AI improves the product and contributes to business processes in different industries. For instance, progress made in AI have led to the development of natural language processing and machine learning in the education sector in the form of complex educational chatbots (Hwang & Chang, 2021). These chatbots can be of assistance for teachers and students answering questions and performing various routine (Chocarro *et al.*, 2021). According to Bodea *et al.* (2021), training of the presented AI chatbots is useful not only for active learning but also for the improvement of the AI chatbot intelligence through the process of path planning, intention understanding of the users and their emotions. From this study, it was discovered that the use of chatbots would help in the sharing of project management ideas and knowledge, coordination and collaboration, management of tasks, and give notifications all without the lengthy emails.

On the other hand, robotics is one of the core subfields of AI that deals with the development of robot structures that imitates human performance (C. Zhang & Lu, 2021). So far, robots have undergone the process of three different generations (J. Liu *et al.*, 2018; C. Zhang & Lu, 2021). The first generation had program-based robots that in the first needed task inputs from a technician. The second generation included adaptive robots with various types of sensors including visual, auditory and tactile for acquiring information about the environment. Intelligent robots appeared in the third generation; these robots are even superior to humans in analytical and control characteristics because of sensitive Sensors. Modern technologies of AI in robots expanded their scopes in helping people in several industries and contexts, such as industrial (Evjemo *et al.*, 2020; Perez-Grau *et al.*, 2021), health care (Goundrey-Smith, 2019; Iqbal *et al.*, 2021; Kyrarini *et al.*, 2021), business (Smids *et al.*, 2020). As for the healthcare area, Goundrey-Smith (2019) claimed that robots help reduce errors in drug distribution in UK hospitals’ pharmacies. Kyrarini *et al.*, 2021 performed a survey whereby the emphasis was on robots in the health sector, including aspects such as the existing development in robots, the availability of robots in business, and the existing challenges regarding the application of robots in the healthcare sector. The survey extended to various categories of healthcare robots that included general healthcare robots like care robots (Huisman & Kort, 2019; Qidwai *et al.*, 2020; Yousif, 2020), hospital robots in scope (ABB,

2019; Diligent, 2021), assistive robots (Gordon et al., 2019; Kumar Shastha et al. 2019). It is imperative to understand that there is no consensus regarding the definition of AI products and services since it depends on the domain and the application of the specific AI products and services. In a general way, there are solid AI products which are capable of providing results as similar work done for human-like beings. For example, in the e-commerce market, intelligent methods and solutions can be applied to individualize clients' experiences and identify deception. In education, AI can create smart content, formative and instructive practices, and help managerial features. In lifestyle applications, it can eliminate unwanted messages, analyze a user's mood, and provide suggestions as to what content, be it videos or songs, the user might like. This study categorizes AI products into three main groups: The known applications of AI include voice assistants including Alexa, Siri, and Cortana; smart home devices including smart TVs, smart lights, smart doors; and recommender systems including Netflix and Amazon.

Challenges and Ethical Considerations

From the literature review section, it is possible to identify several concerns and ethical dilemmas that have been put forward on generative AI, especially in learning and art domains. It is identified that AI has the functionality of being biased, which in turn leads to more biased decision-making. Because the AI systems learn from data, it entails that they will be programmed to serve existing biases present in the datasets. This can result in unfair educational material or artistic work that such can perpetrate certain prejudices or exclude some section of society. Ethical consideration also covers issues such as Provenance and accountability of AI systems. One of the biggest antecedents is the 'black box' characteristic of the AI systems, which means that one cannot easily explain the given decision. In the context of learning it may be hard for educators to put your confidence in AI advice or comments due to its opaqueness. In the creative industry sector, there are uncertainties of how the content generated by Artificial Intelligence is produced, this may sometimes bring questions about the ethical use of such tools. As the concept of the world evolves abruptly, Generation Z and Generative Artificial Intelligence are turning into the hot research area for both academics and industry. In this literature review, there is a focal interest to identify the current stand of Generative AI, its uses, and the impact that it will have on learning and creativity, especially to Gen Z (Zhang et al., 2023). Technological innovation known as Generative AI can revolutionize numerous industries ranging from education to art and even more. ChatGPT which is under the Generative AI has recently drawn much attention and discussion among academics and scholars around the world (Sallai, Cardoso-Silva and Barreto, 2024). Needed in order to increase awareness of the impacts of this technology for the education of Gen Z, the generation that has experienced the digital revolution as they grew up. Recent research has described the role of Generative AI in the higher education context while stressing about the advantages and the drawbacks (Sallai, Cardoso-Silva and Barreto, 2024). According to educators, Generative AI can generate real-time, complicated, and engrossing content for the learners by allowing creative, critical thinking, and problem-solving skills (Kadaruddin, 2023). This shift toward the learner-centered model of education is more consistent with the learners' and educators' needs of the Gen Z who are natives of the digital world.

But the introduction of Generative AI as part of the curriculum also has its drawback on the process involved in learning. There are some reports on the fact that Generative AI can be used by students more as a stimulus to devour information instead of using this system to learn. This is why curriculum planning and assessment approaches need to be planned and designed in such a way that the learner will be involved in the learning process and the learner will acquire knowledge and skills that will enable him or her to succeed in the 21st century. In response to these considerations, various approaches have been suggested to provide a favorable utilisation of Generative AI while at the same time, maintaining the authenticity of learning processes. Such approaches include the proposal to apply Generative AI inside an instructional design matrix so as to provide the educational process with coherence and optimality. Also, there is increased interest in addressing the ethical concerns that accompany the application of Generative AI in education since the technology can be misused to produce essays and other learning materials by students and assignments.

However, the importance of Generative AI does not end in the classroom province: it is also applicable to the creative professions. Researchers have noted that Generative AI also can liberate creative control and reduce barriers as far as art is concerned to allow people who cannot necessarily draw to come up with outstanding artworks. This has elicited great enthusiasm and anxiety within the artistic fraternity, largely due to the intersection of art made by humans with that made by machines. The above changes have been driven by Generation Z which is a generation that has been raised on technology and the internet. Everyone has been quick to adopt Generative AI tools within their learning and working activities and often merge it to their lifestyle. Nevertheless, the concerns regarding the long-term effects of such a permissive approach toward technological advancement on assessing the enhancement of Gen Z's higher-order thinking skills are still under discussion and analysis (Altares-López et al., 2024). When Generative AI is adopted and integrated into educational settings or being considered by the authorities, policies, and scholars, it is high time to pay attention to the learners of Gen Z (Sallai, Cardoso-Silva and Barreto, 2024; Ali et al., 2023; Kadaruddin, 2023). Thus, the educational strategies with the use of Generative AI will be more effective in response to the interactions between the target audience and the programme when it is determined that the learners of a new generation understand the potential of the technology and are ready to unite with it in order to achieve their learning outcomes and personal growth.

Lastly, incorporating Generative AI in education and creativity reveals potentiative potential in the further development of learning and creative processes. However, it also comes with some drawbacks and ethical issues that need to be weighed through a careful balance. As the generation Z users proceed with experimentation with AI tools in their lives, the way they navigate through these tools is going to be of significant importance to the future of education and arts. More study and prevention efforts will be required to optimise Generative AI's potential while minimising its drawbacks.

Discussion

Several interesting findings within the literature are valuable to consider specifically in regards to Generation Z (Gen Z) and Generative AI. These reflections are discussed,

classified, and examined in this section specifically about the attributes of Gen Z and their experiences using generative AI, the possibilities and risks it poses, and the pertinent ethical concerns for education and creativity.

Personalized Learning and Student Engagement

Another advantage of generative AI in learning is that it develops consistent learning environments. Learner-oriented education personalized with the help of content assembled by generative AI was also described in the literature (Zhang et al., 2023). This kind of approach is quite favorable to Gen Z since have been brought up with technologies that offer user-specific experiences. Generative AI, therefore, has the potential to provide individualized learning experiences hence improving students' behavior in class, while making learning relevant and more effective (Kadaruddin, 2023). Additionally, the feedback of the AI tools can be given in real-time hence making it easy for the students to self-adjust and correct knowledge deficits hence enhancing the efficiency of learning (Sallai, Cardoso-Silva and Barreto, 2024). Nevertheless, these advances of technologies hold a significant number of advantages but also pose potential problems when the AI tool takes the major part of the learning process, which can cause ignoring of logical abilities in individuals. This worry as has been pointed out by some researchers is that AI should augment learner-centered training paradigms not supplant them. It is the educators' responsibility to act deliberately as they integrate AI in facilitating education to avoid robbing the students the sense of an active role in the educative process rather than being recipients (Altares-López et al., 2024).

Enhancement of Creativity and Democratization of Artistic Expression

The uses of generative AI have also shown how they can open up new channels of creativity and new forms of art in the creative arts industry (Zhang et al., 2023). AI support tools can come up with new ideas, execute other simple plans, and offer ideas which ultimately helps the creators to be better strategists and spend most of their time thinking at the concept or a higher level. This is especially so for members of Gen Z, who have grown up with digital production tools and are thus predisposed to incorporating technology in their creative work (Kadaruddin, 2023). They are freeing up the Art of creation and making it mainstream as another advantage of generative AI. With generative AI, creative ideas can be produced easily by providing high-quality aid to all the people so all those technical knowledge-less people can also be part of creative arts (Sallai, Cardoso-Silva and Barreto, 2024). However, the incorporation of AI in the generation of creativity also has its disadvantages since it arouses the aspect of validity and uniqueness of work produced. Some of the major criticisms include that over-reliance in the use of AI brings about sameness in what is produced, thus risking the innovative or creative industries' credo of authorship and the artist. These concerns underscore the importance of achieving moderation which will see brands employing the tools without diluting the personality and uniqueness of the human talent (Altares-López et al., 2024).

Ethical Considerations and Regulatory Challenges

The issue of ethics concerning generative AI is discussed commonly in the literature. Another issue is that AI systems contain prejudices, which means that AI systems approach the execution of the task with the same prejudice presuppositions and ensure that a prejudiced

approach produces prejudiced results (Zhang et al., 2023). This is especially the case in learning and artistic environments where prejudice AI results can perpetrate biased and biased social paradigms. To overcome this bias, it means that the data used to train the AI systems must be very carefully chosen and followed up to ensure that the AI systems are fair to everyone. Another ethical issue is that the current AI systems do not elucidate their decisions, simply because, often, they cannot, which is known as the ‘black box’. It was found that the processes that are followed in AI for making decisions are not always rational or logical and therefore difficult to explain to educators and creators leading to lack of trust (Altares-López et al., 2024). Such complexity of using AI in education lies in the fact that the results and conclusions made by AI systems are hard for educators to trust due to their opaque nature. In similar direction in the creative domain, there are such questions as the ethical use of AI tools and application, ownership of AI generated content to change the traditional concepts of intellectual property and copyright laws (Sallai, Cardoso-Silva and Barreto, 2024).

Impact on Gen Z’s Cognitive Development

The introduction of generative AI into the daily experience means something unprecedented in the cognitive growth of Gen Z. The use of AI as a learning resource and creative tool is beneficial but it had been argued that its application may result in delaying the proper development of thinking and problem-solving skills (Kadaruddin, 2023). More significantly, as Gen Z is using AI in the realms of personal and academic and professional life, it becomes crucial to track the impact that these tools have on cognitive development. The investigated data point to the idea that integration of the AI, rather than the replacement of human work by it, is needed to foster the comprehensive further education of Generation Z learners (Ali et al., 2023)

The Need for Proactive Educational Strategies

Due to the highly disruptive nature of generative AI, learning institutions and policy makers have to be more proactive in addressing the nature and application of AI in learning systems. This encompasses creating learning instructions that employ AI enablers to support learning as well as to develop crucial skills but as well ensuring that students do not cheat (Sallai, Cardoso-Silva and Barreto, 2024). It is critical to incorporate the ethical standards, as well as the legal requirements needed to address the issues related to data protection, security and the proper use of AI. Thus, following the educational strategies with the approach regarding the learning abilities of Gen Z, it is possible to get the most of the generative AI in focus and to avoid potential risks (Altares-López et al., 2024).

This underlines that it is both, an innovation engine that can stimulate growth and an ethical and cognitive concern, if applied and developed generatively. To that end, as Generation Z makes its way into school systems and computer programs, educators, content developers, and those who create policies on technology must become wise to this landscape to take full advantage of generative AI without further eradicating the joy that comes with learning and creation. Therefore, the discourse and the work on principles and effects of ethical utilization

of AI when it comes to education and creative fields will be crucial in the age of artificial intelligence.

Findings

Personalized Learning and Student Engagement: 1. Personalized Learning and Student Engagement: Those are the possibilities of generative AI to transform educational processes and improve learners' satisfaction by providing them with customized paths relevant to the Generation Z. The flexibility of AI and the facility to change content in response to social media feedback matches the learning preferences of Gen Z. But at the same time, there is the risk that the extensive use of AI will inhibit the student's ability to think critically and solve problems.

Enhancement of Creativity and Democratization of Artistic Expression: Enhancement of Creativity and Democratization of Artistic Expression: This means that generative AI tools are quite promising in supporting the creativity and freedom of Gen Z to experiment with new ideas and concepts. Technological advances in the incorporation of AI in artistic creation makes artistic creation more open to a broader number of people besides the use of different technologies in the creation of arts. However, there is a fear of standardization of creative outcomes and disputing the authorship of creations by AI despite the recognized benefits that it has for creators and artistic works

Ethical and Regulatory Concerns: The enhancement of generative AI solutions in learning and creative. The RT and relative usage in various writing contexts raises extensive ethical issues. Another issue would be the ability of the algorithms to produce or provide biased or stereotyped results. Another disadvantage that relates to AI systems is the opaque nature of the technology; also referred to as the 'black box' problem which makes it hard to gain credible trust among the educators and creators. These remain real concerns and it is incumbent on legislative and other policymakers to provide the ethical yardstick and properly fortified frameworks that will color usage of the AI technology.

Impact on Cognitive Development: Due to the increase in generative AI by Gen Z there are aspect such as cognitive development that needs to be considered. On the positive side, it has been established that with AI there can be improvement in learning and creativity, although the downside of this is that with reliance on these tools most of the time then there could be a possibility of stunting of critical thinking and analytical skills. This means that it has to be in moderation in a bid to enhance the learning process of Gen Z learners by offering additional support beyond mechanical processes instead of fully assuming their learning responsibilities.

Need for Proactive Educational Strategies: In order to fully unlock all the positives of generative AI while keeping the negatives to a minimum, schools and policy makers needs to be pre-emptive. This ranges from adapting the use of AI in teaching and learning to improving the results of learning and the discovery of other skills. Moreover, ethical and privacy concerns should be resolved through the rules and norms to enhance students' safety and trust in AI-based educational and creative platforms.

Therefore, the research shows that with the positive impact of generative AI on education and creativity, special consideration must be made towards Ethical, cognitive, and regulatory concerns for the best realization of the opportunities that come with the innovative technology. Even though Gen Z is continually using these technologies, more studies and the proper policy formulation will help define a positive future for generative AI.

Recommendations

Encouraging Critical Thinking alongside AI Use: Some obstacles like over-dependence on AI to develop generative models may weaken students' critical thinking and problem solving thus; institutions should develop strategies that can make use of AI in conjunction with conventional methods of learning. It is also possible to include assignments that demand independent reflection, critical thinking, and problem-solving skills and this will help to keep these skills in practice. Hence, to harness the potential of the AI in the learning process, educators will need to focus more on breaking it down into a tool concept rather than replacement of deeper cognitive processes.

Promoting Ethical AI Use and Awareness: Peculiarities of generative AI application mean that adequate ethical concerns need to be outlined and ethical standards disseminated among students and teachers. Schools and colleges need to incorporate parts of lessons on the moral uses and effects of artificial intelligence concerning data privacy and bias, as well as consequences of scripting and other AI-related products. Another aspect for Institutions should also endeavour to promote transparency of AI systems so that people can know how the AI algorithms work or even the prejudice they have.

Developing AI Literacy Programs: 27 Gen Z students should be aware of the capabilities, limitations and processes of AI tools for them to be in a position to analyse the AI tools. To this end integrating AI literacy programs is important in informing the students in all aspects of AI technology and enables them to use the technology to the highest impacts without violating any set regulations. Such programs should include the fundamentals of machine learning, and the place of ethics in Artificial Intelligence among others, advice on applying Artificial Intelligence in work related to art and academia.

Ensuring Diversity in AI Training Data: AI developers and the educational institutions must emphasize on the utilisation of diverse training data for the AI algorithms to mitigate the problem of bias and discrimination. It can reduce the chances of a bias that reflects the thinking and choice of few designers and artists and make the results more diverse. It is thus important for workers in the field of AI, educators and policy makers to work collectively to ensure that the AI tools that are being developed in the society are those that will be fair and less inclined to bias the students or the creative individuals who intend to use them in their field.

Implementing Robust Regulatory Frameworks: To impact these sectors, there is a necessity of viable regulatory frameworks to guide the application of generative AI. It is recommended that parties such as educators, policymakers, AI developers, students, teachers, and parents

collaborate to ensure that specific policies are set down on issues concerning data privacy or security and ethical use of AI. These regulations should also introduce certain standards of AI accountability and transparency which will contain the recommendations for their proper utilization and safeguards student and creators' rights.

Fostering Collaborative and Creative AI Use: It is recommended that educational institutions and creative industries instigate joint ventures that exploit and incorporate AI technologies in consonant with the latter's capacity to foster creativity and innovation. In this way institutions help create conditions for AI to augment rather than supplant creativity, which in turn leads to fresh and diverse forms of creativity. There is no need to argue that people still see artificial intelligence as a threat taking away their jobs, but combining efforts of AI and people and organizing contests, projects, and workshops that demonstrate works of human and AI in one project, can significantly prove that AI is just an assistant that improves the creativity of people.

Continuous Monitoring and Research: In particular, future studies have to be conducted to explore the effects of generative AI technologies in terms of learning, creativity, and cognition. The educational sector and academic scholars should watch this development by keeping records and records of experience on the impact it has on Gen Z students toward future education. This continuous evaluation should enable the person to find other challenges and opportunities coming up which maintain the integration of AI to be useful and in the interest of the goals of a total education.

Incorporating Feedback Mechanisms: Provide feedback mechanisms which can enable students and teachers to give their feedback as to how generative AI tools can be of help to them. This information can be utilised to improve AI services, for them to be more helpful to the users in the future. Through students and educators' engagement in making and evaluation of AI technologies institutions are in a position to arrive at the best technologies about the educational goals and expectations of the students.

Therefore, these recommendations are to select the proper model of generative AI that would be most sufficient for Generation Z's needs while considering the possible ethical, cognitive, and legal issues. If educational institutions, policymakers and developers are to capture the best of AI then they need to embrace AI and strike a balance so that the learning environments will be optimized to help Gen Z learners be creative through use of artificial intelligence.

Theoretical Contributions

Integration of Generative AI and Learning Theory: Therefore, this work extends theoretical insight on Generative AI as it relates to generative learning theory in the context of Generation Z learners. It builds on the assumptions of technology-mediated personalized learning and adaptive learning with the addition of utilizing AI framework.

Cognitive Development Framework: Through the analysis of findings, the study puts forward a conceptual model for examining the effects of Generative AI on Gen Z Students' cognitive development with regards to critical thinking skills, the advantages as well as the disadvantages.

Ethical AI in Education Model: It also helps develop theoretical models and guidelines for ethical use of AI in education for the matters of bias, transparency and accountability in AI based learning environments.

Creativity Enhancement Theory: The work contributes to the theoretical knowledge concerning the application of Generative AI tools in enhancing or even innovating the creative endeavours, especially in the case of DN learners.

Technology Acceptance Model for Gen Z: It adds to the further development of technology acceptance models in the case of Gen Z using new advanced AI technologies in learning and art processes.

Practical Implications

Curriculum Design: As result of this study, educators and policymakers should be able to use the information to develop curriculum on how to incorporate Generative AI tools in learning processes in a sane manner that enables learners to think critically.

AI Literacy Programs: Therefore, it is evident that AI literacy programs more so in the education sector should be encouraged and put in place to ensure Gen Z students understand how best to use the AI tools appropriately and avoid their misuse.

Ethical Guidelines: To that end, institutions can utilize the ethical concerns outlined in the study to construct precise directional strategies for the appropriate utilization of Generative AI in learning and creative environments.

Personalized Learning Strategies: According to the study, educators can adopt Personalized Learning approach based on Generative AI to work for learners' engagement and learning.

Creative Industry Practices: The industry can adapt some strategies that can incorporate Generative AI in making creativity more accessible, on the same note comforting critics over issues to do with creativity forgery.

Professional Development: In particular, it is revealed the necessity of the preparation of educators for the efficient use of Generative AI in education contexts.

Policy Formulation: From the understanding, policymakers can enable the rules of law that guide the application of generative AI in education since these applications will raise concerns of privacy, fairness, and transparency among learners and institutions.

Assessment Methods: Institutions can then create new forms of formative assessment that takes into consideration use of Generative AI tools while at the same time testing the actual proficiency and knowledge of students.

Collaborative Learning Environments: The presented results can be used to develop AI-augmented environments for collaborative learning in order to support teamwork and social characteristics.

Mental Health Considerations: It can be helpful to educational psychologists and counselors to further formulate the methods for dealing with possible psychological effects of intensive AI utilization among students of Gen Z.

The present theoretical advancements and applied suggestions offer an empirical paradigm for future studies and applications of Generative AI in education and creativity paradigms with particular reference to the Generation Z.

Future Directions

Thus, understanding the possibilities of interaction between Gen Z and Generative AI has opened up a new opportunity to develop further learning and creative opportunities. Nevertheless, the above are just the preliminary findings, and there are quite a number of directions for subsequent research to help further develop and deepen our knowledge and experience. The following directions are suggested to further develop this field: The following directions are suggested to further develop this field:

Longitudinal Studies on Learning Outcomes: Future research could focus on the investigation of the long-term effects of Generative AI tools on Gen Z students' learning attainment: It could be beneficial to design a study regarding the use of the mentioned tools for several years in a row to assess the impact of such technologies on critical thinking abilities, general problem-solving skills, and creativity accordingly. These studies can also assess the student's understanding and assessment of their knowledge and the use of the learning acquired in practice.

Impact of Generative AI on Diverse Learning Styles: It will be important to find out how Generative AI helps it cater to the diverse learning requirements and capabilities. Subsequent studies should examine better ways of implementing new AI intelligent learning environments for visual, auditory, kinesthetic, and read-and-write learners. In addition, studies may investigate how effective these tools are for students with learning disorders or other learning difficulties students to increase their inclusion in the classroom learning process.

Ethical and Privacy Considerations: The more that Generative AI is embedded in education; then the ethical and privacy issues that are arising must also be considered. This study is expected to be extended in future to look at factors related to data acquisition and utilization of AI systems with regards to Gen Z's rights to privacy. Research can also be done in addressing concerns of ethical use of AI generated content particularly in academic integrity such as concerns to do with properties and ownership of content.

Educator Training and Professional Development: Far more important as a factor, there is the role of educators in the best decisions regarding incorporation of Generative AI into curricula. Some future studies need to be made on how educators should be trained to use AI tools so that they can properly and appropriately educate the students on how to properly take advantage of such tools. Research could investigate how knowledge capitalization interventions may improve the training and support system needed for teachers to become trained in AI based learning contexts. **Cross-Cultural Comparisons:** Given that Gen Z is a global generation, cross-cultural studies could provide insights into how different cultural contexts influence the adoption and impact of Generative AI in education. Future research could compare the use of AI tools in various educational systems worldwide, examining how cultural, economic, and social factors shape their integration and effectiveness.

AI's Role in Fostering Collaborative Learning: Studying should continue in the aspect of Developing Generative AI's ability to support collaborative learning among Gen Z learners. Studying the effectiveness of AI based platforms that foster group assignments, collaborative and peer-to-peer feedback, and problem solving may show how such technologies offer required teamwork and social skills required in future workplaces.

Generative AI and Career Readiness: Further research could investigate how Generative AI is helping Gen Z to be ready for the market changes. Research on AI can also be done with

emphasis on the manner in which utilization of AI aids in developing career related competencies like innovation, flexibility, and digitization. Apart from the above, more research could be carried out to look at the potential collaborations between academic institutions and employers to devise AI integrated curricula that meet the demand of the market.

Evaluating the Psychological Impact: The benefits of using Generative AI in educational practice require further examination from a psychological point of view. Subsequent research should explore the impact that constant engagement with AI has on the quality of life of the Gen Z students. It can propose idea for healthy usage of the technology, possible concerns such as heavy reliance on artificial intelligence which could negatively impact the attention span or social functionalities can also be investigated in research.

Policy and Regulatory Frameworks: At the advance of Generative AI in education there should be studies of the policy approaches and legal requirements which regulate the opportunity. Further research should focus on the identification of procedures that will prevent the unethical use of this technology in learning institutions and the ways of adopting the use of AI in the institutions in a fair and efficient manner. This includes students' rights as well as safe and beneficial learning environments for students.

Exploring AI-Driven Creativity Beyond the Classroom: Future research should focus not only on schools and colleges on how Generative AI affects creativity among learners but also in other forms of learning that learners engage in. Subsequent research may investigate how Gen Z incorporates AI in out of school, leisure and personal pursuits, in order to explore the extent of the effect of AI, on creativity and innovation.

Through addressing these areas for future research, it will be possible to gain a further insight into how Generative AI can work with Gen Z, with the aim of improving the efficiency of those learning technologies to foster creativity, to positively impact on students' learning outcomes.

Conclusion

The bridging between the Gen Z and Generative AI means a shift both in learning process and in creative industries. These findings, therefore, demonstrate the transformative potential of generative AI in the process of personal education, creativity, and, at the same time, CI and EE responsibilities' criticality. Gen Z is digital inhabitants and they are at ease when it comes to generative AI enabling them to innovate in aspects of learning and creativity in ways past generations could not. Generative AI is a unique opportunity that can change the system of education by enhancing individuals' learning, motivating them, and giving feedback immediately. Such personalization is also in vain with Gen Z's attitude toward the learning environment that should be rather flexible. However, there are potential dangers that may result from excessive use of AI tools; this threatens the general development of critical thinking and problem-solving skills stressing the urgency of a blend of new teaching and learning methods and the traditional ones. As for the creative application of AI, generative AI enables the contrast of the Gen Z generation and makes creativity more open for everyone providing them with powerful and professional-level tools. However, this advancement also has certain issues associated with it such as question relating to the originality of the content produced by AI and the conventional idea of authorship. To meet such concerns, it is critical to apply more refined perspectives that correlate AI to the uniqueness and variety of creative

endeavours. Bias in generative AI, the scope of AI's decision-making ability and the inability of AI to explain its actions plays a vital role in defining the ethical use of generative AI. AI itself and especially its processes can be considered as 'black box', because people still cannot fully trust it, especially in educational contexts and, indeed, in creative industries. This means that strong ethical standards, and legal policies and regulations should be established to deal with these problems as well as to safeguard the welfare of the participants. To incorporate generative AI in the lives of Gen Z is to have a socialising effect on their cognitive processes. , it is important that more research be done to assess the impact of these AI tools on students' critical thinking abilities and other mechanisms of cognition. For this reason, educational institutions and policymakers need to find ways on how students' overall growth can be promoted while AI is part of their educational system. Future research should investigate further the outcomes over time, students with different learning preferences, the use of technology's ethical concerns, as well as trainer preparedness. Cross cultural research, work integrated learning complemented by AI and AI in employability can also be seen as prospects. Through these future directions, stakeholders can anticipate commitments that would optimise on the utilisation of generative AI, and manage on the possible detrimental impacts. In summary, the evolving relationship between Gen Z and generative AI presents a dual opportunity: to make an efficient use of the technology in the best interest of the organisation while handling the flaws as gently as possible. It will be therefore important that on this platform on educational and creative evolution the positives of AI are embraced and advanced technology is employed in a proactive and thoughtful manner where the victories of man will be encouraged, the idea of creativity will not be distorted and society will not be negatively impacted.

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Abbreviations

AI – Artificial Intelligence

Gen Z – Generation Z (who were born between 1997 and 2012)

Declaration of Competing Interests/Conflicts of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Therefore, the authors of the correspondence do not have any conflict of interest.

Financial Disclosure

The authors involved in this research project do not have any relationships with other people or organizations that could inappropriately influence/bias their work.

Consent for Publication

Not Applicable.

Ethics Approval and Consent to Participate

Not Applicable

Funding/Role of the Funding Source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. This research was self-funded by the authors.

Availability of data, materials and code

All datasets and software used for supporting the conclusions of this article are available from various databases. Data included in article/supp. material/referenced in article. Data will be made available on request.

Authors' Contributions/Credit Author Statement

- . Md. Mokshud Ali carried out experiments and data analysis.
 - . H M Atif Wafik designed, coordinated and drafted the manuscript.
 - . Salehin Mahbub conceived of the study and participated in research coordination.
 - . Joy Das assisted to carry out the experiments.
- The authors read and approved the final manuscript.

Additional information

No additional information is available for this paper.

Acknowledgments

None