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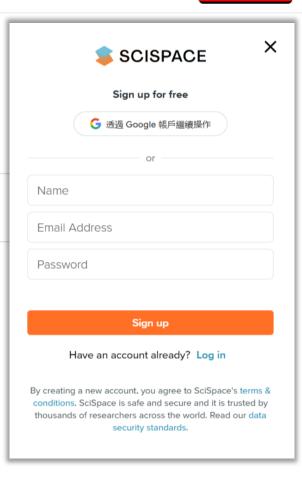
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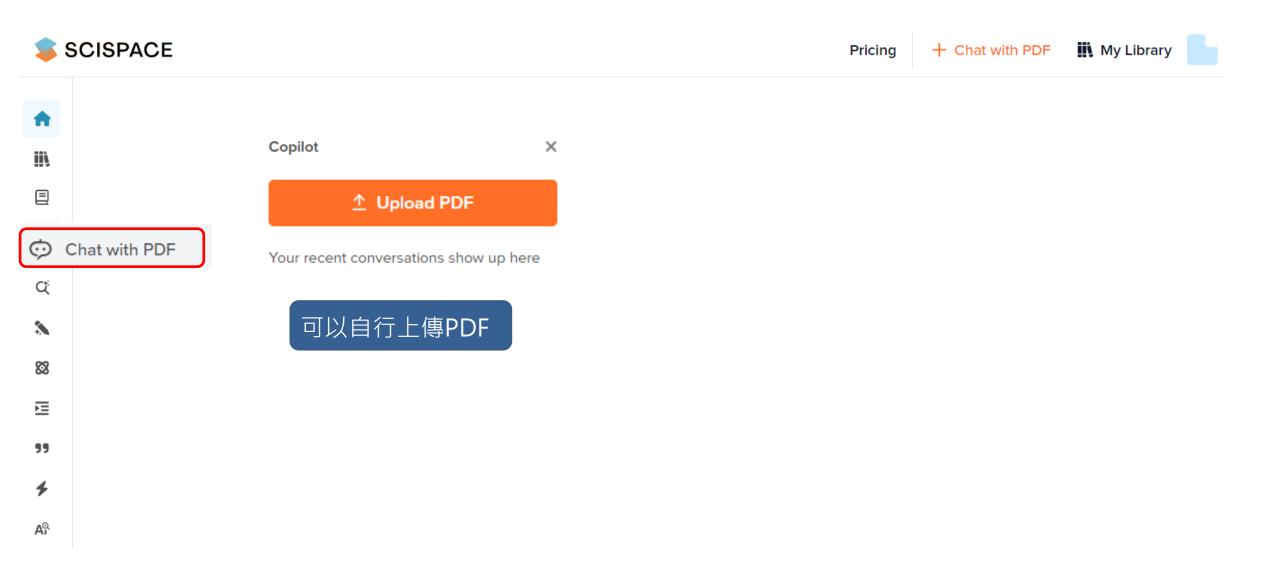
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Journal of Experimental Child Psychology 246 (2024) 105991



Contents lists available at ScienceDirect

### Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp



Math talk by mothers, fathers, and toddlers: Differences across materials and associations with children's math understanding



Lillian R. Masek<sup>a</sup>, Mackenzie S. Swirbul<sup>a</sup>, Alex M. Silver<sup>b</sup>, Melissa E. Libertus<sup>b</sup>, Natasha Cabrera<sup>c</sup>, Catherine S. Tamis-LeMonda<sup>a,\*</sup>

#### ARTICLE INFO

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Infants

#### ABSTRACT

Learning words for numbers, shapes, spatial relations, and magnitudes—"math talk"—relies on input from caregivers. Language interactions between caregivers and children are situated in activity contexts and likely affected by available materials. Here, we examined how play materials influence the math talk directed to and produced by young children. We video-recorded parents (mothers and fathers; English-and/or Spanish-speaking) and their 24- to 36-month-olds during play with four sets of materials, transcribed and coded types of parent and toddler math words/phrases, and assessed toddlers' understanding of number, shape, and spatial relations terms. Categories of math words varied by materials. Numeracy talk (e.g., "one," "two," "first," "second") was more frequent during interactions with a picture book and toy grocery shopping set than with a shape sorter or magnet board; the reverse held for spatial talk (e.g., "out," "bottom," "up," "circle"). Parent math talk predicted toddler math talk, and both parent







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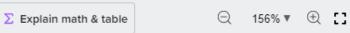


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nitude—words that refer to a size or amount (excluding number words; e.g., "big," "little," "more," "all," "piece"). Math words per minute was calculated (consistent with Pruden et al., 2011) for each of the three types of math talk for mothers, fathers, and toddlers to control for the varying lengths of time that parents and toddlers played with each set of materials.

#### Assessments of toddler math understanding

Researchers assessed toddlers' comprehension of math concepts using three tasks: Point-to-Shape, Point-to-Spatial-Relation, and Point-to-X. All tasks were coded based on whether the toddler identified the correct picture on each trial (correct = 1, incorrect = 0). A second trained research assistant double-coded 20% of the trials. Inter-coder reliability was high (Point-to-Shape  $\kappa$  = .93, Point-to-Spatial-Relation  $\kappa = .77$ , Point-to-X  $\kappa = .96$ ). Internal consistency, as measured by Cronbach's alpha, was acceptable (Point-to-Shape  $\alpha = .78$ , Point-to-Spatial-Relation  $\alpha = .63$ , Point-to-X  $\alpha = .68$ ) given that toddlers are just beginning to learn these math words; hence, knowledge of one word is not necessarily indicative of knowledge of another word. For all tasks, the final score was the proportion of correct trials. We prorated toddlers' performance by number of trials completed (e.g., if a child was administered 8 trials and succeeded at 4, the child received a score of .50). For all tasks, possible scores ranged from 0 (no trials correct) to 1 (all trials correct). 也可單獨選取特定段落

### Point-to-Shape task

Toddlers' understanding of shape names was assessed during the first home visit using the Pointto-Shape task. The researcher presented the toddler with a set of 10 cards, 1 card at a time, each depicting two geometric shapes. The researcher said to the this game, I'll tell you the name of a shape and you show i Explain text asked the toddler to identify a given shape. For example, the that had an image of a triangle on the left and a diamond or "Where's the triangle?" The shape names tested were "hear Summarize gle," "circle," "square," and "oval" (note that "triangle" was

#### Point-to-Spatial-Relation task

Toddlers' understanding of spatial relation terms was asses Point-to-Spatial-Relation task. The researcher presented the to depicting two images of a tiger and one or two cups. The pict the tiger's location in relation to the cup. The researcher said t The tiger is hiding. I'm going to tell you where he is hiding, a researcher then asked the toddler to find the picture that de example, the card would show a picture of the tiger next to the on top of the cup on the right and the researcher would ask, "\ spatial relations tested were "on top of," "under," "between,' to." Of the 58 toddlers who had a first home visit, 52 had dat

sifications of triangles). Of the 58 toddlers who had a first h

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#### Point-to-X task

Toddlers' understanding of number words "one" to "ten" was assessed during the second home visit using the Point-to-X task. Two non-numeric practice trials were given prior to the start of the



Point-to-Shape task Toddlers' understanding of shape names was assessed during the first home visit using the Point- to-Shape task. The researcher presented the toddler with a set of 10 cards, 1 card at a time, each depicting two geometric shapes. The researcher said to the toddler, "Let's look at these pictures! In this game, I'll tell you the name of a shap ...Read more 9:20 PM

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when playing with the magnet boa ents used similar amounts of magnitude words across tasks. Nonetheless, English-dominant and Spanish-dominant parents were similar in the magnitude words that they used across the four sets of materials (Fig. 2).

10

L.R. Masek, M.S. Swirbul, A.M. Silver et al.

Journal of Experimental Child Psychology 246 (2024) 105991

Table 2 Correlations for math talk between each task for toddlers (above the diagonal) and parents (below the diagonal).

Task	Correlations				
Total math talk	1.	2.	3.	4.	
1. Picture book	-	.41*	.49*	.49*	
2. Shape sorter	.29*	-	.66*	.47°	
3. Magnet board	.15	.23*	-	.37*	
4. Grocery shopping set	.34*	.46*	.20	-	
Numeracy					
1. Picture book	-	.17	.26	.32*	
2. Shape sorter	04	-	.42*	10	
3. Magnet board	.02	.24*	-	10	
4. Grocery shopping set	31*	.06	.01	-	
Spatial					
1. Picture book		.03	.09	.11	
2. Shape sorter	.20	-	.64*	.39*	
3. Magnet board	.19	.19	_	.43*	
4. Grocery shopping set	.11	.39*	.29*	-	
Magnitude					
1. Picture book	-	.36*	.41*	.54*	
2. Shape sorter	34*	-	.32*	.32*	
3. Magnet board	34*	.24*	-	.49°	
4. Grocery shopping set	.33*	.31*	.41*	2	

Note. Toddler correlations, to the right and above the diagonal, were calculated based on a dense rank of an average of tokens per minute of math talk used with mothers and fathers (for toddlers who had two visits). Parent correlations, to the left and below the diagonal, are calculated on dense rank tokens per minute.

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Table 3

Mean of the natural log-transformed math words per minute by language dominance, play materials, and type of math talk.







		2	10	10	
Total math talk	1,	2.	3.	4.	
1. Picture book	-	Al*	.49*	A9*	
2. Shape sorter	.29*	-	.66°	AT	
3. Magnet board	.15	.23*	-	.37*	
4. Grocery shopping set	34*	.46*	.20	-	
Numeracy					
1. Picture book	-	.17	.26	.32*	
2. Shape sorter	04	2	.42°	16	
3. Magnet board	.02	24*	_	10	
4. Grocery shopping set	.31*	.06	.01	-	
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3. Magnet board	34*	24"	-	.49°	
4. Grocery shopping set	.33*	.31*	.41*	-	

Standard A High Quality

Note. Toddler correlations, to the right and above the diagonal, were calculated based on a dense rank of an average of tokens per minute of math talk used with mothers and fathers (for toddlers who had two visits). Parent correlations, to the left and below the diagonal, are calculated on dense rank tokens per minute.

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#### Table 2 Correlations for Math Talk:

- . The table shows correlations between math talk during different tasks for toddlers (above the diagonal) and parents (below the diagonal).
- Total Math Talk Correlations:

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when playing with the magnet board than with the picture book, in contrast, spanish-dominant parents used similar amounts of magnitude words across tasks. Nonetheless, English-dominant and Spanish-dominant narents were similar in the magnitude words that they used across the four sets of mate

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4. Grocery shopping set	.34"	.46*	.20	-	
Numeracy					
1. Picture book	-	.17	.26	.32	
2. Shape sorter	04	_	A2*	10	
3. Magnet board	.02	.24*	-	-,10	
4. Grocery shopping set	31*	.06	.01	-	
Spatial					
1. Picture book	-	.03	.09	.11	
2. Shape sorter	.20	-	.64"	.39*	
3. Magnet board	.19	.19	-	.43*	
4. Grocery shopping set	.11	.39*	.29*	-	
Magnitude					
1. Picture book	-	.36*	.41*	54"	
2. Shape sorter	.34"	-	.32*	.32*	
3. Magnet board	34*	.24*	-	A9*	
4. Grocery shopping set	.33*	.31*	.41*	_	

Note. Toddler correlations, to the right and above the diagonal, were calculated based on a dense rank of an average of tokens per minute of math talk used with mothers and fathers (for toddlers who had two visits). Parent correlations, to the left and below the diagonal, are calculated on dense rank tokens per minute.

p < .05.

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Standard	High Quality			
Total math talk	1.	2.	3.	4.
I. Picture book	-	.41*	A9*	A9*
2. Shape sorter	.29*	-	.06*	AT*
3. Magnet board	35	23*	20 H	37
4. Grocery shopping set	347	.46°	.20	-
Numeracy				
I. Picture book	-	317	26	-32*
Z. Shape sorter	04		.42*	16
3. Magnet board	.02	24"	200	10
4. Grocery shopping set	31"	.00	.01	-
Spatial				
1. Picture book	20	.03	.09	:11
2. Shape sorter	20	2	.64*	39*
3. Magnet board	.19	.19	-	43°
4. Grocery shopping set	11	39*	391	327

#### Table 2 Correlations for Math Talk:

. The table shows correlations between math talk during different tasks for toddlers (above the diagonal) and parents (below the diagonal).

#### Total Math Talk Correlations:

- · Picture book task had a moderate positive correlation with shape sorter and magnet board tasks.
- · Shape sorter task had a moderate positive correlation with grocery shopping set task.
- . Magnet board task had a weak positive correlation with shape sorter task.
- · Grocery shopping set task had moderate positive correlations with shape sorter and magnet board tasks.

### Numeracy Correlations:

- · Picture book task had positive correlations with grocery shopping set task.
- . Shape sorter task had a moderate positive correlation with picture book task.

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C Literature Review

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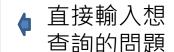


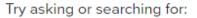
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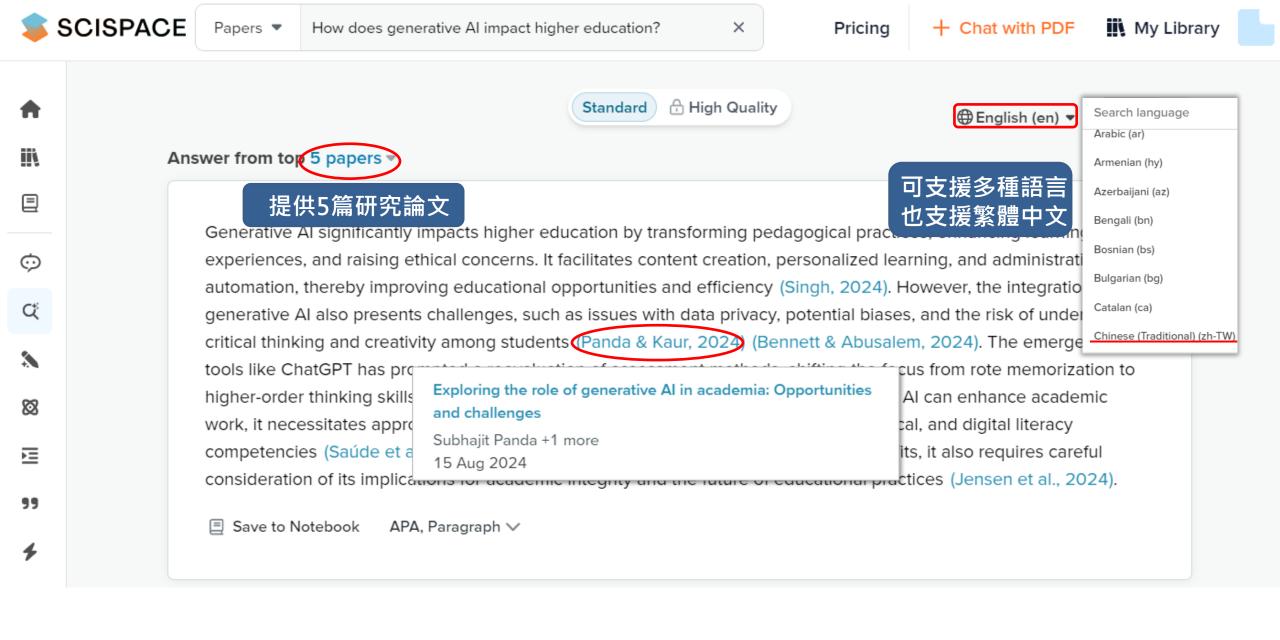
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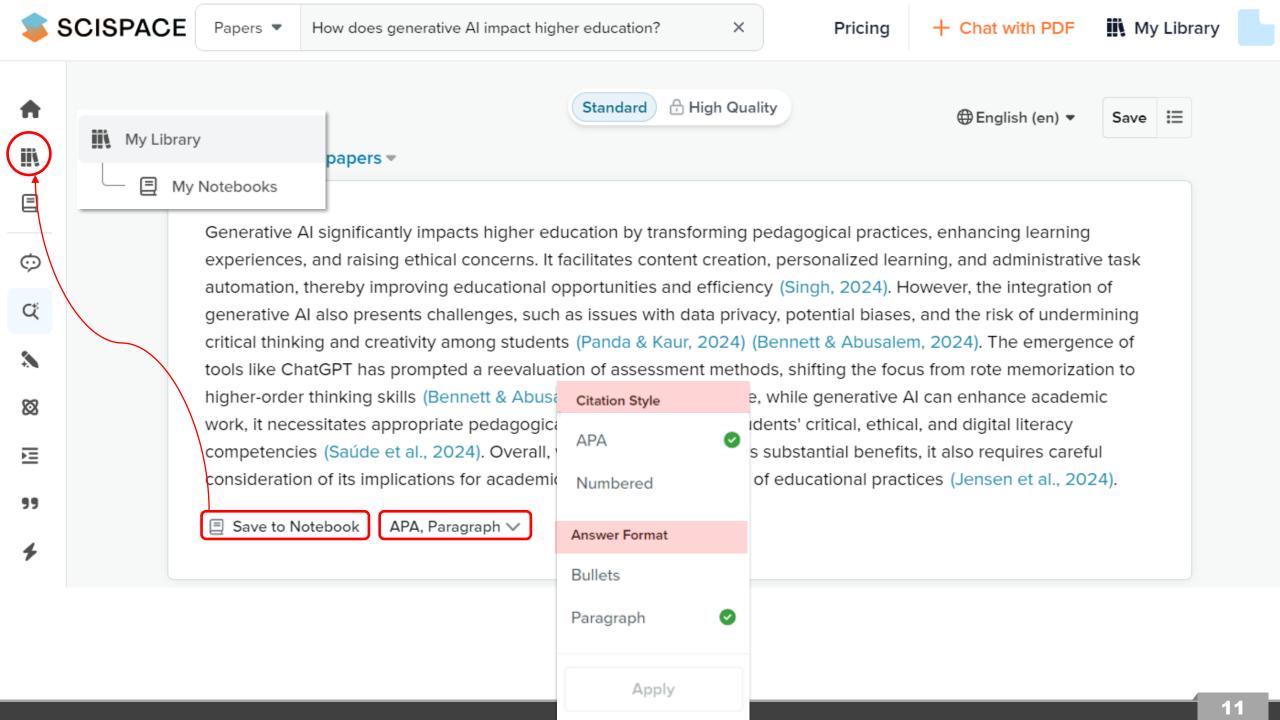


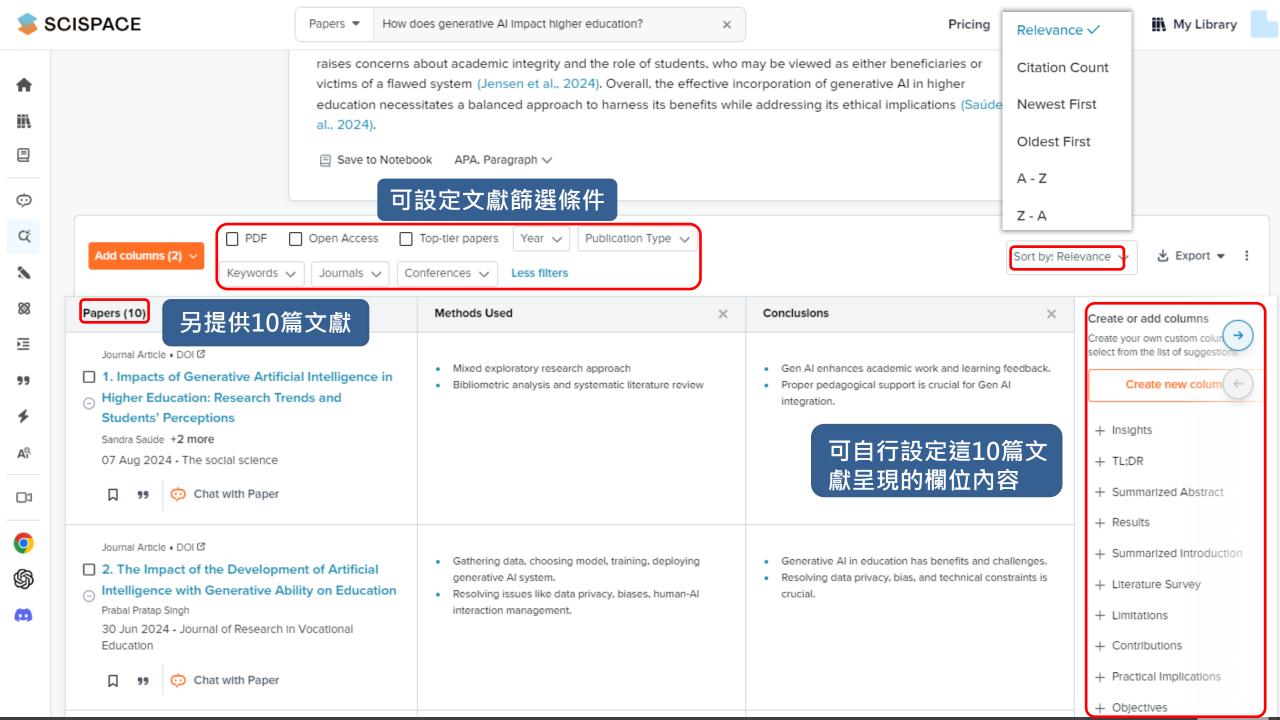


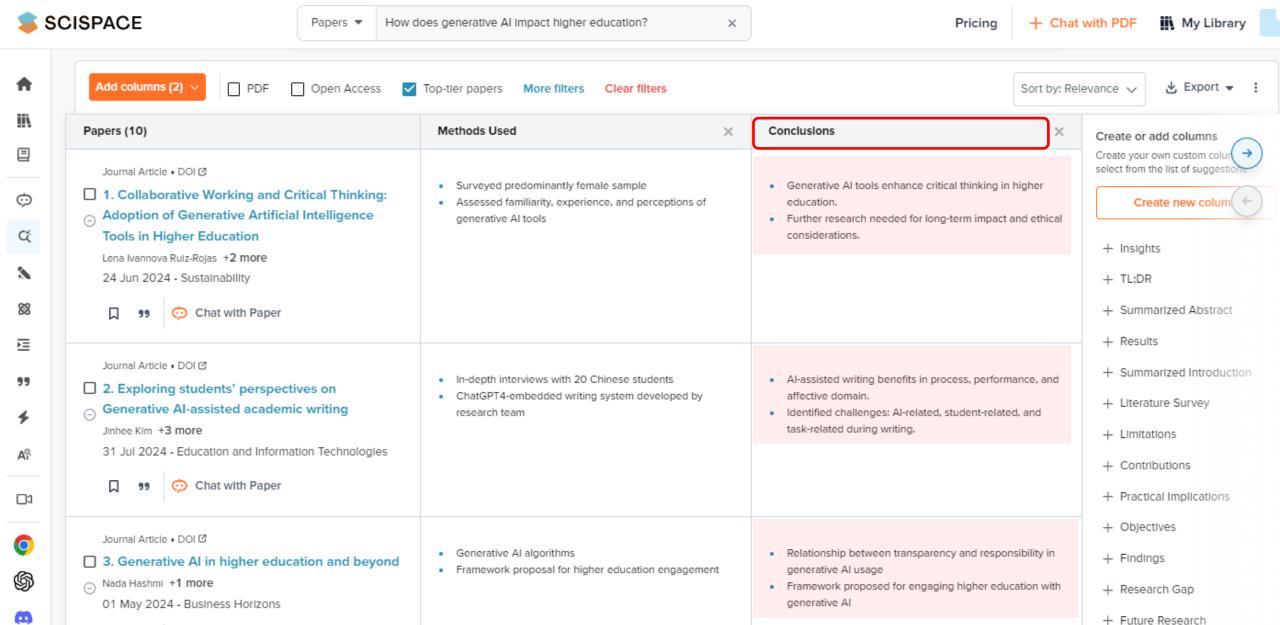


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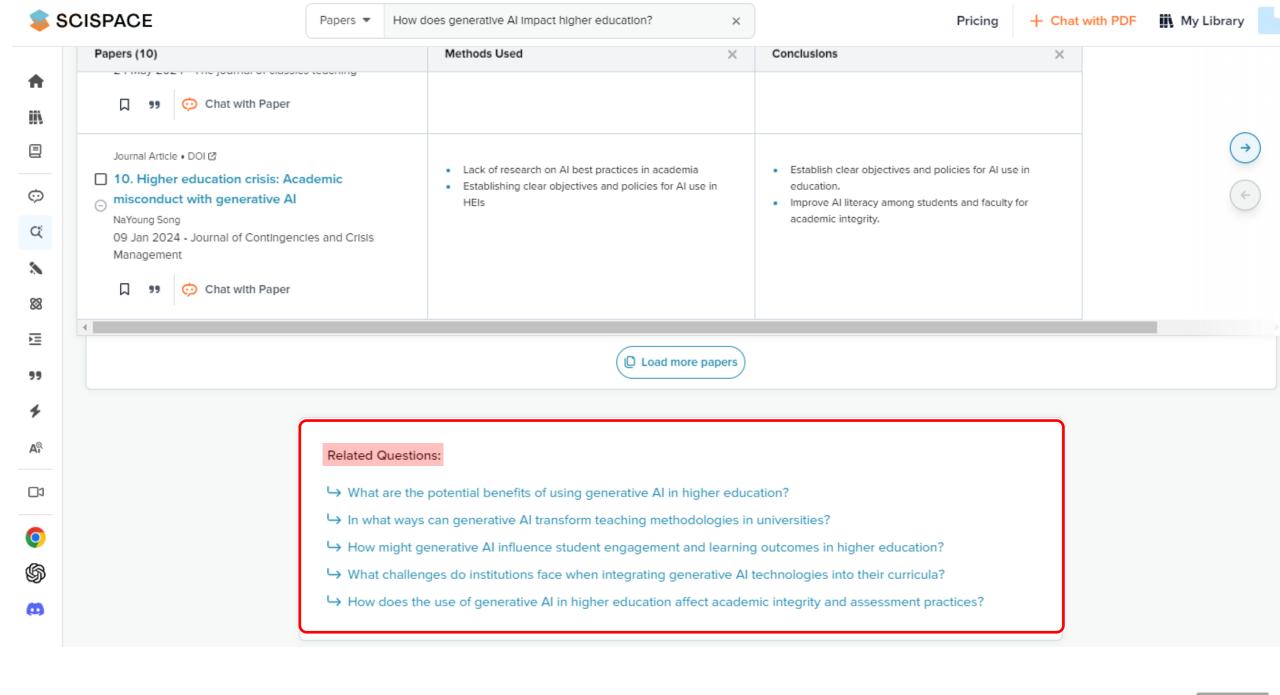






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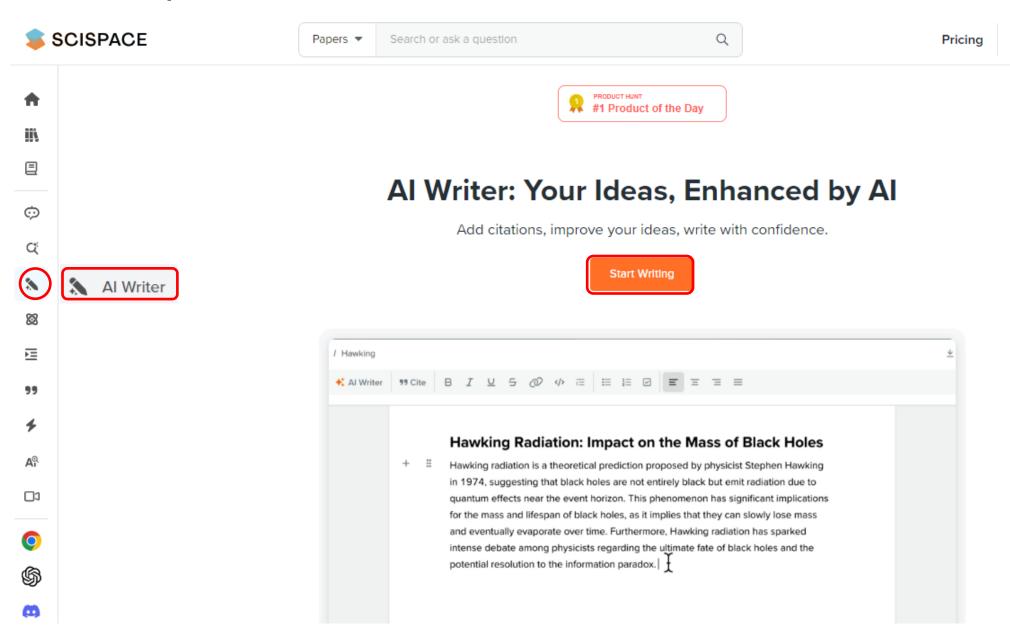
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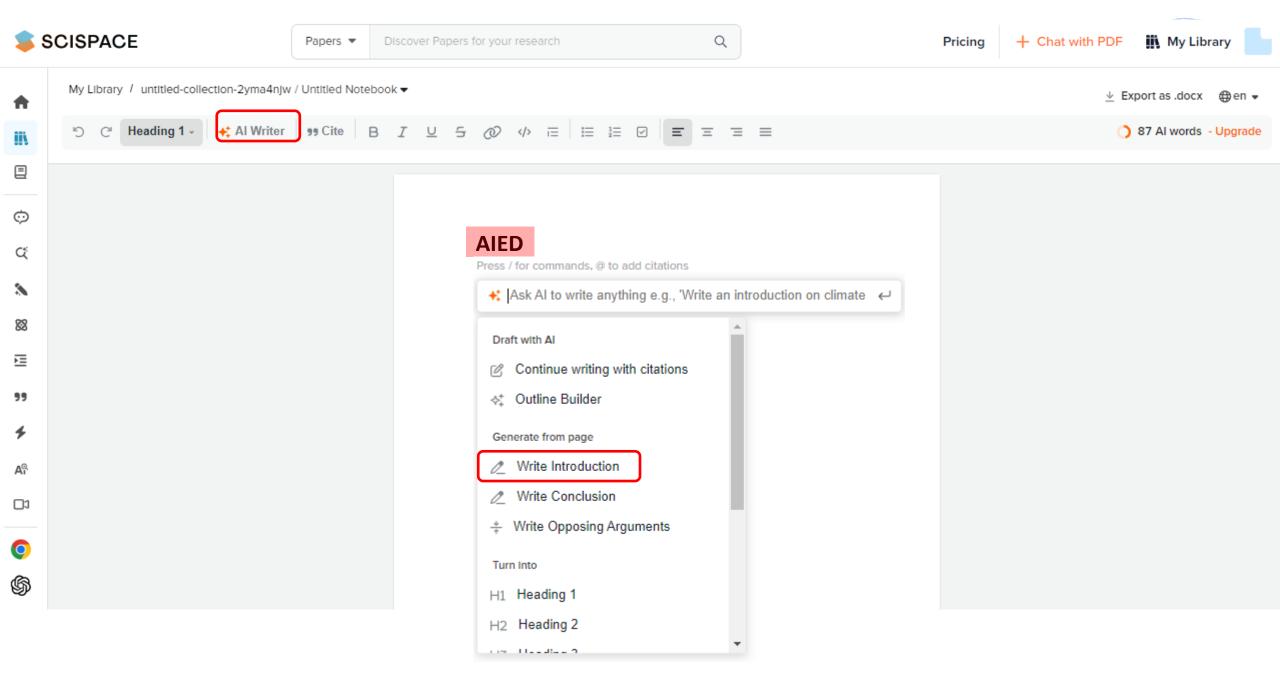


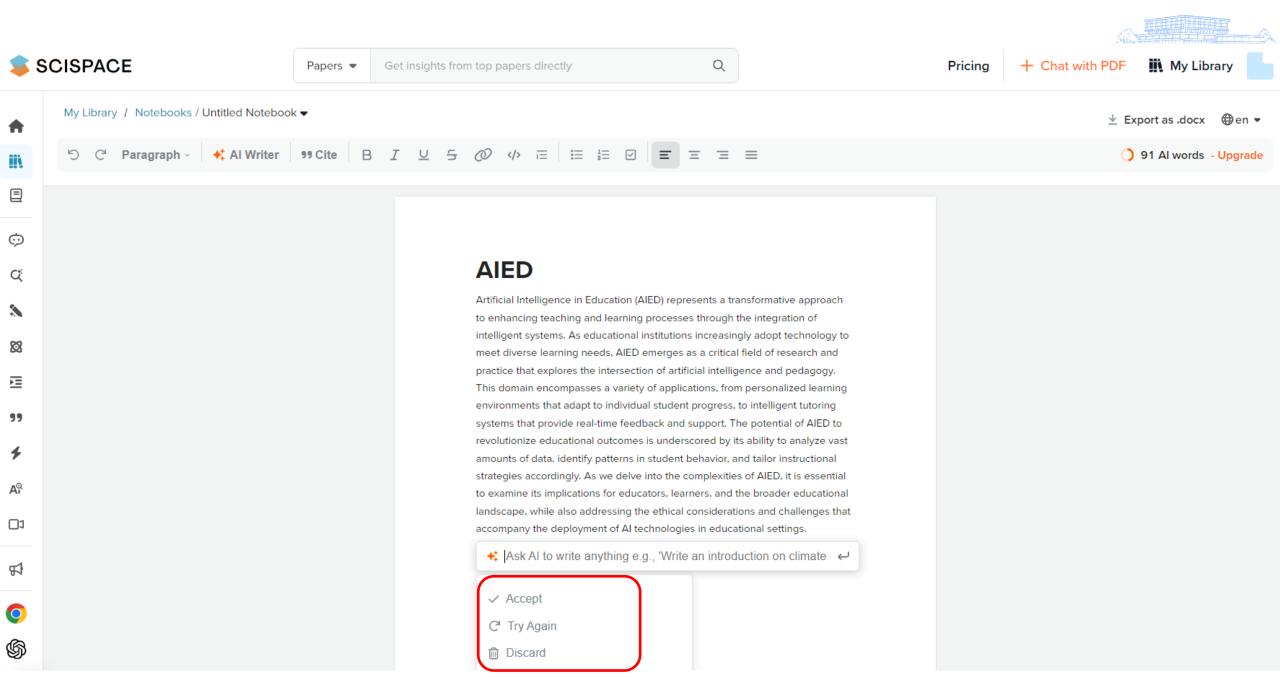
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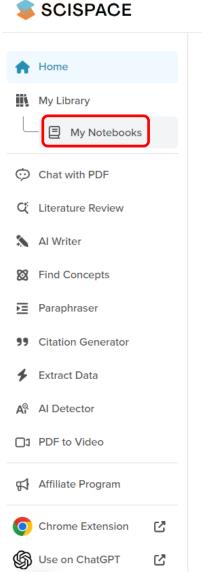


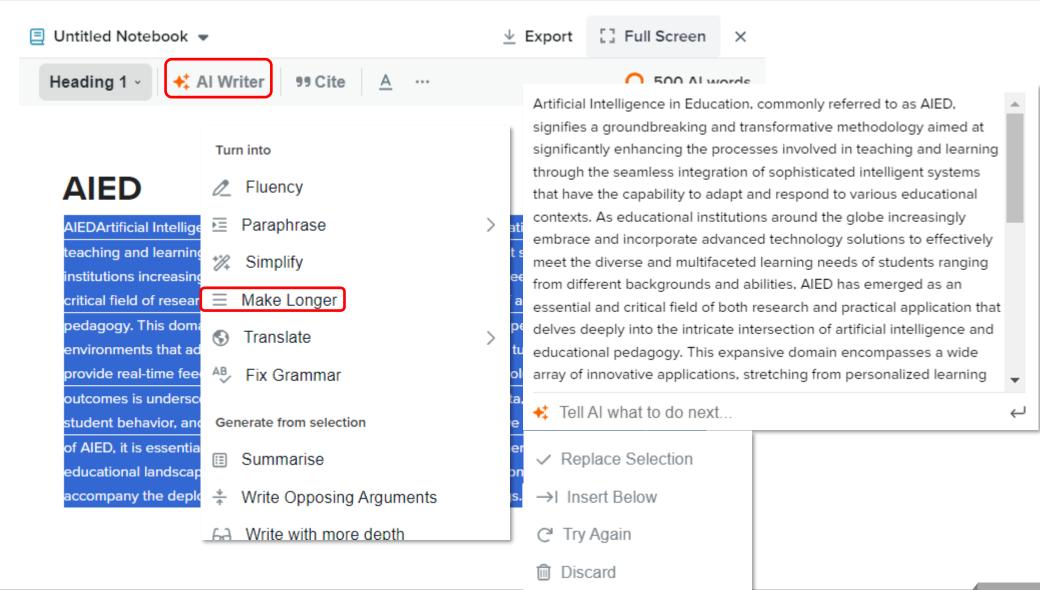


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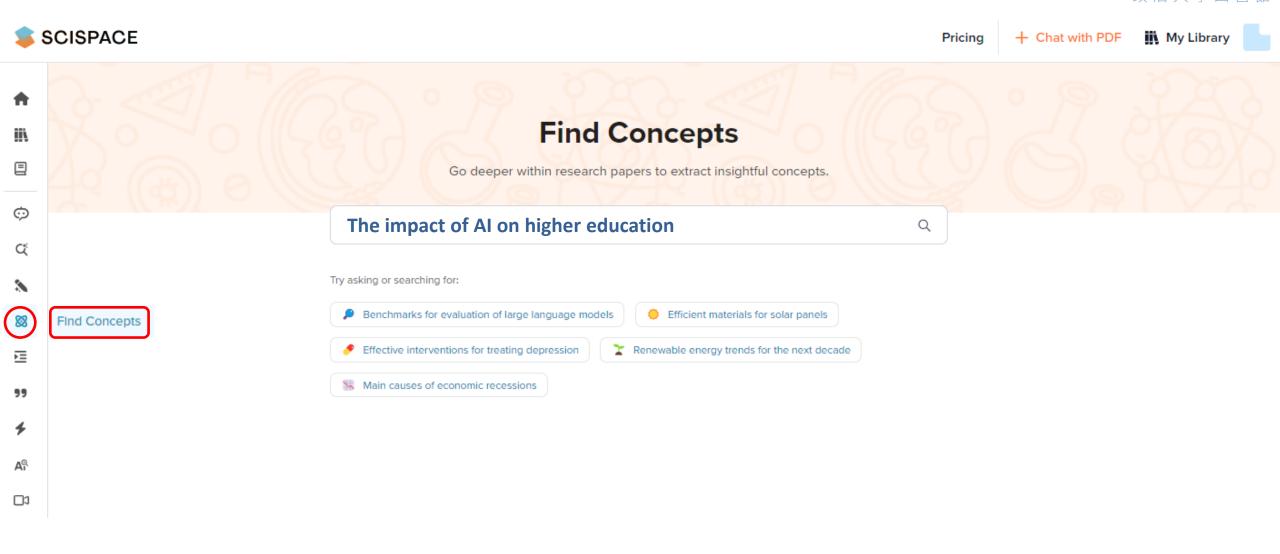
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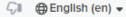
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### 提供5個關鍵概念

(Al) in higher education is transforming teaching and learning processes, enhancing student experiences and institutional efficiency. Al-driven systems, such as Just in Time Artificially Intelligent Tutors (JITAITs), provide immediate assistance to students, facilitating a more interactive and responsive learning environment [2]. These systems exemplify how AI can personalize education, adapting to individual student needs and improving engagement and outcomes through tailored learning experiences [4]. Moreover, Al-driven tutoring systems offer personalized support and realtime feedback, which significantly enhances the learning experience by addressing specific student challenges [3]. The orchestration of human decision-making with AI capabilities allows for scalable and effective educational interventions, ultimately leading to improved learning outcomes [4]. Additionally, AI enhances student support services, streamlining administrative processes and providing resources that cater to diverse student needs [5]. As higher education institutions navigate the challenges of rapid technological change and globalization, the adoption of AI technologies is crucial for meeting the evolving demands of students and society [1] 5]. Thus, Al is not only reshaping educational methodologies but also redefining the overall landscape of higher education.

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### artificial intelligence in teaching and learning

This concept directly addresses the query by focusing on the specific application of artificial intelligence within the context of teaching and learning processes in higher education.

· Exploring the impact of artificial intelligence on teaching and...

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### Concepts

### Sources

### artificial intelligence in teaching and learning

This concept directly addresses the query by focusing on the specific application of artificial intelligence within the context of teaching and learning processes in higher education.

This paper explores the phenomena of the emergence of the use of artificial intelligence in teaching and
learning in higher education. Recent technological advancements and the increasing speed of adopting
new technologies in higher education are explored in order to predict the future nature of higher education
in a world where artificial intelligence is part of the fabric of our universities. We pinpoint some challenges
for institutions of higher education and student learning in the adoption of these technologies for teaching,
learning, student support, and administration and explore further directions for research.

 $\times$ 

### Just in Time Artificially Intelligent Tutors (JITAITs)

Al-driven tutors that provide immediate assistance to students, exemplifying how Al can enhance teaching and learning in higher education. • This paper introduces the idea of a HyperClass based on HyperReality, an advanced form of distributed virtual reality where physical reality and virtual reality, and human intelligence and artificial intelligence intermesh and interact to provide anyone, anywhere, anytime learning, in which teaching could be done by Just in Time Artificially Intelligent Tutors (JITAITs) that will pop up when needed, whilst students use avatars—online simulacra of themselves—to interact as telepresences in classes from different countries and locations. This paper explores the potential of artificial intelligent (Al) systems in the university's core functions of teaching, learning and knowledge nexus, against the background of rapid technological

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### AI-Driven Tutoring Systems

Intelligent tutoring systems use AI to provide personalized support and real-time feedback to students, enhancing their learning experience. Collected by SciSpace models from web sources 3

### Personalized Learning

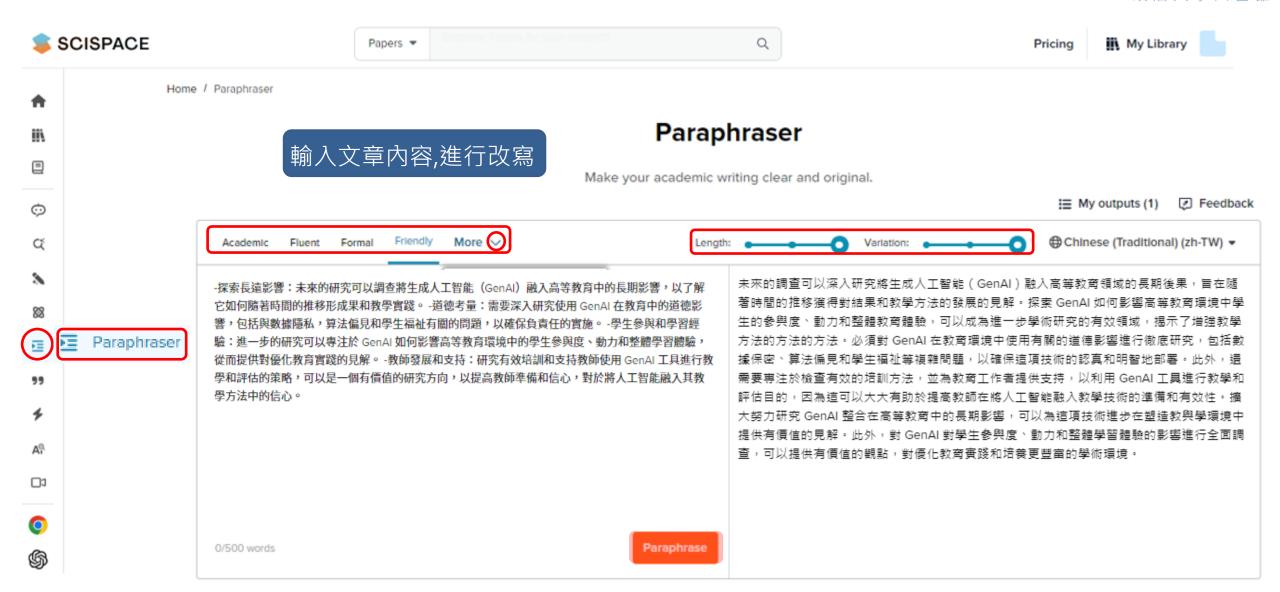
Al enables tailored educational experiences that adapt to individual student needs, improving engagement and outcomes.

- With the powerful learning ability and computing ability, artificial intelligence can push personalized
  learning resources for learners after a comprehensive analysis of the collected big data, making the
  adaptive learning coefficient close to 1, for which learners can complete learning tasks in a more pleasant
  state and make more progress in study; Al-supported Multi-dimensional diagnostic evaluation and resource
  feedback of test proved to strengthen students' language cognition ability and promote the development
  of English learning.<sup>[1]</sup>
- The experiences of personalized learning created by (1) seamless orchestration of human decision-making

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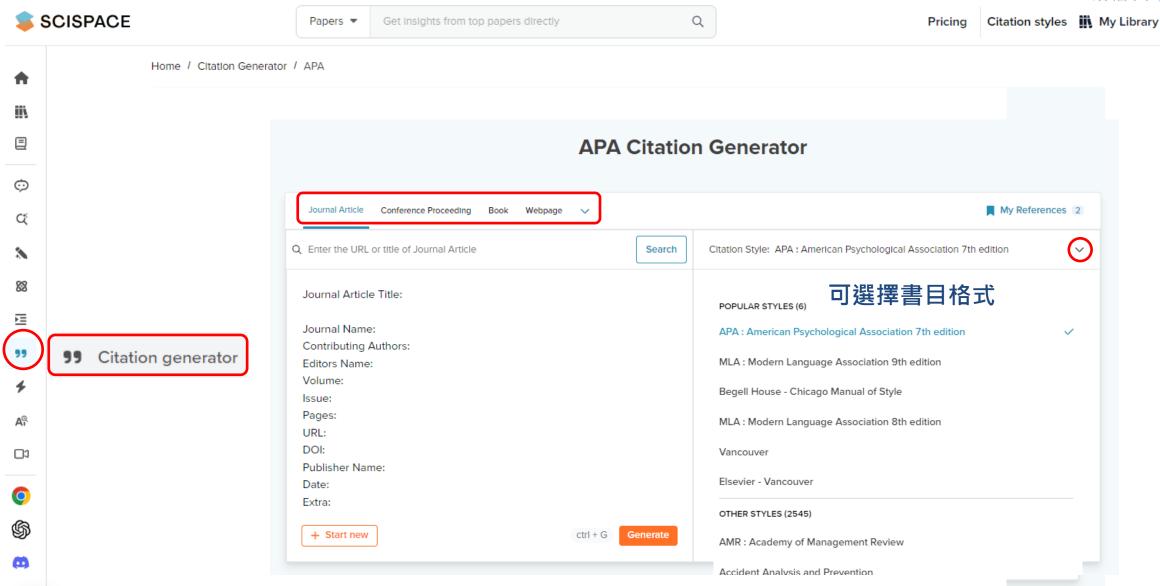
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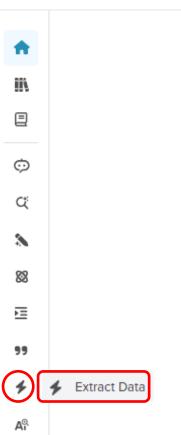
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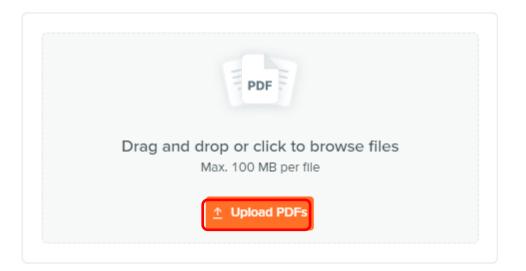


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1. How do cultural factors affect FinTech resistance?

2. What changes might longitudinal studies reveal over time?

3. Which personalized services could reduce user resistance?

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PDF file Summary

### INTRODUCTION

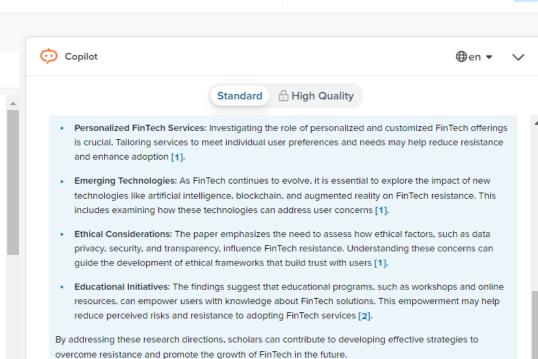
- The COVID-19 pandemic has accelerated the shift from traditional banking to digital financial technologies (FinTech), enhancing convenience and reducing direct contact.
- Despite the rapid growth of FinTech services globally, adoption remains low in Pakistan, highlighting a need to understand consumer resistance factors.
- Key barriers to FinTech usage include unfamiliarity, security concerns, and perceived complexity, which this
  research aims to explore.

### LITERATURE REVIEW

- FinTech has improved access to financial services, particularly in underserved areas, and has significantly transformed payment systems.
- Banks have responded to the rise of FinTech through partnerships and incubation programs, yet barriers still hinder widespread adoption.
- Consumer literacy about financial services has increased, but persistent barriers limit the potential growth and efficiency of FinTech services.

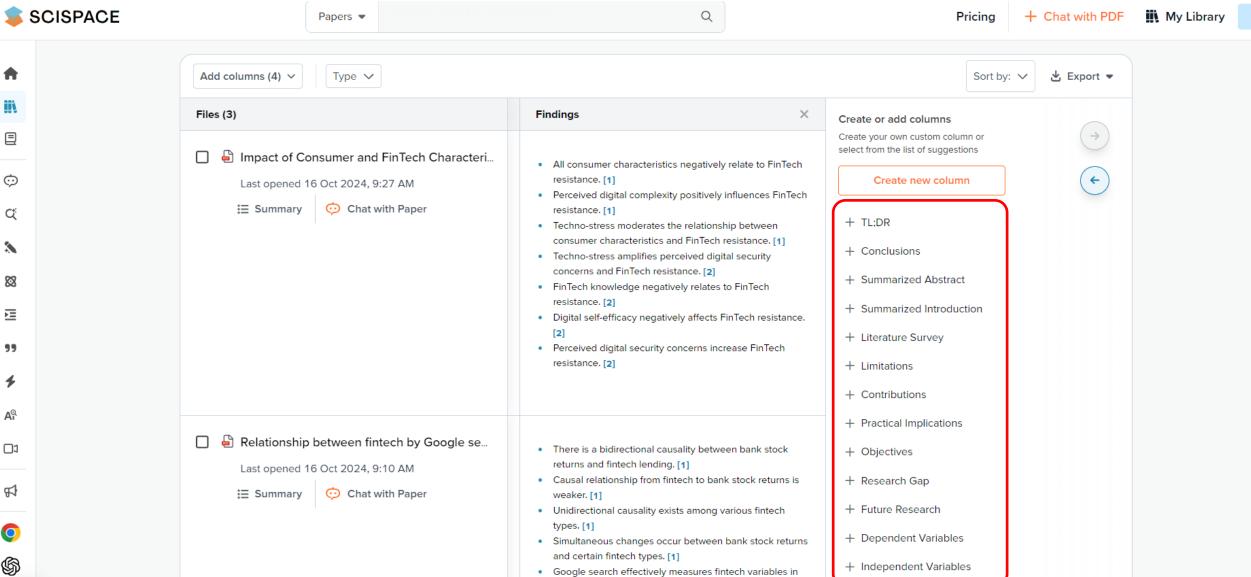
### FinTech Resistance

- Innovation resistance is a common reaction to new technologies, reflecting individuals' reluctance to accept changes in rapidly evolving sectors like FinTech.
- Understanding the reasons behind innovation resistance is crucial for FinTech companies to develop strategies that address consumer concerns.



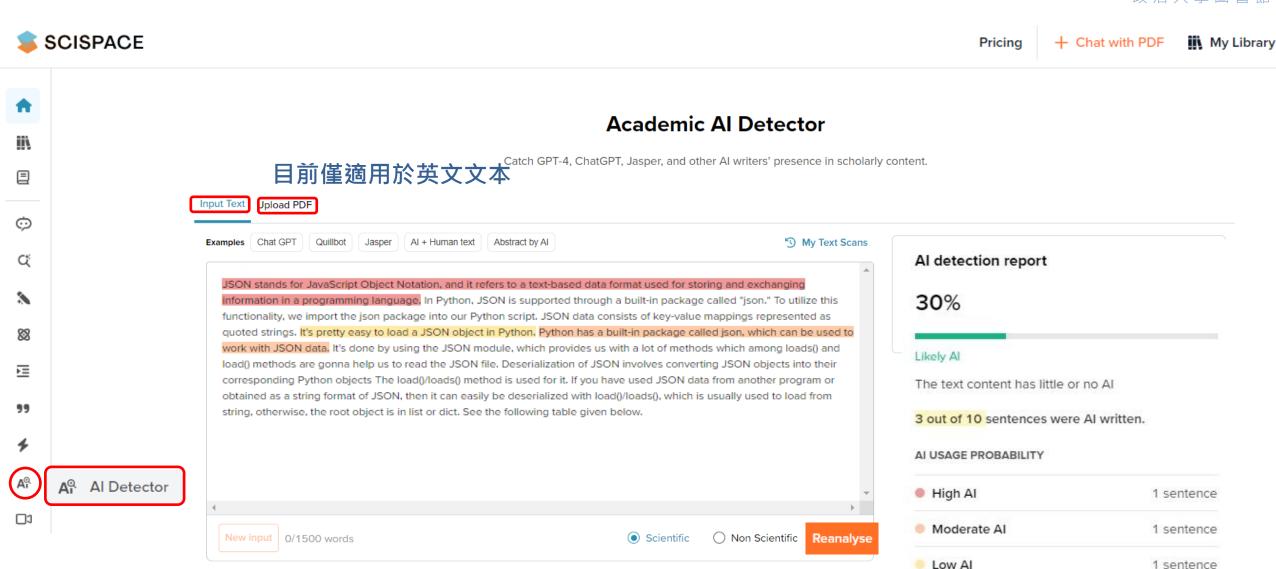
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### SciSpace功能-Academic Al Detector







工具只能輔助分析,對文本的全面理解和詮釋仍是研究者的責任

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研究者應保持批判性思維,對分析結果進行質疑和驗證,確保研究結論的可靠性和科學性



# 問題諮詢



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