The Age-Curiosity Paradox: A Cross-Sectional Analysis of Scholarly Curiosity Among Generation Alpha Students

Abstract

*This study explores the "Age-Curiosity Paradox" among **Generation Alpha**, investigating how scholarly curiosity evolves as students transition through critical developmental stages in a digital-first world. While traditional psychological discourse often suggests a decline in curiosity as students adapt to structured schooling, this research examines the potential for a qualitative rebound during the transition into the **Formal Operational Stage**. The primary objective was to analyze variations in curiosity levels across Grades 6 to 9 and identify specific cognitive thresholds that influence inquisitive behavior. Utilizing a quantitative research design, data was collected from **193 students** in Lucknow using a self-developed, bilingual Curiosity Questionnaire covering traditional and digital inquiry dimensions. The study employed **One-Way ANOVA** and **Tukey HSD Post-hoc** tests to analyze mean differences across grade levels. The results indicate a striking non-linear trajectory in scholarly curiosity. Specifically, the null hypothesis—positing no significant difference across grades—was **rejected** ($F=100.027$, $p < 0.001$), while the hypothesis supporting the "**Age-Curiosity Paradox**" was accepted. The most significant finding was a dramatic surge of **24.24 points** in curiosity scores during the transition from **Class 7 (M=120.71) to Class 8 (M=144.96)**. This surge suggests that the onset of formal operational thinking acts as a cognitive catalyst, enabling students to move past basic observations toward complex, abstract reasoning and "epistemic resilience". The findings imply that in the "phygital" era, cognitive maturation and digital social inclusion effectively reverse the traditional curiosity decline. The study concludes that Generation Alpha exhibits a unique "Curiosity Rebound," necessitating a dynamic pedagogical approach that leverages this high-tier inquisitive drive in secondary education. Further longitudinal research is recommended to explore the sustainability of this cognitive momentum into late adolescence.*

Keywords: *Generation Alpha, Age-Curiosity Paradox, Formal Operational Stage, Epistemic Resilience, Scholarly Curiosity.*

Introduction

Curiosity has been the cornerstone of human civilization and progress (Van Bemmel, 2008). It is the fundamental drive that compels an individual to ask "why" and "how," serving as the engine of intellectual growth (Jirout, 2020). In the realm of education, curiosity is not merely a psychological trait but the very bedrock of effective learning (Shin et al., 2019). A curious student does not simply memorize information; they strive to explore, internalize, and challenge it (Yazici & Kartal, 2025). However, the modern educational landscape and shifting global paradigms have fundamentally altered the nature of this inquisitiveness (Devega et al., 2025). While curiosity was once confined to textbooks and the physical classroom, it has now expanded into the vast, interconnected world of digital mediums (Ngongpah & Oni, 2025).

At the heart of this transformation is **Generation Alpha**—the first cohort born entirely within the 21st century (Jha, 2020). Growing up amidst smartphones, artificial intelligence, and constant internet connectivity, these children are truly 'Digital Natives (Nagy & Kölcsey, 2022).' For them, technology is not a tool but an extension of their identity and existence (Seijo, 2019). The curiosity of Generation Alpha differs significantly from previous generations; it is characterized by a demand for instant gratification and a preference for multimodal learning (Pereira et al., 2024). However, a critical question arises: does the structure of formal schooling sustain the curiosity of these digital natives, or does it begin to stifle it over time?

A long-standing concern among educationalists is the perceived decline in curiosity as children progress through higher grades, a phenomenon often termed the **"Curiosity Dip"**(Salam, 2012). Traditionally, this decline is attributed to a rigid curriculum, the mounting pressure of standardized examinations, and a pedagogical focus on rote learning rather than creative inquiry (Kanthimathi & Raja, 2025). In the early stages (Class 6-7), students are introduced to new subjects with a sense of novelty (Evans et al., 2018). Yet, as they transition toward secondary levels (Class 8-9), the burden of career aspirations and competitive academic environments intensifies (Lexmond, 2000). Conventional wisdom suggests that as age increases, the frequency of questioning decreases, and the focus shifts narrowly toward academic scores (Eccles et al., 2018).

However, does this traditional assumption hold true for the contemporary Generation Alpha? This is where the **"Age-Curiosity Paradox"** begins (Wattad & Chen, 2023). From a developmental perspective, the ages of 11 to 15 (covering Classes 6 to 9) represent a vital

transition in cognitive growth (Keating, 2004). According to Piaget's theory, children at this stage move from the 'Concrete Operational Stage' to the '**Formal Operational Stage**' (Moshman, 2009). This signifies a shift toward abstract reasoning and logical deduction (Byrnes, 2010). They no longer just ask "what is this?" but begin to contemplate the underlying logic of systems (Wellman, 2020). Therefore, it is possible that what appears to be a decline in curiosity is actually an evolution—a shift toward a more sophisticated, "scholarly" form of inquiry that emerges in higher grades (Fuller, 2006).

Researching this subject is particularly crucial in the Indian context, where the **National Education Policy (NEP) 2020** emphasizes inquiry-based and discovery-oriented learning (Khan, 2022). To align with these goals, we must understand how the mental inclinations of students evolve across different grades (Harris et al., 1969). Lucknow, as a prominent educational hub with a diverse mix of public and private institutions, provides an ideal sample for such a study. We observe that by Classes 8 and 9, the complexity of the curriculum increases significantly—Science bifurcates into specialized disciplines like Physics, Chemistry, and Biology, while Mathematics demands higher-order logic. This increased complexity creates new 'Information Gaps' that may actually trigger higher levels of information-seeking behavior (Chen & Ma, 2012).

The present study explores this very paradox. The primary objective is to analyze the variations in scholarly curiosity among students from Class 6 to Class 9. Does curiosity truly diminish with age, or is it revitalized in the case of Generation Alpha? Our preliminary analysis suggests a surprising trend: curiosity levels in Class 8 and 9 are substantially higher than in the lower grades. This finding could be revolutionary, suggesting that educators and curriculum designers should view higher grades not as a period of academic burnout, but as a window of opportunity to harness mature, scholarly curiosity (Rohmaniyah et al., 2025).

Ultimately, this paper seeks to highlight the multidimensional nature of curiosity (Yow et al., 2022). We are not merely discussing numerical scores, but the evolving behavior that transforms a teenager into a scholar. The journey from Class 6 to Class 9 is more than just an academic promotion; it is the journey of a digital native's mind reaching cognitive maturity (Hoffman, 2010). Through this introduction, we establish the foundation upon which our hypotheses and subsequent analysis are built.

Literature Review

The conceptualization of curiosity has undergone a significant transformation in academic discourse, evolving from a simple innate instinct to a complex "intellectual catalyst" that drives systematic information seeking (Jirout, 2020). In contemporary philosophy and psychology, curiosity is no longer viewed as a monolithic trait but as a multidimensional process of navigating uncertainty (Reio, Jr, 2024). For **Generation Alpha**, this process is further complicated by their unprecedented immersion in a digital ecosystem from birth (Abildina et al., 2025). To understand scholarly curiosity within this cohort, it is essential to first analyze the global body of research that defines the shifting nature of inquisitiveness among digital natives (Radford et al., 2007). The traditional benchmarks of curiosity must be re-evaluated to account for a generation that does not merely consume data but actively interacts with it through sophisticated digital interfaces (Sher et al., 2019).

The cognitive architecture of Generation Alpha is uniquely shaped by their modes of communication and learning (Pereira et al., 2024). Researchers suggests that digital natives do not process information through "linear" pathways—such as reading a book from cover to cover—but rather through "associative" and "hyperlinked" navigation (Spires et al., 2018). Their scholarly curiosity is often ignited by multimodal stimuli, where text, video, and interactive AI-driven platforms converge (Runcan, 2025). For these students, curiosity is a mechanism to bridge "Information Gaps" almost instantaneously (Pereira et al., 2024). When examining students from Class 6 to Class 9, it becomes evident that their inquisitive behavior is intrinsically linked to how much they are challenged by complex, non-linear data (Jariatin et al., 2024). Therefore, assessing this generation’s curiosity requires a shift from measuring "passive interest" to measuring "active inquiry" and "digital discovery" (Wu et al., 2018).

Despite this potential for digital exploration, a long-standing and concerning narrative exists within educational psychology known as the **"Curiosity Dip"** (Mcleod, 2011). Prominent researchers have documented that as children progress through the formal schooling system, the frequency of their spontaneous questioning drops significantly (Ronfard et al., 2020; Ross & Killey, 1977). This decline is traditionally attributed to an "educational funnel" effect, where the pedagogical focus shifts from open-ended exploration to standardized assessment and grade-oriented outcomes (Saunders-Stewart et al., 2012). In the Indian academic context, the transition

from middle school (Class 6-7) to secondary levels (Class 8-9) is often characterized by a sharp increase in academic rigor and the psychological burden of future career competition (Evans et al., 2018). Conventional wisdom suggests that this systemic rigidity inevitably stifles the natural inquisitiveness of students, leading to a state of academic passivity by the time they reach high school (Digennaro & Borgogni, 2015).

However, the "Age-Curiosity Paradox" explored in this study challenges this traditional decline by situating the discussion within the framework of cognitive maturity (Whatley et al., 2025). Jean Piaget's theory of cognitive development provides a robust foundation for this argument. As students move through Classes 6 to 9 (typically ages 11 to 15), they enter the **"Formal Operational Stage"** (Labouvie-Vief, 2015). This developmental milestone is marked by the emergence of abstract reasoning, hypothetical thinking, and systematic logic (Commons et al., 1982). While 'perceptual curiosity' regarding novel stimuli naturally tends to diminish with age, 'epistemic curiosity'—the drive to resolve intellectual contradictions and acquire complex knowledge—demonstrates the capacity to increase during cognitive maturation (Reio, Jr, 2024). This suggests that the "dip" observed in earlier studies may have been a failure to measure the *quality* of curiosity rather than its *quantity*. Class 8 and 9 students may appear less "visibly" curious because their inquiry has become more internal, scholarly, and targeted.

The intersection of digital fluency and cognitive maturity creates a "rebound effect" that explains the higher curiosity scores observed in older students (Chu & Fung, 2021). In Classes 8 and 9, the academic curriculum becomes increasingly specialized; Science bifurcates into Physics, Chemistry, and Biology, and Mathematics demands a higher level of abstract logic. This increased complexity serves as a "productive struggle" that creates new, sophisticated information gaps (Tirupathi, 2024). For a Generation Alpha student equipped with advanced digital search skills, these gaps are not hurdles but invitations for deeper exploration (Ugli, 2025). Thus, the paradox lies in the fact that as the school system becomes more demanding, the student's internal drive to master complex systems becomes more resilient (Gorghiu et al., 2024). This evolution represents a shift from the "childlike wonder" of Class 6 to the "scholarly inquiry" of Class 9 (Shayer, 1979).

Furthermore, the socio-cultural environment of an educational hub like Lucknow plays a vital role in shaping this paradox. Students in this region are exposed to a competitive yet resource-

rich environment where the pressure to succeed often coexists with access to diverse learning platforms. This study posits that the "Age-Curiosity Paradox" is a result of students utilizing their burgeoning cognitive skills to navigate academic pressures through heightened curiosity (Hulme et al., 2013). Instead of retreating from the challenges of Class 9, these digital natives appear to be leaning into them, using their scholarly curiosity as a tool for academic survival and mastery (Obro & Odofin, 2025). This finding necessitates a re-evaluation of how secondary education is delivered, suggesting that older students are more intellectually ready for inquiry-based learning than previously assumed.

In conclusion, this literature review establishes that the relationship between age and curiosity is not a simple downward trajectory but a complex, paradoxical evolution (Whatley et al., 2025). While the "Curiosity Dip" remains a valid concern for traditional schooling, the emergence of Generation Alpha and their entry into the Formal Operational Stage provides a new lens for analysis (Moshman, 2020). The higher curiosity levels found in Classes 8 and 9 indicate that the flame of inquiry does not die out; rather, it transforms into a more disciplined, scholarly fire (Salam, 2012). By bridging the gap between Piagetian theory and modern digital pedagogy, this paper contributes a new perspective to the field, suggesting that age is not a barrier to curiosity but a gateway to a more profound form of scholarly engagement.

Theoretical Framework and Hypothesis Development

The conceptualization of curiosity has evolved from a simple instinct to a complex "intellectual catalyst" essential for navigating the uncertainties of the 21st-century digital ecosystem(Litman, 2019). For Generation Alpha, this process is uniquely shaped by an unprecedented immersion in multimodal stimuli and interactive platforms, where curiosity serves as a primary mechanism to bridge "Information Gaps" almost instantaneously(Reio, Jr, 2024). However, a persistent narrative in educational psychology, known as the "Curiosity Dip," suggests that as students progress through formal schooling, their spontaneous questioning and exploration significantly decline due to academic rigor and standardized assessments(Grossnickle, 2014).

This study challenges the universality of the "dip" by situating the discussion within Jean Piaget’s theory of cognitive development, specifically the transition into the **Formal Operational Stage**. As students move from Class 6 to Class 9 (ages 11–15), they develop the capacity for abstract reasoning and systematic logic(Moshman, 2009). While 'perceptual

curiosity'—the basic interest in novelty—may naturally decrease, this cognitive maturation allows 'epistemic curiosity'—the drive to resolve complex intellectual contradictions—to intensify(Hidi & Renninger, 2019). In Classes 8 and 9, the academic curriculum becomes increasingly specialized, acting as a "productive struggle" that invites deeper, scholarly exploration rather than academic passivity(Cleak, 2019).

Consequently, this research proposes the **"Age-Curiosity Paradox,"** suggesting that in the competitive yet resource-rich educational environment of Lucknow, scholarly curiosity undergoes a rebound rather than a decline(Hulme et al., 2013). This paradox posits that as the school system becomes more demanding, the student's internal drive to master complex systems becomes more resilient, transforming "childlike wonder" into disciplined "scholarly inquiry"(Bowman, 2011). Based on this theoretical evolution, the following objectives and hypotheses were developed to guide the study:

- **Objective 1:**To classify Generation Alpha students into Low, Moderate, and High levels of scholarly curiosity using statistical normative grouping based on (M ± SD).
- **Objective 2:**To examine differences in scholarly curiosity scores across Class 6, 7, 8, and 9 students in order to investigate the existence of the "Age-Curiosity Paradox."
  - **Hypothesis 1 (H_1):** There is no statistically significant difference in scholarly curiosity scores among Generation Alpha students across Class 6, 7, 8, and 9.
  - **Hypothesis 2 (H_2):**Students in higher classes (Class 8 and 9) exhibit significantly higher levels of scholarly curiosity compared to students in lower classes (Class 6 and 7), supporting the "Age-Curiosity Paradox."
- **Objective 3:**To examine the impact of transition into the Formal Operational Stage (Class 7 to Class 8) on the development of scholarly curiosity among students.
  - **Hypothesis (H_3):**There is a statistically significant increase in scholarly curiosity scores from Class 7 to Class 8, indicating the influence of the transition into the Formal Operational Stage.

Research Methodology

The present study adopts a **Quantitative Research Approach** utilizing a **Descriptive Survey Research Design**. This design was selected for its efficacy in collecting standardized data to identify developmental patterns and trends within the "Generation Alpha" cohort. By using a **cross-sectional approach**, the study captured curiosity dimensions across Grades 6 to 9 during a concentrated period, allowing for objective comparisons between these academic subgroups.

Participants and Sampling

The target population comprised middle school students in **Lucknow** born within the Generation Alpha timeline. To ensure external validity, **Simple Random Sampling** was employed to select a sample where every student had an equal and independent chance of participation. The final sample consisted of **193 valid respondents**, drawn from two distinct educational environments to ensure socio-economic diversity: **Babu Triloki Singh Inter College (Public sector)** and **S.M. Public School (Private sector)**.

The demographic distribution represents a diverse cross-section of the cohort:

- **Gender:** 81 Male students (42.0%) and 112 Female students (58.0%).
- **Institutional Distribution:** 96 students (49.7%) from the Public sector and 97 students (50.3%) from the Private sector.
- **Grade Distribution:** Class 6 (n=45), Class 7 (n=48), Class 8 (n=45), and Class 9 (n=55).

Research Tool

Data was collected using a **Self-Developed Curiosity Questionnaire** specifically designed to bridge the gap between traditional curiosity and modern digital inquiry. This bilingual tool consists of **47 items** covering three dimensions: non-digital practices, classroom-based curiosity, and digital inquiry. The tool was validated through expert consultation to ensure content accuracy and face validity before administration. The researcher personally administered the tool; out of 215 initial responses, 22 were removed following a rigorous screening process to ensure data quality, resulting in 193 valid cases.

Statistical Techniques

To test the formulated hypotheses, both descriptive and inferential statistics were applied using **SPSS version 26.0**.

- **Descriptive Statistics:** Mean and Standard Deviation were used to calculate average curiosity levels.
- **Standard Normative Grouping:** Following the $(M \pm SD)$formula, students were categorized into Low, Moderate, and High curiosity levels.
- **One-Way ANOVA:** For this specific analysis of the "Age-Curiosity Paradox," **One-Way ANOVA** served as the primary inferential tool to compare mean scores across the four grade levels (Class 6, 7, 8, and 9) at a 0.05 level of significance. This allowed for the identification of significant shifts in curiosity during the transition into the formal operational stage.
- **Ethical Considerations:** Participant anonymity and informed consent were strictly maintained throughout the research process.

Results and Findings

The primary goal of this section is to present the empirical evidence gathered to test the "Age-Curiosity Paradox" among Generation Alpha students. The analysis was conducted using SPSS version 26.0, focusing on the categorization of curiosity levels and the comparative analysis of grade-level variations.

Categorization of Scholarly Curiosity Levels (Objective 1)

The first objective aimed to categorize Generation Alpha students into Low, Moderate, and High levels of curiosity to establish a baseline for their inquisitive behavior. This was achieved by applying statistical normative grouping (M± SD) to the total sample of 193 students.

Table 1: Distribution of Participants by Scholarly Curiosity Levels

Curiosity Level	Range of Scores	Frequency (N)	Percentage (%)	Remark
Low	Below 118.32	39	20.2%	Lower Tier
Moderate	118.32 – 149.95	98	50.8%	Majority Cohort
High	149.96 & Above	56	29.0%	Upper Tier

Total		**193**	**100.0%**	

As illustrated in Table 1, the vast majority of the participants (**50.8%**) fall within the **Moderate** level of scholarly curiosity. A significant portion of the sample (**29.0%**) exhibits a **High** level of inquiry, while only a small minority (**20.2%**) is categorized in the **Low** level.

This distribution highlights a **'Resilient Inquisitiveness'** among Generation Alpha students in Lucknow. The findings show that even within a structured school environment, nearly one-third of the students maintain a very high drive for learning and digital exploration. This categorization is essential for understanding the **'Age-Curiosity Paradox'**, as it reveals that high-level curiosity is not lost, but actually peaks as students transition into higher grades.

The Age-Curiosity Paradox: Variations Across Grades (Objective 2)

The second objective aimed to examine the differences in scholarly curiosity scores across Classes 6, 7, 8, and 9 to investigate the existence of the "Age-Curiosity Paradox". This objective was tested using two hypotheses: a null hypothesis (**Hypothesis 1**) assuming no significant difference, and an alternate hypothesis (**Hypothesis 2**) predicting higher curiosity in senior classes.

Table 2: One-Way ANOVA of Curiosity Scores across Different Class Levels

Source of Variation	Sum of Squares	df	Mean Square	F-value	Remark
Between Groups	29474.938	3	9824.979	**100.027**	**Significant**
Within Groups	18564.284	189	98.224		**(p <0.001)**
Total	48039.223	192			

As illustrated in Table 2, the One-Way ANOVA revealed a statistically highly significant difference in curiosity scores across the four class levels, with an **F-value of 100.027 (p <0.001)**. Based on this result, the following decisions were made regarding the hypotheses:

- **Hypothesis 1:** Since the p-value (0.000) is less than the significance level of 0.05, the null hypothesis, which assumed no significant difference across grades, was **rejected**.

- **Hypothesis 2:** The significant F-value and a mean comparison (Class 6/7 M ≈121 vs. Class 8/9 M ≈145) provide strong empirical support for the "Age-Curiosity Paradox." Consequently, **Hypothesis 2 was accepted**.

This finding suggests that scholarly curiosity among Generation Alpha does not follow a linear decline with age. Instead, the significant surge in scores during the transition to higher classes indicates a qualitative rebound in inquiry. This shift aligns with the transition into the formal operational stage, where increased cognitive maturity and digital social inclusion enable students to engage more deeply with complex information, thereby validating the "Age-Curiosity Paradox" in the contemporary educational landscape.

Impact of the Formal Operational Stage Transition (Objective 3)

The third objective aimed to examine the impact of the transition into the Formal Operational Stage (specifically from Class 7 to Class 8) on the development of scholarly curiosity among students. The hypothesis predicted a statistically significant increase in curiosity scores during this transition, reflecting the cognitive shift associated with this developmental stage.

Table 3: Comparative Analysis of Curiosity Scores (Class 7 vs. Class 8)

Transition Period	N	Mean (M)	Std. Deviation (SD)	Mean Diff.	Remark
Class 7	48	120.71	4.72	**-24.24**	**Significant**
Class 8	45	144.96	13.83		**(p <0.001)**

As illustrated in Table 3, the mean curiosity score for students in Class 8 (M = 144.96) was substantially higher than that of students in Class 7 (M = 120.71). The Post-hoc Tukey HSD test confirmed that this surge of **24.24 points** is statistically highly significant at the 0.05 level (p <0.001). Consequently, the **hypothesis was accepted**.

This finding suggests that the transition from Class 7 to Class 8 serves as a critical developmental threshold for Generation Alpha. The significant leap in scores indicates that as students enter the Formal Operational Stage, they undergo a qualitative shift in their inquiry patterns. Instead of a decline, these students exhibit a "Curiosity Rebound," leveraging their newly developed abstract reasoning skills and digital social inclusion to engage in more complex

scholarly exploration. This transition validates that the secondary school environment, coupled with cognitive maturation, provides the necessary stimulus for enhanced inquisitive behavior.

Discussion and Conclusion

The empirical results of this study provide a compelling perspective on the cognitive development of Generation Alpha, specifically regarding the "Age-Curiosity Paradox." The most striking finding is the non-linear trajectory of scholarly curiosity, which challenges the traditional "curiosity dip" narrative and highlights a significant rebound as students enter higher grade levels.

The rejection of the null hypothesis and the subsequent acceptance of Hypothesis 1 and 2 reveal that curiosity is not a declining trait but one that undergoes a qualitative transformation. While previous psychological discourse often suggested that curiosity diminishes as students age and adapt to structured schooling, the mean scores of 120.71 for Class 7 and a remarkable 144.96 for Class 8 demonstrate a statistically significant leap with an F-value of 100.027. This surge suggests that the transition from middle school to secondary school acts as a cognitive catalyst rather than a constraint.

The significant leap observed in Objective 3 specifically points toward the influence of the Formal Operational Stage. As students in Lucknow transition from Class 7 to Class 8, they move beyond concrete observations to abstract reasoning. The mean difference of 24.24 points between these two grades suggests that this period is a critical threshold where "epistemic resilience" begins to manifest. In the contemporary "phygital" era, Generation Alpha students in higher classes do not merely seek information; they utilize their matured cognitive fluency and digital social inclusion to engage in complex scholarly inquiry. This implies that the digital landscape provides a continuous stimulus that, when combined with cognitive maturation, effectively reverses the traditional curiosity decline.

In conclusion, this research establishes that Generation Alpha exhibits an "Age-Curiosity Paradox," where inquisitive behavior reaches its peak during early adolescence. The empirical evidence indicates that the secondary school threshold is a pivotal point of cognitive resurgence; in this era, maturing abstract reasoning skills act as a bridge to deeper scholarly engagement. These findings highlight the need for a dynamic pedagogical approach that supports this high-tier

curiosity in higher classes, moving away from outdated instructional models that assume a lack of interest in older students.

Despite the significant insights gained, this study is subject to certain limitations. Firstly, the geographical scope was confined to school students in Lucknow, which may limit the generalizability of the findings to rural or culturally diverse regions of India. Secondly, the reliance on a sample of 193 students, while statistically valid for this analysis, necessitates larger-scale studies for broader validation. Furthermore, the cross-sectional nature of the research provides a snapshot of curiosity at a specific point in time, potentially overlooking the fluid day-to-day evolution of these traits. Acknowledging these constraints provides a clearer context for interpreting the results and underscores the need for more extensive investigations.

While this study establishes a significant rebound in curiosity at the secondary level, further longitudinal research is necessitated to explore the long-term sustainability of this drive. Future investigations should focus on whether this high level of epistemic inquiry persists throughout the transition from late adolescence to early adulthood, particularly identifying how AI-enhanced learning environments can be optimized to maintain this inquisitive momentum across all developmental stages.

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