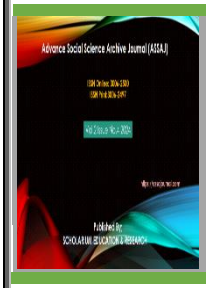

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THE COGNITIVE FRONTIER: AI'S ROLE IN SHAPING ACADEMIC PERFORMANCE AND ATTENTION CAPACITIES OF GEN-Z STUDENTS

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ABSTRACT

The study aims to explore the effects of artificial Intelligence on the cognitive functions and attention capacity of undergraduate Students. Given the growing application and use of AI tools in the learning environment, the study aims at establishing how these aspects apply advance, and transform scholarly learning activities while identifying the strengths and weaknesses connected to such applications. Most appealing advancements in education powered by AI have positively impacted learning by simplifying computationally intensive problems and increasing efficiency, distraction is a negative impact of excessive use of AI among students. The study uses the Cattell-Horn-Carroll (CHC) model of cognition to assess the relationship between AI engagement and the development of cognitive abilities alongside the attention span among Gen-Z students who are in a major developmental stage of brain development. The primary study adopting a quantitative and qualitative research design, assessing semi-structured questionnaires and following ethical precautions. They point to the positive effect of AI on academic performance, increased productivity, but at the same time the negative effect in the form of a lower duration of attention and initiative thinking. The result is intended to offer direction to both educators and stakeholders, including suggested solutions in order to enhance the use of AI in education. In overcoming these issues, the goal of this study is to create a balanced learning experience that increases creativity, focus and innovation together with the benefits of Artificial Intelligence.

Keywords: Cognitive Frontier, AI in Education, Academic Performance, Attention Capacities, Gen-Z Students

Introduction

Artificial intelligence (AI) grows at a fast pace and affects the majority of spheres of human life, changing industries, societies and individuals. The field that has been most impacted by AI is perhaps education and it has changed the way students obtain, analyze, and use information. In order to discuss the possibilities of AI in an academic

environment one should first introduce the integral concept tied to its meaning and the way it is becoming more and more all-encompassing.

Artificial intelligence, in its general sense, is the modeling of human intellect by computers, primarily information systems. Specialty uses of AI are in the domains of specialized systems, natural language interfaces, speech processing, and optical character recognition. AI's capacity to imitate human capabilities of reasoning makes it possible to perform tasks which previously demanded human input for things like decision making, problem solving, and skills in pattern recognition. It is becoming common to be applied in various sectors to increase production, efficiency and precision.

Nowadays, AI has turned into an enabler in the education sector, offering the students unlimited access to the learning tools, feedback, and smart tutors. These innovations make concentration on complex teaching tasks easier enabling students to work harder and smarter improving their performance. Yet, this shifting trend to AI poses pertinent questions to the higher education learning models regarding impacts on cognition, creativity, and extended learning in a population predominantly first-generation learners of the millennium: Generation Z students.

Generation Z participants are those born between 1997 and 2012, and they are also the first generation to grow up with almost constant access to technology such as AI. The experience shared by students of this generation using AI tools for academic purposes shows that there are two sides of the same coin. On the one hand, AI has edged up the effectiveness of the learning process and made education more available and open for everyone. However, the widespread application has brought controversies as it brings negative consequences to users such as decreased critical thinking, creativity as well as the ability to focus

The rationale for the present research comes from the growing body of data pointing to a question of whether, along with the convenience of the application of AI in education, the intellectual development of students is hampered. For example, now learners tend to use various AI tools in order to complete intricate assignments that require minimal mental processing. However, this kind of approach gives positive results in the short term, but it negatively impacts important aspects of thinking and creativity on which success in studying and career depends.

Furthermore, this is happening at the same time that technological development in learning processes is increasing while students' attention diminishes in equal steps. A shift in tasks and demands, reliance on AI and digital platforms weakens focused attention, this is especially true in Gen Z; social media, which others argue is another strong force in this generation also does not help, as result in consistent, distracted patterns of information processing. Such patterns may be problematic for the far future cognitive consequences and even the period of childhood could be critical for these trends.

The following paper aims to analyze the correlation between AI integration in learning and teaching and students' intelligence quotient and their attention levels. Therefore, in order to set up this study, the Cattell-Horn-Carroll (CHC) cognitive framework will

be used. A very specific and all-encompassing kind of lens that the model offered for viewing the various facets of human intelligence include, that of the band of fluid intelligence (mattered on problem solving and reasoning), crystallized intelligence that is the ability to acquire knowledge and attention control. Using the CHC framework, this work investigates how the use of AI technologies affects students' CDSI in learning environments.

As well as focusing on the cognitive effect, this study also explores the effect of AI on learning behaviors and interactions. AI technologies, and all the amazing aspects that come with them, are undeniably about the enhancement of productivity and the organization of the academic process, but the overuse of these technologies might be counterproductive in terms of creativity and intrinsic motivation. For example, use of hurried AI written papers or solutions decrease the potential chances of creativity and self-expression.

In addition, it will make students too reliant on AI aids and bring them a generation of learners who are indifferent to the profoundness of their learning processes.

It is for these reasons that this research employed a mixed methods research design, whereby data shall be collected quantitatively as well as qualitatively. A 17-item semi-structured questionnaire will be used to question the undergraduate students on the usage of AI tools within academics, advantages, and disadvantages of them, and self-assessed changes in attention span and creativity. This study will also respect the following ethical practices: participants' anonymity and voluntary rationale in the conduction of the study.

Finally, this research expects to generate knowledge that is responsive to the challenges of AI integration in education settings. In this manner, the results of this study are expected to have implications for educators, students, and policymakers regarding how AI should be utilized to avoid or minimize the bad points and maximize the good points. For instance, discovering how conversations about AI can promote ideas for enhancing cognition with enacted benefits while discouraging trivial skills, imagination, and long concentrated attention can create higher teaching and learning practices.

This study goes further than simply providing one more scholarly contribution as it raises important questions about how the present evolution of AI technologies is influencing human and social thinking and practices. Thus, the interactions of AI and its penetration into various spheres of life raise the question about the consequences of such tendencies for cognitive abilities and concentration more and more often. Such knowledge will be particularly important for the tasks of training subsequent generations for life in an AI-centric environment as well as protecting the foundational cognitive and creative abilities that determine human potential.

As it will be discussed in the subsequent sections of this paper, such tendencies can be explained by various factors that enhance the usage of AI in education; cognitive and behavioral patterns characteristic of this process; and practical consequences in the sphere of education that will help to create a balanced and effective learning environment. As a result of this endeavour the study aims to advance literature on the

application of AI in framing the future of the education system and its implications in society.

Thesis statement:

The research question of this study is, though the implementation of AI tools in learning institutions as a method of teaching and learning presents benefits for students particularly the undergraduate students such as increased productivity and access to information, it has some limitations. Particularly, AI may influence the student negatively, reducing their IQ through reduced engagement in critical and creative thinking skills, though in attention span too, particularly among the generation Z students who are still in the critical developmental processes. The purpose of this study is to investigate the positive and negative effects of AI on students' learning skills, namely their strengths and weaknesses that AI has on forming specific learning behaviors, learning-related thinking, and learning endurance**.**

Literature review:

When computer pioneer Alan Turing exposed the underlying technology in 1950, the field of artificial intelligence (AI) was established. Turing had introduced the concept of an intelligent machine. In order to determine whether a machine could replicate human logic, he created the Turing Examination in 1950. This exam included a human respondent, a human interrogator, and a machine. The interrogator had to identify which the machine based on the responses to a series of questions was posed to both the respondent and the machine. While the computer was allowed to respond anyway it saw fit to avoid detection, the human respondent's role was to help the interrogator correctly identify the subject (Copeland, 2023).

However, obstacles prevented Turing from starting work immediately. Initially, there needed to be a significant shift in computers. Before 1949, computers were only capable of carrying out commands, which is a prerequisite for intelligence. Commands could not be stored by them. In other words, computers were able to obey directions but were unable to recall their past actions. In addition, computing was costly. Leasing a computer may have cost over $200,000 a month in the early 1950s. Only wealthy IT firms and esteemed academic institutions could afford to risk their money on these uncharted areas. To convince investors that machine intelligence was a worthy project, a proof of concept and the support of influential individuals were required. (Anyoha, 2017).

According to Ma and Siau (2018), for example, AI will expedite curriculum and registration correctness and consistency. Furthermore, because the human sciences and liberal arts are less susceptible to the field of artificial intelligence than other fields like accounting and finance predict that majoring in these subjects will grow in (Ma and Siau, 2018).

This study is crucial for a wealth of information about how AI is affecting higher education, but it may be criticized for not addressing the problem head-on because the effects are far more significant. When it comes to the teaching and learning process, there is no denying that AI is taking the place of lecturers and tutors in a variety of ways, including e-learning and blended learning. As students engage with a

virtual classroom via Blackboard, Moodle, Turnitin, or any other platform, the presence of an e-learning professor is minimal (Jlu & Laurie A, 2018).

In a similar vein, Professor Roland T. Chin of Hong Kong Baptist University (2018) thinks AI will completely change the way we live, work, study, teach, make decisions, and prepare for the AI era. Thus, AI is about profound changes in the teaching and learning process rather than just its surface-level effects (Chin, 2018).

Jennifer Rexford, the head of computer science at Princeton, makes an argument that conditionally supports this idea. "Learning how people learn will hopefully help us and others think more broadly about retraining down the road," she concludes, implying that AI is effective at both learning and teaching if others learn (Rexford, 2018).

Jennifer claims that because the only way to succeed is to understand learning styles, AI's effectiveness is just temporary. Similar to this, Jabar and Yousif (2011) contend that e-learning offers learners artistic and pedagogical features in addition to incorporating and dealing with a vast array of content types that effectively respond to their needs, making the learning process in this world more interactive and engaging, according to recent researchers (Jabar and Yousif, 2011).

One drawback of Jabar and Yousif's methodology, which is discussed below in the Education and Unit Study, may be the lack of compelling examples of how AI affects learners' day-to-day lives. AI, for instance offers deep learning and teaching methods to improve performance for both the tutee and the tutor. Using hypermedia in a writing lesson, for instance, makes mistakes easier and saves time. Before AI, for instance, it took a very long time for a teacher to grade papers, appraise them, and look for plagiarism. AI has made it possible to check for linguistic errors and academic integrity in a matter of minutes. A lecturer does, in fact, submit the work to Turnitin, Grammarly, or other tools using artificial intelligence. Based on the outcomes produced by the utilized program, it might offer helpful criticism in a short amount of time. Even if AI is excellent at handling linguistic and academic integrity concerns, the human mind is frequently needed to complete the final step at the semantic, pragmatic, and cognitive levels (Mellul, 2018).

However, by addressing numerous learning styles, including autonomous learning, visual learning, e-learning, audio-visual learning, and deep learning, AI facilitates and stimulates both the learner and the teacher while providing a variety of links for students regarding the topics required by the subject matter. Similarly, AI helps the instructor to identify the areas that need improvement and apply the taxonomy of learning methods that the student requires (Jabar and Yousif, 2011).

In the meantime, as the learner gains autonomy and the freedom to receive input at any time and from any location, AI strengthens independent learning. Lastly, Richer asserts that AI has a positive impact on education by offering expert systems to diagnose and evaluate learning outcomes as well as intelligent computer-assisted instruction that fosters learning intuition (Richer, 1985).

Unquestionably, AI significantly improves the process of teaching and learning.AI not just affects the teaching and learning process but also the evaluation and grading procedure. AI quickly verifies research projects and assignments using Turnitin and

other technologies against billions of resources. Because of this, it is simple to determine whether a student plagiarized. Similar to this, assignments with criteria and scales are given online rubrics and grading forms, and final grades are applied to the turned-in work instantly and hassle-free (Mahana et al., 2012).

AI has an impact on education, but it also appears to be limited to this field and follows the student after graduation. For example, AI will affect the future employment market for necessary skill sets, claim Wang and Siau (2017). In place of unstructured disciplines that necessitate intricate cognitive interference, it will replace numerous other studies that include repetitive duties and easily automatable structures (Wang & Siau, 2017).

A collection of computer programs and technologies that simulate human intellect and brain function are collectively referred to as artificial intelligence. Artificial intelligence systems automatically acquire human intelligence characteristics like learning and knowledge transfer when developing computers or intelligent applications that simplify a variety of jobs. Over the past 20 years, this company has expanded in tandem with the growing need for intelligent products (Susdarwono, 2021).

Artificial intelligence is defined as intelligence that may intelligently or intelligently under all circumstances imitate human behavior in order to accomplish tasks effectively and practically with this technology (Siahaan, Jasa, Anderson & Valentino 2021, 186-193).

The massification of students has resulted in an increase in the burden. Presently, contemporary technology, such as artificial intelligence, must be used to address this troubling issue (Andrea et al. 2015, 527–532).

However, AI won't be useful until academics, support staff, and administrative workers (stakeholders) embrace it. However, there hasn't been much research done on the use of AI in higher education (Agarwal 2005, 39).

Numerous studies have shown that learning enhanced by AI consistently performs better than learning in traditional teacher-centric settings (Nasrallah 2014, 1–18).

AI is now an essential component of the virtual world. AI undoubtedly has a significant impact on both general education and higher education (Edtech, 2020).

In any higher education institution across the world, for instance, effective usage of filters for emails, advertisements, apps, YouTube, and virtual assistants like Google, digital libraries, Google Scholar, and other digital research engines (García-Vélez et al., 2021).

When discussing how AI will affect teaching and learning in higher education, it is clear that the two primary areas of focus will be curriculum and enrollment (Taneri, 2020).

Theoretical Framework:

The theoretical framework of this study is the Cattell-Horn-Carroll (CHC) Cognitive Theory, which provides a conceptual lens for analyzing the correlation between the usage of artificial intelligence (AI) and the cognitive skills of the undergraduate learners. A student's aptitude, focus, IQ, and creativity are major components of his or her academics. Since AI is a new member of the educational environment, the focus should be drawn on how this member can either strengthen or weaken such mental

skills. The CHC model that gives an extensive conception of human intelligence offers a framework through which the nature of the engagement between AI and the students' cognitive processes – including how AI may transform attention, memory, problem solving, and creativity – can be objectively examined.

The Cognitive Theory of CHC is defined below in details.

The CHC Theory of Cognitive Abilities is a broad model of human intelligence that integrates aspects from two prominent theories: Raymond Cattell's Gf-Gc theory and John Horn's Theory of Fluid and Crystallized Intelligence, and John Carroll's three-stratum model. The CHC model organizes cognitive abilities into three levels:

1. Stratum III: General Intelligence (g)

This is the highest level and can be regarded as a general factor that determines all types of work with data. It is the basic form of intelligence and is also responsible for influencing other capacities that are involved in many problem-solving processes, such as speed, storage and processing of information, and working through solutions. Intellectual capacity is normally assessed by Intelligence Quotient (IQ) and is assumed to be the core determinant of performance. General intelligence, therefore, is composed of different faculties which are, on the one hand, the operational or problem-solving intelligence and on the other hand the laps or knowledge-based intelligence types, as recommended in the CHC model.

2. Stratum II : Broad Cognitive Abilities

This level entails the components of mental abilities that are not so broad as the notion of intelligence. These abilities include:

Fluid Intelligence (Gf): A measure of one's propensity to reason or solve a problem for which there are no previous samples for imitation. It is associated with reasoning, abstract thinking and flexibility.

Crystallized Intelligence (Gc): The total sum of information,speaking and communication abilities which are acquired through practice and study. These are; Vocabulary, general knowledge, and verbal reasoning.

Short-Term Memory (Gsm): Flexibility may be conceptually defined as the extent to which an individual is capable of maintaining and manipulating data in working memory.

Long-Term Storage and Retrieval (Glr): The storage of information and its recall at convenient time based on specific requirements.

Processing Speed (Gs): A technical skill such as information processing, where reaction time and speed of decision making may be parameters.

Visual-Spatial Thinking (Gv): The means by which an agent can acquire and think through data involving vision and space.

Quantitative Knowledge (Gq): Mathematical proficiency that is the capacity to learn and use mathematics.

- **Attention (At)**: That ever-demanding and dynamic ability to remain focused on a particular operation for a period of time. This dimension is especially pertinent to analysis of the impact of AI on students' ability to concentrate on their academics.

3. Stratum l: Narrow Cognitive Abilities

These are the specific and specialized cognitive skills that affect one or another academic assignment or daily activities. They may include specific talents in areas such as language, memory and visual spatial skills and can thus be regarded as the most specific of the abilities within the characterization of the CHC framework of intelligence.

Connection between the CHC Cognitive Theory and AI and Cognitive Development

The rationale for using the CHC model for ground analysis on how AI permeation impacts student learning is due to the way the model categorizes cognition in dimensions susceptible to tool affordances. All these dimensions are important in explaining how or whether the use of AI may impact the learning of the students in a particular way. The study focuses on three specific cognitive abilities from the CHC model that may be particularly influenced by AI:

1. Attention (At):

Working memory has been defined as one of the essential human cognitive functions, and attention is an integral constituent of learning. According to the CHC model, attention can be defined as the maintenance of attention applied to the content of the learning task and important to mastery learning processes. By applying AI tools in learning, students might be forced to change the way they focus on the tool being used. Instant response systems and applications that perform exhausting computations and routine actions can demotivate users from continued practice. In addition, the ever present, extensive and ubiquitous engagement with digital devices and the notification services provided by social media networks which are often also AI assisted has been demonstrated to result in attention deficit. This study will examine the relationship between AI usage and students' attention spans for tasks and the role of AI in maintaining the learners' focus on learning activities.

2. Fluid Intelligence (Gf):

On the other hand the CHC model defines fluid intelligence as the capacity to think, reason and solve problems especially those that are unique. It is most directly related to problem solving activities which need creativity and adaptation. AI will complement fluid intelligence by giving students means to handle problems and solutions in an efficient manner. However, continuous use of such resource in solving problems may help the students develop their own way of solving problems instead of using an automated AI solution. The research questions of the study will seek to find out whether the use of AI enhances the generation of creative and critical thinking as well as the fluid intelligence among the students or whether the use of AI enhances the development of rigid thinking persons who only rely on the automated solutions provided by the AI systems.

3. Crystallized Intelligence (Gc):

Crystallized intelligence is a kind of intelligence that can be obtained through learning process throughout a person's life. Technological applications such as the search engines, writing aids and research instruments may improve on how students obtain and use. For instance, it can make lots of knowledge available and convenient;

this kind of knowledge may improve a student's crystallized intelligence. However, the study will also take cognizance of the drawbacks like passive learning from AI because students depend on the information provided by AI rather than trying to build their understanding of other related materials.

Cognitive Development and the influence of AI

The incorporation of the AI technologies in learning institution has the potential of causing dual impact to the cognitive functionality. First, AI is an external cognition that can enhance human learning through aiding in proctoring, arriving at quick decisions, simplifying difficult activities, providing details, and saving students' time, which all make students study smarter. For example, students can engage AI applications to calculate problems within minutes, to improve spellings and grammar, and to access so much information in a very short time. These tools may further help students to improve their crystallized intelligences through their learning.

On the other hand, the AI may play a role in the cognitive entrapment in which the students do not have to expend much effort thinking critically, which is vital in the enhancement of fluid intelligence. Students seem constantly require AI to do their work, which may reduce the quantity of effort they expend on sophisticated pondering, possibly affecting the development of such skills. This consideration is well illustrated by AI analytical instruments, which give answers to specific queries without the applicant having to use their mind in the efforts or independently discover various solutions.

Also, the number of hours spent indoors, with children watching screens, may result in decreased, and distracted, learners. Here the role of the CHC model's dimension of attention (At) could be seen, because students may have difficulties with maintaining appropriate level of focusing on academic tasks due to using AI tools that provide a constant stream of stimuli and instant rewards. Perhaps this scattered attention might prove detrimental to mastering both focused attention, which is important for mastering academic work that often requires students to concentrate for long periods of time. The ability to pay constant attention and concentrate which is important for creative thinking may also be affected if the constant interruption by the uses of the devices is an aim.

Linking CHC to Research Questions

The CHC model will be utilized as a theoretical foundation for this particular study to determine the Impact of AI on Undergraduate Students, Students' Cognitive Performance, namely, IQ, Attention, and Creativity". The study will address several key questions:

1. In what ways does the use of AI influence students' estimation of general, fluid, and crystallized intelligences?
2. How, specifically, is AI related to students' selective attention (At) or, in other words, their concentration on tasks relevant to college learning?
3. Does the use of AI diminish student's fluid intelligence as it eliminates the use of imagination and reasoning that are central to creativity and problem solving?

This research adopts the CHC cognitive theory as a theoretical framework to examine the cognitive impact of AI utilization and to contribute meaningful information on the benefits and challenges of incorporating AI tools into the college education environment for the undergraduates.

Methodology:

The purpose of this study is to understand the influence of AI on the academic performance of undergraduate students and analysis of IQ and short span of concentrative nights. This research will use both a quantitative and qualitative research approaches in data collection in order to get a full picture regarding the impact of AI on students learning and their cognitive abilities. The next subheadings describe the research design, data collection techniques, subjects, measures, data analysis plans, and concerns about ethics.

Research Design:

Thus, this research work employs descriptive correlational research design to examine the relationship between the level of use of AI technology and cognitive performances of the students studying at any level of their undergraduate studies. A descriptive design allows the researcher to capture the characteristics of the participants and the patterns of AI usage in relation to their cognitive abilities, while the correlational approach helps to identify potential associations between the variables of interest: AI use, intelligence quotient, concentration ability and creativity.

Since cognitive processes are intricate this research is anchored on the Cattell-Horn-Carroll (CHC) theory of cognitive ability which comprises of processing speed, attention and memory. Consequently, in this research, the five domains identify areas in which the effects of AI tools on students' cognitive processes will be investigated.

Participants:

The subjects in this study are the undergraduate students of the large public university selected from different faculties. In order to include effectively diverse students a purposive sample will be carried out; students from different departments, from first year students to final year students will be included in the sample. The target population is meaningful and the students' number will be sufficient for statistical analysis; 200 students will be recruited. It is believed that the sample size here will give equal distribution of the participants' academic background and experiences with AI tools.

In order to make the sample as random as possible all the participants will be selected using stratified random sampling This means that the target population subgroups such as STEM or non- STEM students, students from different year levels will be included in the sample in proportions that are representative. This method also helps analyze the impacts of AI more particularly across a wide range of disciplines in academia.

The participants will consist of regular users of AI that include using of AI in completing their homework, research, or solving academic problems, and occasional use of AI with limited use in their academic activities. This division will assist the researcher to find

out how the extent and the frequency of AI utilization is related to the shifts in intelligence quotient, attention span, and creativity.

Data Collection Methods:

Mixed research design is used in this study, where quantitative and qualitative research data collection techniques are used. The advantage of employing both methods is that the research problem is addressed by combining factual information and distinctive participants' experiences.

1. **Quantitative Data Collection**

The first type of collected quantitative data is questionnaire focused on participants' intelligence, AI adoption, and efficiency. The survey will consist of the following components:

AI Usage Questionnaire: This section of the survey will query participants on their usage of AI and what they do with it. It will also co-opt questions like "How frequently do you employ AI tools in your academic practice?" and "Which AI tools to you find yourself using most often (for example, GPT models, chatbots, or automated research assistants)?" The responses will be touching on the itemized questions to be answered by the students and generally the responses will be rated on a Likert scale of rating which will include Very Frequently, Frequently, Occasionally, Rarely and Never. This will enable the researcher to group the participants according to their level of AI tool usage, as either light or moderate or heavy.

Cognitive Ability Assessment: Intelligence, both inherent and acquired intelligence (average intelligence [AQ]/AIQ), will be evaluated using an objective, standard intelligence test such as the WAIS or a similar test. This test will establish participants' g, speed of processing, attention, and working memory. The WAIS consisting of tasks that measure the Verbal Comprehension Index, Perceptual Reasoning Index, Working Memory Index and Processing Speed Index is appropriate for the present participant group and yields valid estimates of cognitive functioning.

Attention Span Measurement: The study will perform a digital attention task (e.g., the Continuous Performance Test (CPT)) that will be used to determine the attention span of the participant. This task evaluates time-grained utilization, issues to impulse control, and use of concentration as applied to tasks that take hours. Participants will also complete a self-administered form on their screen usage and effects on their attention capacity during the day.

Creativity Questionnaire: The research will consist of the Creativity Self-Report Questionnaire that measures the students' view regarding their own creativity levels. This instrument will ask how often they brainstorm, create new products or content, or solve problems in a new fashion. The replies are expected to inform the result as to whether employing AI more often is viewed as a decline or boost to creativity.

2. Qualitative Data Collection

Besides quantitative data, the study will also include qualitative data collection techniques in form of semi-structured interviews whose purpose will be to elicit students' perception on their use of AI as well as AI effects on one's cognition. Semi-structured interviews give the opportunity to ask open-ended questions and most

importantly respondent's responses can encompass a wide, result is gaining better understanding of participants' thoughts, feelings, observations and perceptions of how AI affects the human cognition, including attention and creativity.

The interview will consist of questions such as:

1. "In what way do you think; LeChat has affected your ability to concentrate on academic work?"
2. Has AI impacted your method of reasoning or creativity?
3. Here again people asked about their own stand: "But in your own view do you think that AI has made learning easier or has it somewhat lowered your IQ?"
4. Has your academic performance or your habits changed since you started utilizing AI tools?

These interviews will be tape recorded, transcribed and analyzed for features pertaining to intelligence, creativity and attention span. To analyze the collected data, the method of thematic analysis that is particularly suitable for handling qualitative data will be adopted.

Data Analysis Procedures

1. Quantitative Analysis

The quantitative data shall be analyzed statistically with a view of knowing the relationship that exists between the use of Artificial Intelligence and Cognitive Abilities. The analysis will include:

Descriptive Statistics: Since we shall be analyzing participants, demographic characteristics, and AI usage, frequency distributions by gender, age, education level, frequency of AI usage, IQ scores, parity of attention, mean creativity scores, and standard deviations will be employed.

Inferential Statistics: Correlational research methodology, such as "correlation analysis" and "multiple regression" shall be used to analyze the extent to which AI deployment impacts cognitive performance. Pearson coefficient will establish the connection between establishment of AI, and alteration of IQ, attention span, or creativity. Through multiple regression analysis one will be able to factor out moderating variables such as the type of course the student is pursuing, their year level and the nature and strength of the relationship between cognitive abilities and AI usage.

Comparative Analysis: Independent sample t-tests or ANOVA (Analysis of Variance) shall be used to test the median difference between the CGI and three groups of persons AI light, moderate, and heavy users. This analysis will also reveal the correlation of usage of AI in enhancing differentiation of IQ score, attention span, and creativeness.

2. Qualitative Analysis:

In this assignment, thematic analysis will be considered to evaluate the qualitative results that will be obtained from the interviews. All the interview recordings will be transcribed by the researcher and then analyzed and coded for patterns on the effects of AI on brain development, creativity and attention span. They might be like, "AI saves time," "AI impacts creativity" or "distractions as a problem."

Ethical Considerations

This research will ensure that ethical policies recommended by the universities Institutional Review Board (IRB) are followed. Key ethical considerations include:

Informed Consent: The participants will be explained the rationale of the study, the procedures involved and possible drawbacks. They will be required to give their consent before agreeing to participate, and the right to withdraw from the study at any one time without any reasons being demanded from them.

Confidentiality: All data will be kept secure and anonymous to ensure participant ignorance throughout the study will be protected by aliases. Data will be ensured to remain secure and only made available to the researchers.

Voluntary Participation: No participant shall be compelled to participate in the study nor shall they be offered any form of inducement.

Minimizing Harm: To reduce any psychological impact or distress occasioned by the discussions on learning difficulties and the cognitive or the intellectual capacity, the study will seek to eliminate any psychological harm.

Detailed Analysis and Discussion:

Understanding Cognitive Abilities and Their Development

Cognitive abilities are the mental skills essential for everyday functioning, including thinking, learning, reading, remembering, and paying attention. These abilities are integral to how individuals process information and respond to their environment. Traditionally, cognitive development has been nurtured through challenges that require effort, problem-solving, and creativity. However, the advent of Artificial Intelligence (AI) has significantly altered this dynamic. AI tools have simplified tasks, reducing the cognitive load required to solve problems or engage in learning activities. AI-powered platforms such as intelligent tutoring systems, automated essay graders, and content generators offer immediate solutions to academic problems, enhancing productivity but often at the expense of critical thinking and creativity. While these tools enable students to achieve academic success efficiently, they may also diminish the mental effort involved in learning, thereby affecting the natural development of cognitive abilities.

The Role of Attention in Cognitive Functioning

Attention is a cornerstone of cognitive functioning, enabling individuals to focus on tasks and process information effectively. It plays a critical role in academic success and personal productivity. However, in an age dominated by AI and digital technology, sustaining attention has become increasingly challenging.

AI-driven applications and digital platforms provide quick solutions and instant gratification, which can weaken the ability to focus on long-term, complex tasks. For example, a student using AI to generate essay outlines or solve mathematical problems might skip the cognitive processes involved in understanding the task deeply. Over time, this dependency on AI tools could lead to a decline in sustained attention, critical thinking, and problem-solving skills

Impact of AI on ADHD Trends

Undoubtedly, one of the most dramatic cognitive phenomena observed in recent years is an increase in the frequency of attention deficit hyperactivity disorder – ADHD in students and even grown-ups. It is worth mentioning that ADHD is a neurodevelopmental disorder that refers to a constellation of difficulties in maintaining attention and controlling impulsive behaviors; this type of disorder has become more apparent in the past decades.

ADHD in Children and Adults

The National Survey of Children's Health shows that about 5.8 million children in the United States received an ADHD diagnosis at some point. Earlier it was only 6% in the decade of nineties and has risen to 10% in the recent decade. Publications across both groups reveal that dysphoria diagnosis amongst adults are continued to rise than those of the adolescents, a figure that has more than doubled between 2007 and 2016. The prevalence of ADHD in adults is estimated to be somewhere between 2.5 % and 4.4% with considerably higher prevalence of male individuals.

The Role of Technology in ADHD Prevalence

Although the increased rate of ADHD diagnoses can be partly attributed to enhanced diagnostic criteria and increased awareness between the general public, there is no doubt that technology plays an important role here. There are positive relations between difficulties in attention and the continuous exposure to digital stimuli like notifications and basic flow of information. Newman, Steiner and barber (2011) says that for the people having ADHD, technology increases the possibility of worsening of symptoms because the single undertakings normally take a lot of time.

Despite the fact that technologies such as AI and other digital tools are not only helpful in completing the work more efficiently but also cause some of these difficulties. For example, learners diagnosed with ADHD will rely on the technologies to do the work instead of going through each piece thoroughly. Such a behaviour could potentially make the attention deficiency even worse, as technology and gadgets become a necessity that has to be constantly used.

Shorter Attention Span in the New World of Technology

The specifics of the new information age have effectively lessened people's ability to pay attention to a specific detail or subject. The continuously lit screens notifications, and the multimedia platforms present users fast-paced, short intermittent intermissions of stimuli that inculcate the brain to work at short intervals.

Why the Attention Span is Actually Decreasing

The theory of attentional capture as well as the theory of change blindness will help to understand how technology affects attention. Attentional capture clarifies how stimuli with related information can capture attention like push notifications. Change blindness is one of the ways through which one statistically denies crucial aspects within scenes due to distraction.

Such platforms are orchestrated by artificial intelligence, which exacerbates efforts to make work less tasking by requiring constant multitasking as well as instant solutions. For instance, a student who uses several AI tools dealing with different assignments

will find it tough to focus on one task at a time. In the long run, such behavior negatively affects the capacity to forge the kind of intense learning experience.

Potential Interventions

Nevertheless, technology has its solutions for all of these challenges as well. Technological advancements present apps that guide people in being more attentive and improve their technology use. Furthermore, the use of AI in education can take the forms that would ensure students stay engaged for a long time by offering the content in a stepwise section where the student is required to think critically and solve a problem.

An Insight into Artificial Intelligence and Cognitive Development in Undergraduate Students

It is acknowledged the integration of AI in education has brought great innovations in the ways learning takes place especially among the undergraduate students. AI has various advantages for students, for example, learning presentation and access to materials, yet it has gracefully complicated questions.

Advantages of AI in Education

AI tools have mainly acted as a depository for students where they get access to quality education material and feedback. An ITS is designed to learn the course objectives, deficiencies and preferences of a learner, and enhance performance. Self-organizing also increases efficiency and productivity as supported by AI-powered platforms that help students do tasks more efficiently with little or no input from their teachers.

Obstacles to Cognitive Growth

However, such gains should be born in mind that they arrive hand in hand with some demerits. The ready availability of AI-based products means that we can have answers to complex problems or meaningful, especially academic material paths without expending extra mental effort. For instance, with AI, students may be able to obtain research papers or solve mathematical problems, but they will not be creative or analytical enough to develop the papers or solve the problems.

In the long run, this reliance on AI is most likely to discourage the development of archetypal cognitive skills that are so vital in day-to-day lives and careers. Also, the continual changes of pace in students' learning process may hinder the learning of some values such as tenacity and perseverance that is instilled in learners through difficulty.

AI and Creativity

Another specific cognitive faculty which AI is hypothesized to have an impact on is creativity. By getting a fresh idea or thinking from AI there is a chance for creativity to be a limitation to one's imagination since creativity is enhanced by self- expression.

For instance, a concept that a student finds on an AI-generated paper and then he or she has to write based on this concept will limit their creativity in a certain way. In addition, the availability of AI solutions reduces the incentive for students to search for other solutions or generate their own ideas.

Balancing AI Benefits and Drawbacks:

To prevent the negative impacts of AI while taking the positive outcomes, educators and policymakers should be moderate. Strategies may include:

1. Promoting Critical Thinking: It was also noted that embedding activities that would warrant intensive involvement and thinking steps enhance problem solving among students.

2. Encouraging Responsible AI Use: Actually making members of a society aware of the shortcomings of AI and help them use AI in the right manner can make society more responsible when it comes to its usage.

3. Enhancing Digital Literacy: Informing students on how to assess and therefore integrate the incoming information from AI devices can in fact foster cognitive improvement.

4. Designing AI-Driven Challenges: The results show that patterning and template matching techniques can be used to assist in the development of a person's cognitive skills, if discoverable and unhampered by orthodox computer interfaces, AI tools that encourage creativity and sustained attention should be incorporated.

Conclusion:

In recent years, AI has taken root in teaching and learning practices and its effects on undergraduate students have been felt in manners such as cognitive effects like IQ and attention span. In this paper, the nature of AI in modulating human cognitive ability has been considered from the perspective of the Cattell-Horn-Carroll (CHC) theory of cognition as both facilitative of and a detriment to cognitive development. The insights that emerged in this study of the use of AI tools by the students suggest that, although valuable in increasing the general efficiency and available knowledge, AI also poses a number of limitations pertaining to critical thinking, creativity, and focus.

First, the study established the tripartite nature of the relationship between AI and IQ. On the positive side, AI tools favour crystallized intelligence (Gc) by increasing students' access to vast arrays of information and thereby aiding the growth of their databases as well as their efficiency at tasks that involve recall of fact and their application. Writing tools, research tools, and language models that AI creates offer students the opportunity to optimize the processes they have to complete in their schools and universities, without having to spend hours building them from scratch. This may lead to an overall enhancement of efficiency and recall hence the performance as per the anticipated academic standards.

But it was also established that the positive impact of AI could be counterproductive to the establishment of fluid intelligence (Gf) which is seen as critical thinking, problem solving and creative thinking. When students over rely on the ability of the AI to give a solution or answer to a given academic challenge, they may skip the abilities that foster abstract thinking and creativity. If implemented to excess, AI applications might lead to such erroneous learning behaviors such as willingness to accept facts given by an AI teacher without questioning the information received. This may inhibit their development of problem solving and abstract thinking skills they need to solve problems not encountered in their classroom or on their tests as well as limiting their fluid intelligence growth.

Taking attention span Reforming attention span as the resultant impact of the use of AI inside a classroom, perhaps one of the most daunting concerns that emanate from this study. Pertinent to the existing literature on the negative impacts of digital tools on attention, this study discovered that AI could partly be to blame for reduced attention among students. The availability of information literally at one's fingertips and ability to get an instantaneous response from the AI tools, ultimately deters the student's attention span toward a particular task, making it challenging for the student to devote time on laborious tasks such as reading. Some of the concerns include, and a frequent distraction, notifications on the screen coupled with quick user switching between different responses from the AI application will make it difficult to focus for long on academic activities. This tends with other research that states that with the use of digital devices such as artificial intelligence, the brain is rendered less capable to concentrate on single processes enhancing the quality of learning and engagement.

Further, AI thwarts attention span more quietly in the form of social media and other digital interruptions with a similar layout as cognitively assorted quick content feasting. To a greater degree this trend is observable for the Generation Z, who has been surrounded by digital devices throughout life. The developmental cognitive process continues up to mid-20s of any individual and these students are still in a period of attention and learning. Excessive use of AI services and/or multitasking may prevent them from using the opportunity to apply themselves to serious, concentrated learning – knowledge that is important not only for good grades, but for becoming better people in today's complex world.

Therefore, the present study aims to reveal the relationships between the various dimensions of using AI and the variations in cognitive development observed in the underwear students. On one hand, AI remains perhaps the most effective tool that can augment efficiency of learning and facilitate knowledge acquisition. On the other hand, AI presents the threat to development of student's intellect especially in those sectors which desired accomplishment entails effort, critical thinking, and creativity. The cognitive theory of Cattell-Horn-Carroll (CHC) is informative of how different aspects of cognition such as intelligence quotient knowledge, focus, and innovation are affected by AI. However, the discussion emerging from the current research calls for elaboration of a balance between the benefits of AI and the promotion of independent critical thinking, creativity, and perseverance among educators, learners, and policymakers.

Finally, the whole concept of education in an AI-loaded environment will be contingent on how the AI is going to be used as a tool for promoting education. As it is clear that AI can supplement and improve the efficiency and even the training of students and knowledgeable workers, there must be a systematic attempt to avoid the negative effects of this technology, which can contribute in the meanwhile to the weakening of the processes that form and develop children's and young people's cognitive abilities and skills.

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