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## UNDERSTANDING THE PERCEPTIONS OF HIGHER EDUCATION STUDENTS ABOUT PERSONALIZED LEARNING THROUGH GENERATIVE ARTIFICIAL INTELLIGENCE

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| KEYWORDS  | ABSTRACT   |
|---|--|
| <p style="color: red;"><b>Personalized Learning, Higher Education, Generative Artificial Intelligence</b></p>   | <p>This qualitative phenomenological research study aims to understand the perceptions of higher education students about personalized learning through Generative Artificial Intelligence (GAI). For the nuanced and comprehensive insights 15 participants were selected through purposive sampling from three renowned universities in Lahore: FAST, University of Lahore, and Lahore College for Women University. Researcher collected data over semi-structured interviews with 5 participants. Findings of study vindicate that widespread adoption of GAI tools among Higher Education students is due to perceived ease of use and usefulness in the personalized learning. The participants from diverse academic background reveal that GAI is playing an instrumental role in enhancing their personalized learning experience. Benefits reported by the participants include assistance in writing and research, ideas generation, easy accessibility of information, project and assignment assistance, and enhanced learning experience over visualization, summarization, and comprehension of text. However, challenges like undue reliance, adverse impacts on creativity and thinking capabilities, data privacy &amp; security concerns were also reported. Therefore, the study recommends policymaker and educators to raise ethical awareness among higher education students and equip them with skills to use GAI responsibly and effectively. The AI creators are recommended to enhance usability and accessibility of GAI tools for optimizing the use of GAI in the higher education.</p> |
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### INTRODUCTION

The generative artificial intelligence as a subset of artificial intelligence is rapidly emerging as a pivotal force in Higher Education. It has revolutionized traditional paradigms of pedagogy and learning (Baidoo & Ansah, 2023). One of the significant aspects of the generative artificial intelligence is its capacity to create personalized educational content catering specific needs

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and preferences of students on individual basis. Learning is an innate phenomena that begins with cognitive experience and ameliorates with every experience. Cultural background and environment of the student also plays a significant role in shaping the learning of a student. Learning of every student is the personalized journey that broadens students' knowledge and develop myriad of practical skills thereby pretty their perspectives (Shemshack et al, 2021). Artificial Intelligence in the education considers unique learning needs of every student and strives to foster personalized learning experience through providing the intelligent learning environment. Such personalized learning environment not only enhances student knowledge acquisition but offers students with personalized feedback of progress (Chaudhry & Kazim, 2022).

The generative artificial intelligence tools that are gaining popularity among higher education students for personalized learning ChatGPT, Grammarly, Snapchat AI, Gemini AI, BlackBox AI, ChatPdf.com, Leonardo AI, and Humata AI. ChatGPT released in 2022 has caused a surge of interest among Higher Education students to use Generative Artificial Intelligence tools in education endeavors. ChatGPT is conversational artificial intelligence system that has capacity to generate human like responses and maintain coherent conversation on myriad of topics including articles, journals, books, and websites. Various researches vindicate that ChatGPT has potential to enhance Higher education teaching and learning (Adiguzel, Kaya & Cansu, 2023; Baidoo & Ansah, 2023). Similarly, Fliki AI is a GAI tool that provide students with relevant educational content. This is more beneficial for those learning English as second language, as observed by Chan and Lee (2023). Text-to-text AI generators, such as ChatGPT, offer writing assistance to students. Higher education students can design interactive presentations, solve quizzes, as well as perform adaptive learning activities to improve their personalized learning experience.

AI studio is yet another GAI tool that can help students visualize their proposed projects in form of realistic AI generated videos. Other GAI tools such as You.com and ChatPdf enable higher education students to organize large volumes of texts and read summarized versions of text. Moreover, Generative Artificial Intelligence has the capacity to integrate virtual reality with augmented reality technologies thereby offering immersive learning experience (Humble & Mozelius, 2022). All of GAI tools are transforming higher education by providing students with novel methods for personalized learning. One of significant benefits of GAI is its ability to generate highly original output in response to prompts provided by user. These AI tools help students brainstorm ideas and receive feedback on their writing resulting in overall support and improvement in their writing skills. Mizumoto and Eguchi (2023) investigated reliability and accuracy of ChatGPT as automated essay scoring tool. Their findings revealed that ChatGPT significantly reduced grading time, ensured consistency in scoring provided immediate scores & feedback on students' writing skills thus ensuring effective personalized learning.

### Research Questions

1. How familiar the higher education students are with Generative Artificial technologies?

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2. What are potential benefits, challenges, and drawbacks associated with using generative artificial intelligence for the personalized learning, as perceived by the higher education students?
3. What are the perception of higher education students about ease of use and usefulness of generative artificial intelligence in the personalized learning in the higher educational institutions.

## LITERATURE REVIEW

### Generative Artificial Intelligence

In most simplistic terms word “generative” implies “generate,” “produce” or “create.” Thus, generative AI is capable of generating content. “Generative artificial intelligence (AI) describes algorithms such as ChatGPT. They be used to create novel content. This includes audio code, images text, simulations and videos” (McKinsey & Company, 2023) Generative AI includes group of machine learning algorithms designed to generate new data samples mimicking existing datasets. One foundational technique in GAI is Variational Autoencoder (VAE). This is type of neural network that learns to encode and decode data maintaining its essential features (Kingma & Welling, 2013). The key component of generative AI is generative model. It models potential data distribution and generates new data. The generative AI tools are considered helpful in research for Higher Education students as GAI tools assist researchers in generating innovative ideas, synthesizing pieces of information, and summarizing substantial volumes of THE text, which are helpful for researchers in the analysis of data and building framework of their research papers (Chan & Zhou, 2023). This data is similar to original data. Applications of generative AI are wide-ranging. Thus, these include image generation natural language processing and music generation (Lim, Gunasekara, Pallant, Pallant & Pechenkina, 2022).

### The Development History of Generative Artificial Intelligence

Generative Artificial Intelligence swiftly evolving field within Artificial Intelligence has roots in era spanning the 1950s to 1970s. This initial phase was characterized by focus on language generation. Mainly in natural language processing, machine translation. The technological approaches of this time were basic. They largely depended on the rules and templates for text creation. In domain of NLP early Generative AI efforts concentrated on syntax and grammar analysis. They aimed to decode the structural nuances of language. The generative systems from this period utilized rule-based methodologies. They sought to embed the principles and structures of the language into computer programs. This allowed for the production of simple sentences and paragraphs. Nonetheless, these systems were constrained by their inability to grasp the complex semantic meanings. They therefore failed to generate the intricate language patterns.

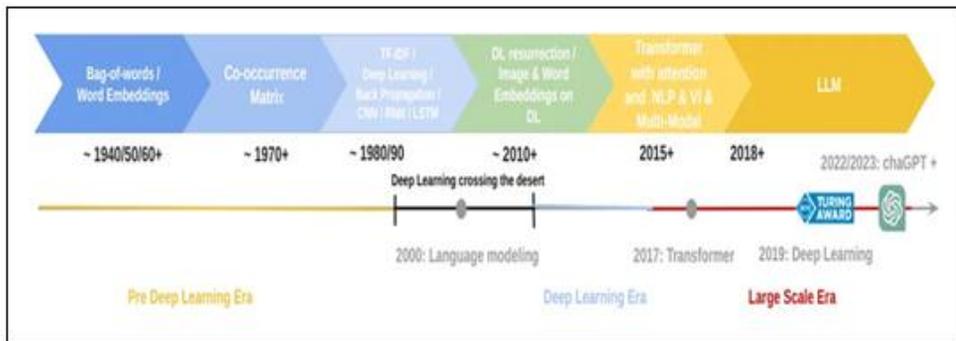
Furthermore, the generative AI's contributions to arts through creation of computer-generated music and artwork not only augment human creativity but they also offer new paths for art education cultural preservation. Despite these strides generative AI confronts some challenges

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necessitating further innovation. Among these challenges is adversarial sample issue. Models fail to accurately recognize or generate the outcomes under specific conditions. This demands more sophisticated solutions (Hughes et al. 2021). Moreover, opacity of Generative AI models complicates understanding their decision-making processes. This calls for more interpretable and transparent approaches. Lastly ethical, privacy and security implications of Generative AI continue to be critical areas. These necessitate ongoing exploration & resolution (Zohny et al. 2023).

**Figure 1**

*The Visual Representation of GAI tools evolved over years.*



### Identified Role of GAI in Enhancing Personalized Learning

In realm of GAI in personalized learning ,four key roles have been identified. This highlights versatility of GAI in enhancing educational experiences. Firstly, AI-based systems like smart labs and tutors tailor learning tasks to match individual students' skills. This ensures that each student is engaged at their own level. Thus, the level of proficiency that is suitable (Hiranker & Kittisunthonphisarn 2020). Secondly, through human-machine conversations facilitated by GAI chatbots,students can engage in dialogues and these dialogues are with machines. This improves their communication skills by practicing in continuous conversational flow. Thirdly, ability of the Generative Artificial Intelligence to analyze student work and learning processes allows for provision of immediate evaluation and feedback (Bonneton-Botte et al. 2020). Fu et al. (2020) and Porter and Grippa (2020) also support these findings. Lastly, GAI technologies enhance adaptability of digital learning environments by collecting data on student learning. This facilitates more personalized and engaging educational experiences (Samarakou et al., 2015).

This multifaceted approach underscores Generative AI's significant role in modernizing and personalizing students' learning experiences. In domain of assessment AI integration suggests two promising roles. First, AI-driven grading systems have confirmed the advantages over traditional methods. They offer quicker more precise and secure feedback for both formative and summative assessments. Despite these benefits, application of automatic grading remains largely uniform. It is restricted to specific fields such as language learning. This limitation signifies that the deployment of technology in diverse classroom settings faces challenges. It

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signals ongoing developmental phase. Secondly, the ability of GAI to predict the student performance in the online education states has shown potential. By analyzing engagement in activities like discussion boards, AI technologies can forecast students' achievements. They can also predict course outcomes. Still challenge lies in selecting data for predictive models of artificial intelligence. Data selected for model differ from those usually used in educational research.

The review of literature identified four key learning outcomes impacted by AI in education. Firstly AI robots are effectively used in various disciplines to enhance student engagement. Particularly helping students with low achievement feel more secure, valued and confident (Xia et al. 2022). Secondly, significant improvement in academic performance was observed not only benefiting mainstream students but with special needs. Despite these advancements some studies indicated benefits of AI might be skewed towards motivated or high-achieving students (Khan et al., 2021). Thirdly AI-supported real-time feedback platforms have fostered sustainable development in the crucial 21st-century skills. These skills include communication collaboration, creativity problem solving self-regulated learning. They encourage students to reflect on their learning process. Also they tackle challenging problems (Porter & Grippa, 2020). Fourthly, while AI has been shown to increase the students' confidence in learning and reduce anxiety its widespread use has led to increased anxiety among some students about their future employment prospects (Kim et al. 2021). Wood et al. (2021) contributed to body of research.

Consequently, Generative AI is posited as being effective than traditional teaching methods in delivering knowledge. This reshapes hierarchy of learning outcomes. It prioritizes skills like questioning. It promotes need for novel outcomes such as AI literacy. Generative AI holds promising prospects in enriching students' learning experiences. In advanced AI technology can revolutionize education by offering students immersive learning experiences. It can span different historical periods and cultural settings using virtual reality and augmented reality. For instance students can explore and understand diverse life experiences through the virtual reality create virtual classrooms. Three-dimensional models and experiments be displayed. This makes learning interactive and engaging (Zhang & Wang 2022; Humble & Mozelius 2022). Also AI can enhance learning through educational games. These games are designed in virtual environments. This makes learning enjoyable motivating for students. AI significantly enhances education by providing the personalized as well as intelligent learning experiences for the students. This leads to overall innovation and growth in field of education (Lim et al., 2023).

## RESEARCH METHODOLOGY

The research aims to recognize perceptions of higher education students about personalized learning through GAI. To achieve the research objectives, phenomenological approach within the qualitative research method is employed to gain deep insights into the experiences of students using Generative Artificial Intelligence for their personalized learning. This approach is suitable for understanding essence and meaning of students' perceptions. By understanding the broader educational, social, and technological contexts that shape students' perceptions,

the study can provide more meaningful and actionable insights for the educators aiming to implement GAI tools effectively. The study involved higher education students from different academic backgrounds and year of study. The researcher selected participants of the study on basis of purposive sampling. Only those students were interviewed who had experience of using Generative Artificial Intelligence tools for personalized learning. Purposive sampling of students enable the researcher in the collection of detailed, relevant, and contextually rich data that was essential to understand perceptions of higher education students about personalized learning over Generative Artificial Intelligence. The researcher approached the administration from three different universities located in Lahore and explained them the purpose of the study.

Ethical permissions from relevant authorities were obtained before approaching the students and seeking their consent to be interviewed. Data was collected and interviews were recorded on the researchers' personal mobile phone. These recordings were later used for transcription. Initially, all interview transcripts and focus group recordings were transcribed verbatim by the researcher. The responses of every protocol designed for semi-structured interviews were transcribed. Codes were made for repeated responses. The researcher began data analysis with a predetermined set of codes, while maintaining flexibility to adjust and expand the list as needed. Thus, the codes and sub-codes for the transcripts of interviews were finalized by the researcher after a rigorous analysis of transcripts of the data. After Coding, thematic analysis approach was employed to identify recurring themes, patterns, and trends within the data set. During this phase, preliminary codes were assigned to segments of text that encapsulated key ideas, concepts, or topics discussed by participants. These initial codes were generated both deductively, based on pre-defined research objectives, questions, and inductively, allowing for the emergence of new themes from the data. Once initial coding was complete, codes were organized into broader themes and sub-themes through the process of the categorization and grouping.

### DATA ANALYSIS

The data on field indicates about familiarity of almost all participants with generative artificial intelligence.

#### Theme: Well Familiar with Generative Artificial Intelligence

**Table 1**

*Excerpts from Field Data on 'Well Familiar with Generative Artificial Intelligence'*

| Theme: Well Familiar with Generative Artificial Intelligence  |
|---|
| P1: I am pretty much familiar with it I have been using it since Fsc. (INT:05.06.2024)  |
| P2: I am quite familiar with Generative AI tools and I have used GAI tools including ChatGPT and Gemini AI etc. (INT:05.06.2024)  |
| P3: I have been using these Generative Artificial Intelligence tools for an year now. The GAI tools I have used are Perplexity AI, Meta AI, and ChatGPT. (INT:05.06.2024) |
| P4: I am familiar with some of the Generative Artificial Intelligence tools such as ChatGPT, Gemini AI, Black-box and Dall-E. (INT:05.06.2024)                            |

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P5:Yes I am quite familiar with Generative AI tools.I have used ChatGPT,Mode.AI, and a lot of audio and video generator tools of AI.(INT:06.06.2024)

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The table shows almost all participants are well familiar with generative artificial intelligence. Their familiarity varies as students with different academic backgrounds use different GAI tools. Nevertheless, the ChatGPT is one of widely used tool among all the participants. Other Generative Artificial Intelligence tools that frequently used by participants are Grammarly, Meta AI,and Gemini AI. In this linking, the participants with the data science and computer science background use Blackbox AI for learning coding. Moreover,participants highlighted the assistance of GAI tools in comprehension of difficult text and concepts and in preparation of test and exams. The widespread familiarity of higher education students with diverse range of GAI tools highlight paramount standing of generative artificial intelligence in personalized learning.

### Theme: Exceptional And Fascinating Experience

**Table 2**

*Excerpts from Field Data on 'Exceptional And Fascinating Experience'*

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| Theme :Exceptional And Fascinating Experience  |
|--|
| P1:Snapchat AI is one of first GAI tool I used. I randomly asked it meaning of a word and it explained me really well. That was the point where I was hooked to Generative Artificial Intelligence for Learning. (INT:05.06.2024)  |
| P3:It was fascinating experience because Generative AI was responding to questions really smartly. For first time it really surpassed my expectations as it almost provided me with the codes and logical answers as if it were a human. So it was really a good experience. (INT:05.06.2024)  |
| P5:When I encountered GAI for the first time I felt like finding a virtual friend which is understanding my problems and responding accordingly. I was struggling with my mathematics problems before that. Getting to know of ChatGPT and finding stepwise solutions on it made mathematics problems way easier to me. (INT:06.06.2024) |

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Table highlights that first experience of using generative artificial intelligence for personalized learning was mostly surprising, fascinating, and exceptional. Most of the students described how surprising and engaging it was to realize potential of Generative Artificial Intelligence to produce human like responses. P1, P3, and P5 mentioned how GAI exceeded their expectations and provided them answers of questions they were previously struggling with.P5 highlights the stepwise solution of ChatGPT has enabled her to solve mathematics problems on her own. Overall experience of participants about use of GAI for personalized learning was good and useful.

### Theme: Easy Accessibility

**Table 3**

*Excerpts from Field Data on 'Easy Accessibility'*

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| Theme: Easy Accessibility   |
|---|
| P3:For the first time it really surpassed my expectations as it almost provided me with the codes and |

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logical answers as if it were a human. (INT:05.06.2024)

P4:I don't have to find things on Google anymore. Through GAI tools I can get all the information at one place(INT:05.06.2024)

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P5:I was struggling with my mathematics problems before that. Getting to know of ChatGPT and finding stepwise solutions on it made mathematics problems way easier to me.(INT:06.06.2024)

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In table 3, participants highlighted easy accessibility of GAI tools as P3 mentioned accessing all the answers of logical questions and coding related problems and P4 mentions having access of all the information at one platform eliminating the need to surf on Google.P5 and mentions how Generative Artificial Intelligence has made personalized learning easier as they can access the answers of any problem they are facing in complex subjects like mathematics and even have basic structures of assignments.The easily accessible information on Generative Artificial Intelligence tools have made the personalized learning more engaging and easy for participants.

### Theme: Emotional Engagement

**Table 4**

*Excerpts from Field Data on 'Emotional Engagement'*

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| Theme : Emotional Engagement   |
|--|
| P1:I asked Snapchat AI meaning of a word and it explained me really well.That was the point where I was hooked to Generative Artificial Intelligence for Learning.(INT:05.06.2024)   |
| P3: It almost provided me with the codes and logical answers as if it were a human.(INT:05.06.2024)  |
| P5:I think Generative Artificial Intelligence tools are miraculous for the students who are unable to afford tuition. These tools help as tutors and assistants in our personalized learning.It help us clear our concepts on our own.(INT:06.06.2024) |

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Table 4 indicates developments of emotional engagement amid participants and Generative Artificial Intelligence tools.P5 refer to Generative Artificial Intelligence tool as personal tutor and virtual friend. The participants also highlights the accessibility of information has made personalized learning easy for students who can not financially afford tuition. Similarly,the other participants like P1 and P3 expressed their feelings that they hooked with Generative Artificial Intelligence because it was providing them such assistance in personalized learning as if it were human.Such emotional engagement of higher education students highlights the effectiveness of GAI tools in providing assistance to concerned students in their personalized learning.

### Theme: Make Learning Easier & Enhance Learning Experience in Personalized Domain

**Table 5**

*Excerpts from Field Data on 'Make Learning Easier & Enhance Experience in Personalized Domain'*

---

| Theme:Make Learning Easier and Enhance Learning Experience in Personalized Domain  |
|--|
| P2:I use ChatGPT in Chinese language course as Chinese is a very vast language.On Google sometimes it gets too confusing as I can not find one answer for the question as every website provides different answer.However, on ChatGPT I get my answer in very less time.(INT:05.06.2024) |

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P4: ChatGPT and Black box help me in writing codes. If I am facing any sort of problem while coding I just have to give a prompt to these GAI tools and they can fix the errors in my codes readily. Dall-E is yet another tool that I use for graphic or visual representation of my work. It enhances my learning experience in personalized domain. (INT:05.06.2024)

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In table 5, participants reported that GAI tools significantly enhance their learning experiences and make personalized learning easier. P4 described using ChatGPT and Black Box for coding assistance, quickly fixing errors, and using Dall-E for graphic representation, enriching their personalized learning experience. P2 found ChatGPT particularly useful for Chinese language course, as it provided clear and quick answers compared to confusing and varied results from Google.

### Theme: Assistance in Project Making and Assignments

**Table 6**

*Excerpts from Field Data on 'Assistance in Project Making and Assignments'*

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Theme: Assistance in Project Making and Assignments

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P4: We were given a project to design a game. During the project I was not able to come up with the logic. GPT not only helped me in building the logic but it also helped in dealing with bugs in my game. (INT:05.06.2024)

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P5: In my Entrepreneur project I was searching for novel ideas about creating an innovative product. I used different GAI tools to analyze different ideas and their utility. (INT:05.06.2024)

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In table 6, participants reported that Generative Artificial Intelligence assisted them in their projects and assignments. P4, a student from computer science background relied on ChatGPT to develop logic in her codes and debug the errors in a game design project. Similarly, P5 and P9 used various GAI tools to get novel ideas develop innovative products for entrepreneurial project. Diverse applications of various Generative Artificial Intelligence tools as narrated by higher education students show that GAI tools are proving to be instrumental in enhancing quality of students' assignments and projects. GAI tools are accepted for making personalized learning easier due to provision of variety of options to students in learning in personalized domain.

### Theme: Assistance in Researching and Writing

**Table 7**

*Excerpts from Field Data on 'Assistance in Researching and Writing'*

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Theme: Assistance in Researching and Writing

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P4: Whenever I feel there is a problem such as in making a good sentence in English I am at ease to provide ChatGPT with a prompt in Roman English and ask it to convert in English. (INT:05.06.2024)

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P5: GAI tools provides me with guidance in terms of sourcing out suitable content by providing me links to the relevant content. (INT:06.06.2024)

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The participants reported assistance of DAI in researching and writing tasks. P4, participant with English as second language, highlighted using ChatGPT for making good sentences in

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English. While P5 and P6 reported use of GAI tools such as Meta AI and ChatGPT in sourcing out suitable content for suitable content during writing. Generative Artificial Intelligence tools have gained prominence among students for assisting them in writing and research related tasks.

### Theme: Problem Solving and Conceptual Clarity

**Table 8**

*Excerpts from Field Data on 'Problem Solving and Conceptual Clarity'*

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| Theme: Problem Solving and Conceptual Clarity  |
|--|
| P3: Before Blackbox I could write codes but they were not as neat as I can get with the help of it. I was unable to introduce modularity in codes before but with ChatGPT it really became easy to practice making different codes. (INT:05.06.2024) |

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In Table 8, the participants highlighted using Generative Artificial Intelligence for problem solving and conceptual clarity in complex subjects. P3 mentioned using Blackbox AI for coding, describing how introducing modularity and writing codes neatly was an uphill task before GAI but with GAI made it easy to practice coding in personalized learning. Overall GAI prove to be beneficial in personalized learning as they readily equip students of higher education with various tools for problem solving, conceptual clarity making personalized learning more effective.

### Theme: Ideas Generation

**Table 9**

*Excerpts from field data on 'Ideas Generation'*

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| Theme: Ideas Generation  |
|--|
| P2: In my Entrepreneur project I was searching for novel ideas about creating an innovative product. I used different GAI tools to analyze different ideas and their utility. (INT:06.06.2024) |
| P4: For my recent presentation I am researching my topic on different GAI tools such as Meta AI and ChatGPT to get diverse ideas for my topic. (INT:06.06.2024)                                |
| P5: I used Meta AI and ChatGPT for getting different innovative ideas and in my Entrepreneurship Gala. (INT:06.06.2024)  |

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In Table 9 participants reported using Generative Artificial Intelligence for generating diverse ideas. P2 and P4 mentioned using different GAI tools to analyze different ideas their utility for their Entrepreneur projects. On other hand P4 and P5 mentioned using the Generative Artificial Intelligence tools for getting innovative ideas for their topics in their assignments and presentations to realizing effective outcomes. Overall Generative Artificial Intelligence tools are playing a significant role in enhancing students personalized learning by providing them novel as well as creative ideas and thereby making their academic work more efficient & effective.

### Theme: Undue Reliance on GAI tools

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**Table 10**

*Excerpts from Field Data on 'Undue Reliance on GAI tools'*

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| Theme:Undue Reliance on GAI tools   |
|---|
| P1:Firstly when I was struggling I was learning but as soon as I got to know of ChatGPT I started relying on it and lacked practice on Programming Fundamentals.(INT:05.06.2024)                      |
| P4:We students have started relying on these GAI tools for all of our projects and assignments.I think our ability of thinking will be retarded if the situation remains unregulated(INT:05.06.2024). |
| P5:The drawback I feel is that we have stopped doing the handwork and started relying on it completely.(INT:06.06.2024)   |

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In Table 10, participants expressed the concerns of undue reliance on GAI tools. P1 described how reliance on GAI tools impacted his practice in Programming Fundamentals adversely.P4 and P5 mentioned that over dependence on Generative Artificial Intelligence will make the thinking abilities redundant as students have stopped thinking on their own for completion of their assignments and projects. Overall, undue reliance on Generative Artificial Intelligence tools are curbing student's thinking abilities as well as reducing their ability to work more independently.

### **Theme: Inhibit Critical Thinking and Hampers Human Creativity**

**Table 11**

*Excerpts from Field Data on 'Inhibit Critical Thinking and Hampers Human Creativity'*

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| Theme:Inhibit Critical Thinking and Hampers Human Creativity  |
|---|
| P3: We just stopped thinking on our own start relying on these tools.Critical thinking part is missed. So major drawback I would say is reliance on GAI tools can hamper creativity. (INT:05.06.2024)         |
| P4:Relying on prompts of ChatGPT merely takes away the critical thinking part from student (INT:05.06.2024)   |
| P5:We are forgetting to use natural sense of our thinking.We students have started relying on GAI tools for all of projects & assignments. I think our ability of thinking will be retarded. (INT:06.06.2024) |

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In Table 11, participants expressed concerns that reliance on Generative Artificial Intelligence (GAI) tools could inhibit critical thinking and hamper human creativity. P3 noted that reliance on tools leads to decrease in independent thought and creativity. P5 observed that students are neglecting natural thinking abilities are becoming overly dependent on GAI for projects and assignments, potentially impairing their critical thinking skills. P4 highlighted that using ChatGPT prompts can diminish the critical thinking aspect of learning. Overall, participants felt that excessive reliance on GAI tools could negatively impact ability to think critically and creatively.

### **Theme: Lack of Up to date information and Limited features on free versions**

**Table 12**

*Excerpts from Field Data on 'Lack of Up to date information & Limited features on free versions'*

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| Theme:Lack of Up to date information and Limited features on free versions                |
|---|
| P3: The knowledge these GAI tools have in their free versions is limited.(INT:05.06.2024) |

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P4:The challenge comes when the information on these GAI tools is not updated.(INT:06.06.2024)

P5:I can ask ChatGPT or ArchiVinci AI of rendered pictures but the pictures they provide me with may not always suit preferred style because their free version have limited features. (INT:06.06.2024)

In Table 12, participants highlighted issues with lack of up-to-date information and limited features in free versions of GAI tools. P5 mentioned that while they could request rendered pictures from ChatGPT or ArchiVinci AI, the free versions often lacked the features necessary to match preferred style. P3 and P4 pointed out challenge of outdated information, noting that GAI tools rely on data that requires regular updates to accurate answers. P3 observed that the knowledge available in free versions of these tools is limited. Overall, participants found that these limitations could hinder effectiveness and accuracy of the GAI tools in their academic work.

### Theme: Inaccurate Responses and Repetitive Prompt Generation

**Table 13**

*Excerpts from Field Data on 'Inaccurate Responses and Repetitive Prompt Generation'*

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Theme:Inaccurate Responses and Repetitive Prompt Generation

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P2:The information provided by GAI tools is not always accurate. There are some errors in it which are detectable.(INT:05.06.2024)

P3:Also the information provided by GAI tools is sometimes wrong which I feel should be corrected.(INT:06.06.2024)

P5:Sometimes these tools provide very generic information so I have to ask them again to answer in realistic terms.(INT:06.06.2024)

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In Table 13 the participants identified challenges related to inaccurate responses and repetitive prompt generation when using Generative Artificial Intelligence (GAI) tools. P5, a medical student, stressed sensitivity of inaccurate information provided by GAI tools. P3 mentioned that the tools often offer generic information, requiring follow-up prompts for more realistic answers. P2 and P3 both highlighted that the information provided by GAI tools is sometimes incorrect, with detectable errors that need to be corrected. Participants found that inaccurate responses and need for repetitive, detailed prompts were significant drawbacks in using GAI tools.

### Theme: Data bias and Privacy Concerns

**Table 14**

*Excerpts from Field Data on 'Data bias and Privacy Concerns'*

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Theme : Data bias and Privacy Concerns

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P2: Data on GAI tools is also biased due to Western stranglehold on data.This is one of the biggest challenge because this way the data does not remain factual(INT:05.06.2024).

P3:We all know GAI tools have a data bias in international issues.It favour western stance than taking a neutral position.(INT:06.06.2024)

P5:These tools can stalks us and constantly keep an eye on our activities.So there are these security and privacy concerns.(INT:07.06.2024)

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In Table 14 the participants expressed concerns about data bias and privacy issues associated with GAI tools.. P5 highlighted privacy concerns, mentioning that these tools might monitor user activities. P2 pointed out that GAI tools exhibit data bias in international issues, often favoring Western perspectives over neutral positions. P3 echoed the sentiment, stating that Western control over data leads to the biased information, compromising its factual accuracy. Participants identified significant challenges related to data bias and privacy when using GAI tools.

### Theme: Enhanced Learning through Simplification and Visualization

**Table 15**

*Excerpts from Field Data on 'Enhanced Learning through Simplification and Visualization'*

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| Theme: Enhanced Learning through Simplification and Visualization  |
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| P1:Whenever I am stuck in a problem whether it be a logical problem or any sort of coding problem.I can just put these problems on multiple GAI Tools that are readily available.This is how I think GAI tools become personal assistants in my learning.(INT:05.06.2024)    |
| P2:ChatGPT just breakdowns everything into smaller parts.Other tools help me visualizing such as Dall-E.The GAI tools are even helpful in converting the videos into PDF.I can summarize long passages and articles both with the help of GPT and Gemini AI.(INT:05.06.2024) |
| P3:Generative Artificial Intelligence makes personalized learning a lot more efficient.Getting basic definitions ,summaries,basic structures, and getting material for comparing from GAI has made learning in personal space a lot more easier and faster.(INT:06.06.2024)  |

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In Table 15 participants highlighted how GAI tools enhance learning through simplification and visualization. P1 described how GAI tools act as personal assistants by readily solving logical or coding problems. P2 mentioned ChatGPT breaks down complex topics into smaller, manageable parts, while tools like Dall-E help with visualization and converting videos into PDF. P3 noted GAI makes personalized learning efficient providing definitions, summaries, basic structures, comparative material, thus making learning easier and faster. Participants found GAI tools significantly boost learning by abridging complex concepts & providing visual aids.

## FINDINGS AND DISCUSSION

1. The research study shows all the participants of the study were well familiar with the Generative Artificial Intelligence and had experience of using GAI in their personalized learning.ChatGPT is found to be most popular tool among higher education students. Other most common GAI tools among the participants were Meta AI,Grammarly,and Gemini AI.
2. The first experience of using Generative Artificial Intelligence for personalized learning was described by most of the participants as exceptional and fascinating.However,few participants mentioned the initial struggle to get used to GAI tools.While describing the first experience of using GAI for personalized learning the participants highlighted the easy accessibility of the information through GAI tools.As 4<sup>th</sup> Participants of the study expressed, *I don't have to find things on Google anymore.Through GAI tools I can get all the*

information at one place. Moreover participants expressed their emotional engagement with GAI tools due their significant assistance in their personalized learning. The 5<sup>th</sup> Participant of the study stated, *I think Generative Artificial Intelligence tools are miraculous for the students who are unable to afford tuition. These tools help as tutors and assistants in our personalized learning. It help us clear our concepts on our own.*

3. The research study unveils by using Generative Artificial Intelligence for personalized learning participants learning experience in personalized domain was enhanced and GAI tools were acknowledged for making personalized learning easier. As a participant mentioned, *ChatGPT and Black box help me in writing codes. If I am facing any sort of problem while coding I just have to give a prompt to these GAI tools and they can fix the errors in my codes readily. Dall-E is yet another tool that I use for graphic or visual representation of my work. It enhance my learning experience in personalized domain.* While Assistance in project making and assignments, assistance in researching and writing, problem solving and conceptual clarity, and ideas generation are the other benefits highlighted by participants for using Generative Artificial Intelligence for Personalized learning.
4. With significant benefits of GAI in personalized learning, there are certain challenges and drawbacks of using GAI. The participants expressed their concerns that they were increasingly becoming over dependent on GAI during learning such undue reliance can hamper their creativity and impede their thinking abilities. The 4<sup>th</sup> participant stated *If all of us as architecture students will keep relying on GAI tools only our work will not remain aesthetically pleasing anymore, while, the 5<sup>th</sup> participant mentioned, We students have started relying on these GAI tools for all of our projects and assignments. I think our ability of thinking will be retarded if situation remains unregulated.* Moreover, lack of up to date information on GAI tools, issue of inaccurate responses, limited features on free versions of GAI, the need to prompts repetitively for getting specific answers, data bias in the information of GAI tools, and privacy concerns are other most concerning challenges associated with personalized learning through GAI. A participant during the focus group discussion expressed the challenge he faces for generating prompt for complex courses. He stated, *In technical courses like mathematics or programming we have to add a lot of specific information and go in a lot of detail for writing the prompt. In programming when are multiple variables it becomes challenging to write a prompt for GAI tools.* Similarly, another participant of the study mentioned the issue of data bias in GAI information in these words, *The drawback is that most of these GAI tools are created by West. This is why there is data sovereignty of west and it is also intensifying the North-South gap.*
5. On the perceived usefulness of GAI in personalized learning higher education students considered GAI tools enhanced their personalized learning through simplification and visualization. As a participant of study mentioned, *ChatGPT just breakdowns everything into smaller parts. Other tools help me visualizing such as Dall-E. The GAI tools are even helpful in converting the videos into PDF. I can summarize long passages and articles both with the help of GPT and Gemini AI.* Similarly, the students who struggle with volumes of text and feel difficult to comprehend the meaning of text on their own GAI tools are also useful in this regard as they help students both in comprehension and summarization of text. The 3<sup>rd</sup> participant of the study expressed the usefulness of GAI tools as, *Generative Artificial*

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*Intelligence makes personalized learning a lot more efficient. Getting basic definitions, summaries, basic structures, and getting material for comparing from GAI has made learning in personal space a lot more easier and faster. Furthermore, GAI tools are considered useful by higher education students as these tools enabled focused and tailored learning particularly amid students who struggle to learn in lectures. The 2<sup>nd</sup> participant of study expressed, I learn more in personal domain as in lectures I think I zone out sometimes. GAI tools therefore are well aligned with my learning style as I can search at my own ease. I can get both descriptive explanation and precise explanation. GAI tools helps me in learning without zoning out, while, 5<sup>th</sup> participant of the study mentioned, I learn more in personal domain as in lectures I think I zone out sometimes. GAI tools therefore are well aligned with my learning style as I can search at my own ease. I can get both descriptive explanation and precise explanation. GAI tools helps me in learning without zoning out.* These very insights from participant show that participants perceived Generative Artificial Intelligence tools as useful which is the significant cause of the acceptance of GAI tools among higher education students.

## CONCLUSION

This study indicates that Generative Artificial Intelligence tools have gained wide acceptance among the higher education students due to their ease of use and usefulness in terms of content. Most of the Generative Artificial Intelligence tools are considered user friendly due to their ease of use. ChatGPT is one of most user friendly tool as highlighted by the participants of the study. Overall usefulness of the GAI tools is owed to its tools' ability to provide higher education students with facility of the focused and tailored learning, enhancement of learning experience, and comprehension of difficult concepts. However, there were myriad of issues mentioned by Higher education students that needs to be addressed. The higher education students recommend the developer of GAI to update the information provided on GAI tools and improve the validity of information provided on these tools. Further, the features on free versions need to be enhanced and application version of each GAI tools needs to be accessible to avoid web based glitches and enrich personalized learning experience of higher education students.

## Practical Implications

1. The widespread use of Generative Artificial intelligence tools among higher education necessitate development of policy guidelines for regulation of Artificial Intelligence and all its form. These policy guidelines can guide HEI to ensure ethical compliance both among educators and students. Further, the standard policy guidelines can be incorporated in curriculum so that all Higher Education Institutes can comply with them effectively.
2. The research study highlights the need to integrate Generative Artificial Intelligence with traditional pedagogical techniques. The participants stated both Educators and GAI can complement each other to enrich the learning experience of the students. Educators can use GAI to incorporate innovative techniques into their teaching which

will not only enhance students' learning experience but will also allow educators to grow optimistically in their profession.

3. It is of pertinent importance that all the stakeholders from government level to media utilize their influence in promoting responsible use of generative artificial intelligence among higher education students so that they do not get over relied on GAI tools for their education endeavour. Proper guidance needs to be ensured in order to sensitize students about the cognitive impacts of undue reliance on GAI tools. Government can initiate specialized programs with help of Media to engage students and guide them to use GAI effectively.
4. The privacy and security concerns of students need to be addressed. The Educators can play a significant role. They can arrange open discussion sessions with students and address their concerns with proper guidance and directions.
5. The Generative Artificial Intelligence developers need to address the issue of data bias and inaccurate information to ensure accuracy of the information and maintain the trustfulness among its users in the future,
6. The comprehensive training programs can be initiated nationwide for awareness and guidance of educators and students about ethical considerations of using Generative Artificial Intelligence in order to optimize its use.

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