



Cognitive Gyms: A Pre-emptive Solution for Students' Over-reliance on Artificial Intelligence

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Abstract

We are living in a transitory era where we are witnessing the transition from keypad phones to technology boom and artificial intelligence revolution. Artificial intelligence has deeply embedded in contemporary social, educational and professional environments. This rapid integration of artificial intelligence has definitely helped to increase the work productivity at all levels but over dependence on it is also raising concerns about the gradual erosion of cognitive abilities of human beings. We have seen a global prevalence of digital addiction. As per the statistics, around 27% of world's population is suffering from smartphone addiction. This has significantly been increased after Covid-19 era. Usage of smartphone is anyway associated with psychological symptoms of stress, anxiety, depression, insomnia or what not. Along with this addiction we are heavily relying on artificial intelligence not for entertainment only but for every task i.e. from getting factual information to getting creative ideas; which is definitely leading to cognitive offloading but we need to be aware that this cognitive offloading doesn't turn our cognitive abilities to diminishing side. Given the addiction statistics, we are just a step away from entering the era of cognitive gyms. This paper introduces the concept of "Cognitive Gyms", which are structured environments designed to actively engage and strengthen mental faculties through exercises that promote reasoning, memory, creativity, and focus. This paper argues that Cognitive Gyms can function as individual as well as institutional interventions that encourage deliberate cognitive practice, independent reasoning, critical thinking and balanced AI use. Interventions like cognitive gyms are becoming the need of the hour because this is a pre-emptive solution where we all will be able to use artificial intelligence for our benefits along with preserving our essential human intellectual capabilities.

Keywords: Artificial Intelligence, Cognitive Gyms, Cognitive offloading, Automation Bias

Introduction

Artificial Intelligence has emerged like a boom which can be seen as one of the most transformational technological developments of the twenty-first century. These technological developments are among those social changes which has been adapted by the people of all ages. Although there was times when these AI based technologies were used at a very confined level like to get factual information in field of education or in research laboratories etc. but right now it has taken all over the field of education or

we can say it has been permeate or diffused in every aspect of daily life. Intelligent tutoring systems are providing an alternative to traditional, one-size-fits-all classroom models, virtual assistants are managing time schedules for human beings which shows that not only individuals but organizations are also relying on artificial intelligence tools for one or the other thing. Historically, all the technological tools primarily extended the support at physical level like industrial machinery helped in amplifying human strength, transportation technologies increased mobility, and communication systems increased social connectivity. At present times, contemporary AI systems differ in a critical aspect as they increasingly augment, replicate, and sometimes replace cognitive functions which are traditionally performed by humans. Human being is over-relying and over using this technology which is becoming a major concern for us.

Literature Review

A dilemma has been created by the growing integration of AI with human cognitive processes: while AI democratizes access to knowledge and increases human capacities, it may also steadily reduce the frequency with which people use critical cognitive abilities. Reduced cognitive activity may eventually have a detrimental impact on intellectual capacities, like physical inactivity leads to muscular atrophy. Literature review shows the emerging problem of cognitive dependency under the Guise of Cognitive Offloading, algorithmic dependence and automation bias.

Emerging Problem of Cognitive Dependency under the Guise of Cognitive Offloading

Over the period of decades, human cognition has evolved through continuous engagement with challenging environment while learning through their own complex experiences. With the emergence of AI, digital technologies are performing cognitive functions and we came up as a new word “cognitive offloading”.

Cognitive offloading refers to the use of external tools to reduce the cognitive burden like facts, calculations etc. where we mostly used calculators and different search engines. Now-a-days, artificial intelligence represents a qualitative shift as it not only stores factual information but also the processes and interpretation of it. AI facilitates cognitive offloading through instant access to synthesized information and personalized recommendations regarding particular topics. In fact, recent studies highlight that AI enables the individual to bypass the essential cognitive processes which is a step ahead than cognitive offloading. AI systems encourage friction less interaction which minimizes the needed efforts along with reduced critical thinking which is leading to cognitive dependency under the guise of cognitive offloading because over use of AI extends the cognitive offloading beyond information storage.

Algorithmic Dependence

With the refinement of technologies related to AI, algorithm is becoming very strong like you search something for once at a single platform and suddenly you see it everywhere at every platform. Also, we are becoming dependent on algorithm for decision making which is leading to cognitive atrophy i.e. deterioration of mental abilities.

Automation Bias

Automation bias refers to the tendency of individuals to favor suggestions generated by automated systems while disregarding contradictory information or their own judgment. Parasuraman and Riley (1997) explained automation bias as a critical challenge in human-machine interaction, particularly when users perceive automated systems as more accurate or reliable than human reasoning.

Research Gap

Existing literature on AI has focused on almost all aspects related to AI like technical performance, ethical concerns, fairness, accountability, transparency, and governance, algorithmic bias, privacy risks etc. But relatively little attention is given to the research which examine preventive interventions designed to preserve human cognitive capabilities in increasingly AI oriented environments. Mostly

existing interventions are focusing on limited use of technology rather than active development of cognitive resilience. This paper explores the concept of cognitive gyms as a proactive solution for over-reliance on AI among students.

AI in Educational Context

We are living in a transitory era where we are witnessing the transition from keypad phones to technology boom and artificial intelligence revolution. We are using AI extensively in every field. Specialized tools are available literally for each and every task, because of which it has become an integral part of our lives. AI is helping us in everything i.e. from giving facts to valuable recommendations; from education to health and even in managing finances. As shown in Fig. 1.1 that how AI is contributing in the field of education.

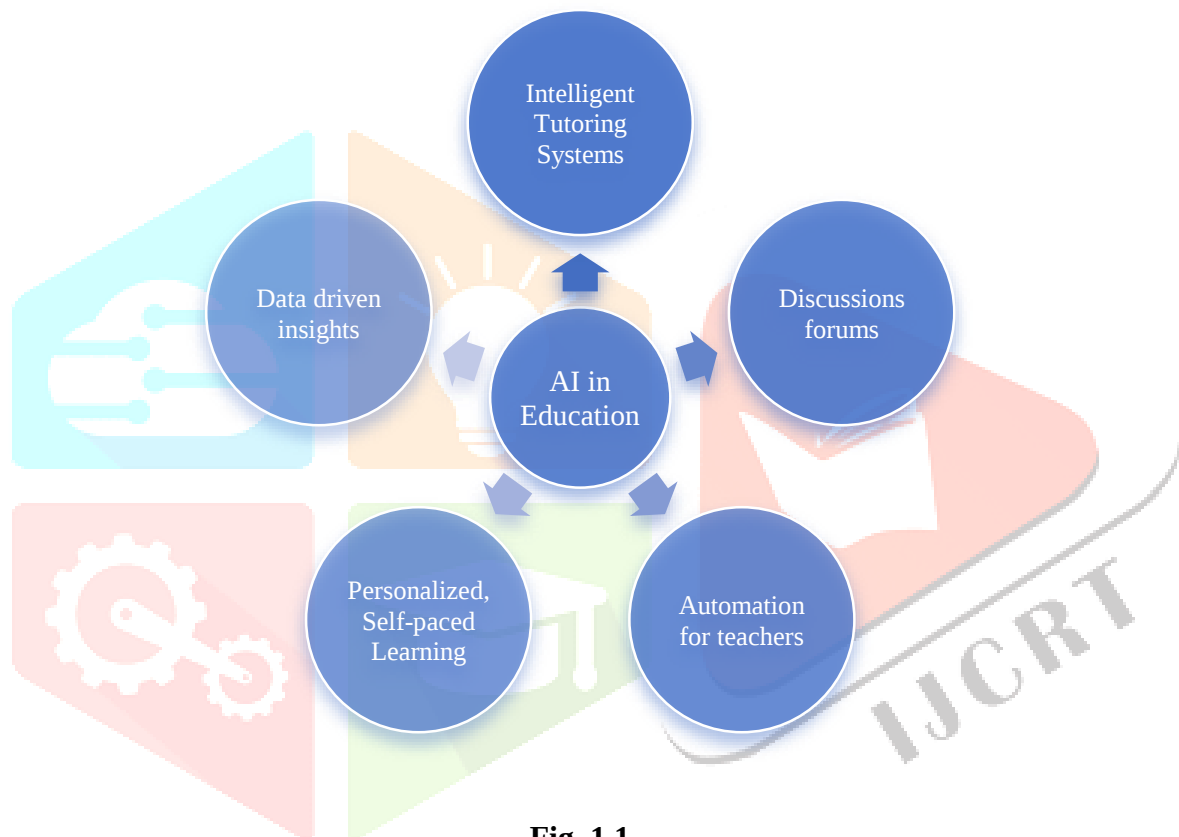
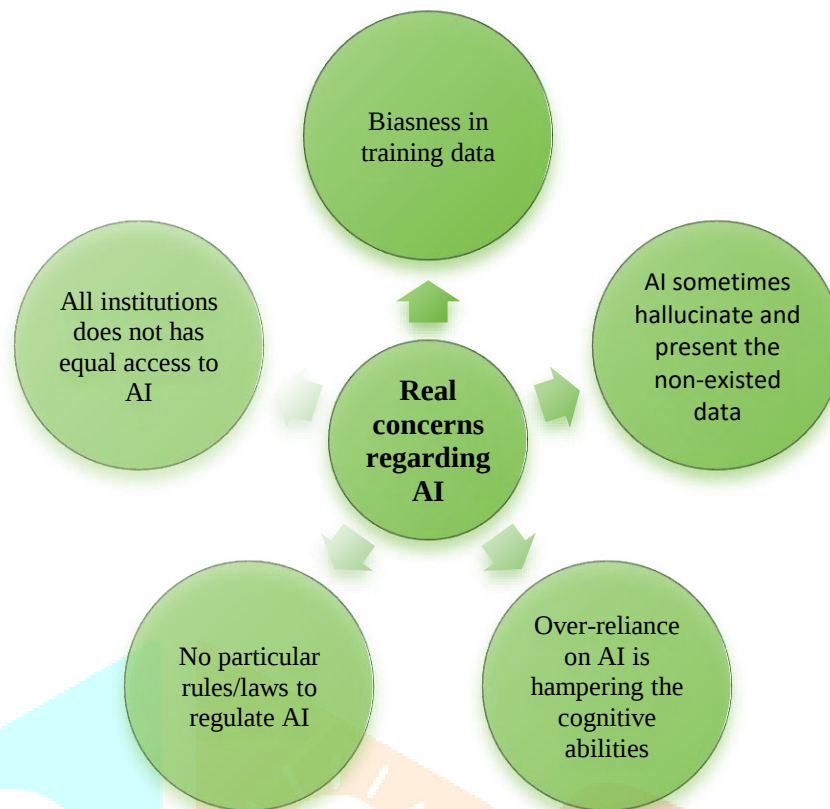


Fig. 1.1

Overall, with the help of AI and assistive technologies we are able to promote the idea of inclusive education that means this rapid integration of artificial intelligence has definitely helped to increase the work productivity at all levels but over dependence on it is also raising concerns about the gradual erosion of cognitive abilities of human beings. We have already seen a phrase that “Human is a social animal” but we have seen a global prevalence of digital addiction which is leading our youth towards isolation. Along with that, there are many real concerns related to artificial intelligence like AI is trained with the help of human beings and there is always a possibility of biasness in training data. Also, all institutions does not have equal access to AI and specialized tools. There is no particular regulations over the usage of AI like in research paper writing till now there is no AI similarity index levels introduced by UGC or like wise agencies across the world. The most important concern is regarding the over-reliance on AI which directly hampers the cognitive strength of human beings i.e. on one side AI is helping us with data driven insights because of which we can take informed decisions but on the other side it is affecting our decision making power while over-relying on it. Sometimes, AI hallucinate and present the non-existed data. So, its usage and concerns are two sides of one coin. Let us see some real concerns regarding artificial intelligence with the help of Fig. 1.2.

**Fig. 1.2**

As per the statistics, around 27% of world's population is suffering from smartphone addiction. This has significantly been increased after Covid-19 era. Usage of smartphone is anyway associated with psychological symptoms of stress, anxiety, depression, insomnia or what not. Along with this addiction we are heavily relying on artificial intelligence not for entertainment only but for every task i.e. from getting factual information to getting creative ideas; which is definitely leading to cognitive offloading but we need to be aware that this cognitive offloading doesn't turn our cognitive abilities to diminishing side. So, the concern is not about cognitive offloading as it is not inherently harmful but over-reliance on AI leading to reduced engagement on critical cognitive process is the actual concern which raises an important question i.e. As the AI becomes more capable, are humans becoming less cognitively active? This paper explores this question by examining the real concerns associated with over-reliance on AI and proposing the proactive concept of cognitive gyms.

Cognitive Consequences of Over-reliance on Artificial Intelligence (Fig. 1.3)

Over-reliance on technological assistance usually reduce the opportunities for practicing memory retrieval, critical evaluation, creative ideation, and independent problem-solving. So, cognitive consequences of over-reliance on AI are huge.

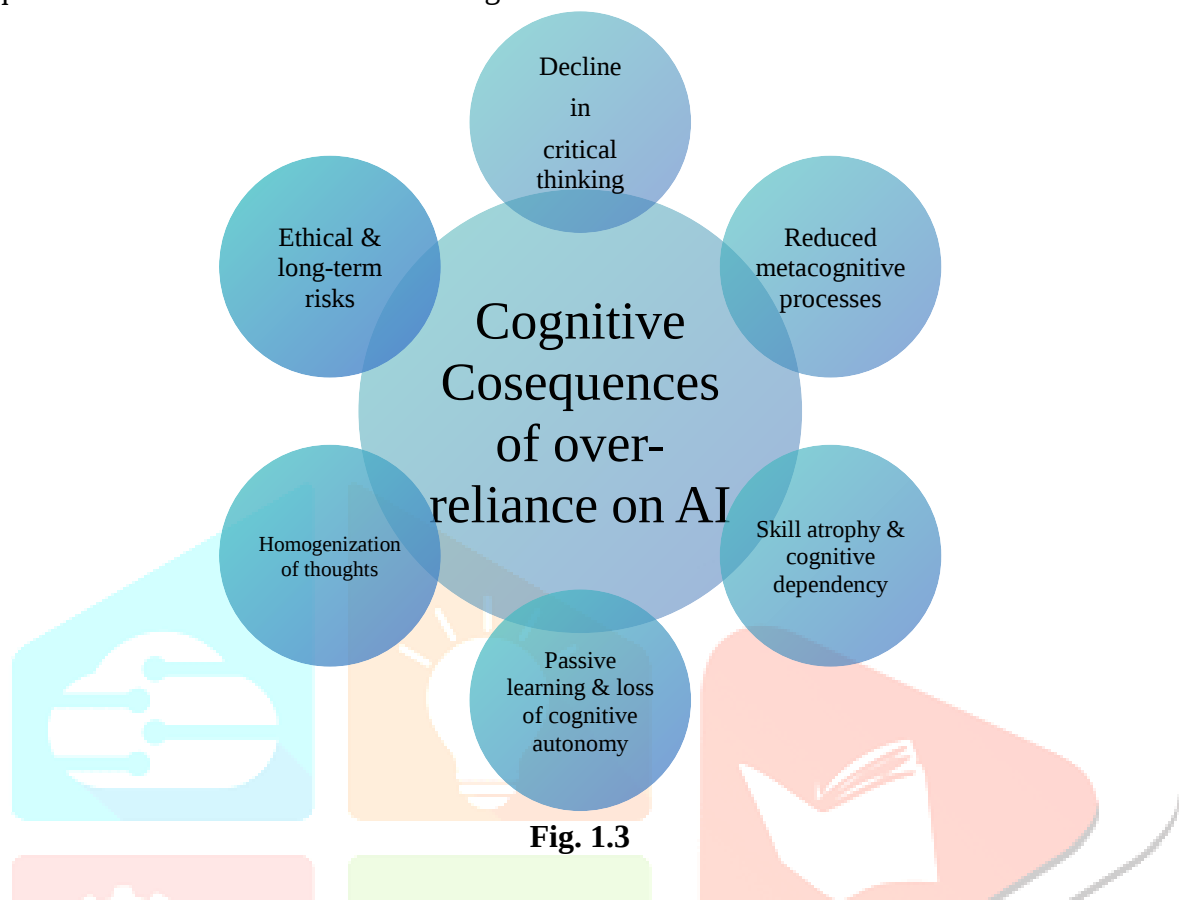


Fig. 1.3

Conceptual Framework of Cognitive Gyms

Although there is no one inventor or originator of this concept but few researchers have used this term recently. For example, a 2025 paper argued that Cognitive Gyms could become institutions designed to strengthen attention, reflection, reasoning, emotional intelligence, and moral judgment in response to the cognitive challenges posed by AI and digital media. The authors explicitly compared them to physical gyms that arose in response to increasingly sedentary lifestyles. A cognitive gym is a structured environment designed to strengthen mental abilities through deliberate practice, similar to how physical gyms enhance physical fitness. Cognitive gyms are ideally based on the idea of active engagement at cognitive level rather than passive consumption of information. As we get involve in cognitive activities there is a progressive difficulty level which helps to increase our mental endurance. These gyms give us reflection and meta cognitive training via different engaging activities.

There can be variety of cognitive gyms providing need based activities on individual basis like physical cognitive gyms where individuals engage in puzzles, debates, and problem-solving activities; digital cognitive platforms include different applications which provide structured cognitive exercises and hybrid cognitive gyms have combination of AI tools with human-led cognitive challenges.

There are few components of any functional gym:

- ✧ Memory training: It majorly includes recall exercises and spaced repetition.
- ✧ Attention training: It includes mindful and focus exercises.
- ✧ Creative challenges: It is concerned with open ended problem solving tasks.
- ✧ Critical and reflective thinking tasks include logic puzzles, argument analysis etc.

Conclusively, concept of cognitive gyms is not against AI. In fact, we can incorporate AI into cognitive gyms very strategically. We should:

- ✧ use AI as a guide & facilitator, not a replacement
- ✧ introduce “cognitive friction” to encourage effortful thinking

- ✧ use AI-driven cognitive gyms which can also support people with various conditions like ADHD, early Alzheimer's disease, or brain injuries by tailoring exercises to their specific deficits and tracking improvement over time.

Types of Cognitive Gyms

As there is no universally accepted definition regarding the types of cognitive gyms but on the basis of literature we came across the following types with there primary goals.

Types of Cognitive Gyms	Primary Goal
Foundational Cognitive Gym	Attention, memory, impulse control
Executive Function Gym	Decision-making and cognitive control
Situational Awareness Gym	Performance under complex conditions
Emotional Intelligence Gym	Emotional and social competence
Resilience Gym	Adaptability and stress tolerance
Critical Thinking Gym	Reasoning and information evaluation
Moral Reasoning Gym	Ethical judgment and wisdom
Reflective/Mindfulness Gym	Self-awareness and cognitive recovery

Need and Importance of Cognitive Gyms

The concept of Cognitive Gyms has emerged in response to growing concerns that modern digital environments, social media, and AI systems may reduce opportunities for sustained attention, deep thinking, reflection, and independent reasoning. Cognitive Gyms are proposed as structured environments where individuals deliberately train cognitive, emotional, and ethical capacities, much as physical gyms train physical fitness. Cognitive gyms are the becoming the need of the hour

1. to improve attention and concentration.
2. to enhance critical thinking and reasoning.
3. to maintain cognitive fitness in the AI era
4. to develop executive functions
5. to build cognitive resilience and adaptability
6. to promote ethical and moral reasoning
7. to support lifelong cognitive health

Challenges of Cognitive Gyms

The concept of Cognitive Gyms is still in emerging phase. So, there are many challenges regarding the concept:

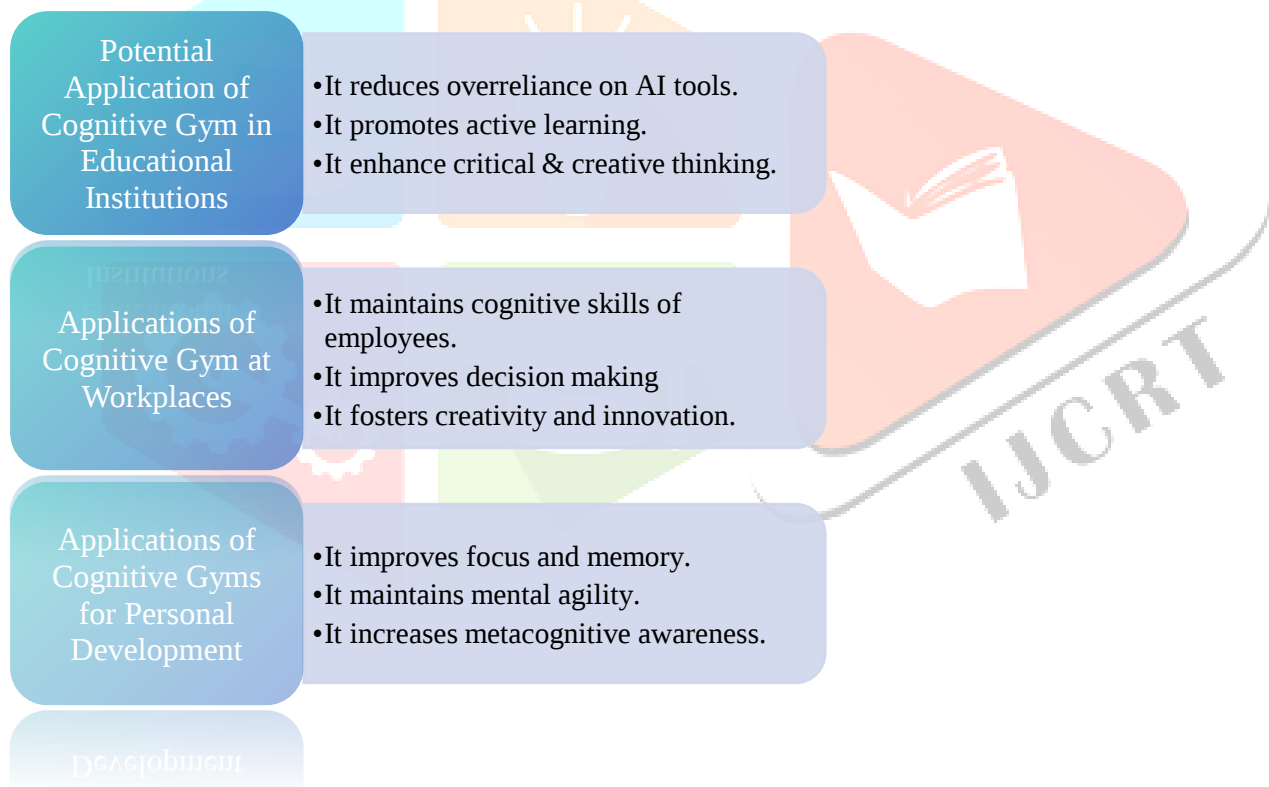
- ✧ Accessibility: It is a challenge to ensure that cognitive gyms are available and affordable to diverse populations.
- ✧ Effectiveness: As many studies show that these are not effective for older people which points out an important question of effectiveness like for whom these will be effective or not?
- ✧ User Engagement and Personalization: Considering the existence if individual differences it is challenging to keep users motivated and consistent in their cognitive training routines. So, personalized programme need to be generated which will gain be a challenge for trainers as they need to tailor the exercises as per individual cognitive needs and abilities.
- ✧ Technological Constraints: Technology is not everyone's cup of tea. People do face struggle while using it which is a bigger challenge. So, making a balanced fit of AI and cognitive strategies will also be a concern.
- ✧ Regulation: Unregulated AI or technology can create chaos which will be difficult to handle. So, regulation of standards and quality is needed in case of AI and also the regulations for cognitive gyms is also needed.

✧ Privacy: Everything is already been exposed in this technology oriented era. So, keeping things low and private will be a big concern while dealing with challenges in case of cognitive gyms. Despite these challenges we definitely have the implications of the concept which can't be ignored.

Implications of Cognitive Gyms for Education

Educational institutes are facing some challenges and concerns while adapting AI technologies but at individual levels there is definitely an over-use of AI like students are using it for smallest thing like assignment submission. In this scenario, cognitive gyms will provide an alternative approach where educators can create better structured opportunities for independent cognitive development rather than prohibiting AI. Some potential applications of cognitive gyms include AI-free learning periods, critical thinking laboratories, problem solving workshops, cognitive fitness curricula, debate and reasoning programs.

Universities increasingly face concerns regarding academic integrity and AI assisted assignments. Higher education institutions could establish Cognitive Fitness Centers where students engage in: Analytical reasoning exercises, Interdisciplinary problem-solving, Independent research activities, Creativity development programs. These initiatives would complement rather than replace AI-enhanced learning environments.



Future Scope of Cognitive Gyms

Some research has shown that cognitive gyms will not lead to any improvements in cognitive or executive functions in older people. So, future research should focus on:

- ✧ Longitudinal studies on cognitive impact of artificial intelligence
- ✧ Longitudinal studies on impact of cognitive gyms on children
- ✧ Effectiveness of cognitive gyms in adolescents
- ✧ Fundamental research about the standardization models of cognitive gyms
- ✧ Exploratory studies on Human-AI relationships

There are many more areas around this Human-AI relationship where we can explore as much as we can. Ultimately, the future is not about resisting artificial intelligence but re-balancing the human-AI relationship where cognitive gyms represent a proactive step toward ensuring that as machines become smarter, humans do not become cognitively passive.

Conclusion

We can conclude that artificial intelligence is one of the best flowers in our garden but it's totally up to us that how we use it for cognitive offloading while maintaining our cognitive abilities alive. Although there is a limited on field research on this concept but in the time of over dependence on artificial intelligence, cognitive gyms is definitely a proactive concept which may become a million dollar industry in upcoming years. To know the actual potential of this concept we definitely need more longitudinal and exploratory research in the particular area.

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