

Inference generation as part of a child's Theory of Mind: A study of Indian primary grade learners

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2nd International Conference on Indigenous Languages: Towards Sustainable Multilingualism, IIT Madras, Chennai

13-15 February, 2020





Research jointly supported by the ESRC and DFID

Multilingualism and Multiliteracy: Raising learning outcomes in challenging contexts in primary schools across India



Overview



- A link between Inference Generation & Theory of Mind (ToM) and its application in an Indian MLE context.
- The study
 - Research questions
 - Subjects
 - Tasks
 - Findings & implications
- Conclusion



Inference Generation & its application in Primary schools

- A reader's attempts to understand the text also leads **to meaning construction at different levels** – Inference Generation.
- The generated inferences might be **accurate or near accurate**.
- Learners' abilities to come up with possible answers is **a proof of their linguistic & cognitive growth**.
- A need of classified categories of Inference Generation: **different comprehension needs & abilities**, and **plan the classroom instructions**.

Two main categories of Inference Generation

<i>Propositional Inferences</i> (text-based inferencing)	Pragmatic Inferences (out-side text inferencing)
'true-inferences' (Chikalanga, 1992)	'not always true' (Graesser, 1981)
'explicit and not between the lines' (Harries et al., 1978)	'invited references' (Hildyard, 1979)
'only one correct answer is possible' & 'no disagreement' (Smith et al., 1974)	'more than one correct answer is possible'

Inference Generation & Theory of Mind (ToM)

“ToM refers to *individual’s ability to assign mental states to oneself and to others*”

(Premack & Woodruff, 1978, p. 515)

- Mental states (e.g., *think, wonder, sad, happy*) are not directly observable
- Building of ToM is natural and the inferences are universal in human adults (Premack & Woodruff, 1978, p. 516)

What are the ways IG contribute to push learners access their world knowledge during the process of comprehension?

1. Task types:

- a. Verbal protocol (Cote et.al., 1999)
- b. Comprehension questions (Long & Golding, 1993)
- c. Story grammar (Gagarina et. al., 2012)

*Can different states of human minds also be attended using open-ended tasks of extended production & **pointed comprehension** questions?*

2. Text types:

a. **Narrative text** (*real world experiences, event sequence, actions of the characters*; Bruner, 1986)

vs.

b. **Expository text** (unfamiliar text – difficult reasoning;
Graesser, 1981)

The Study

Research questions:

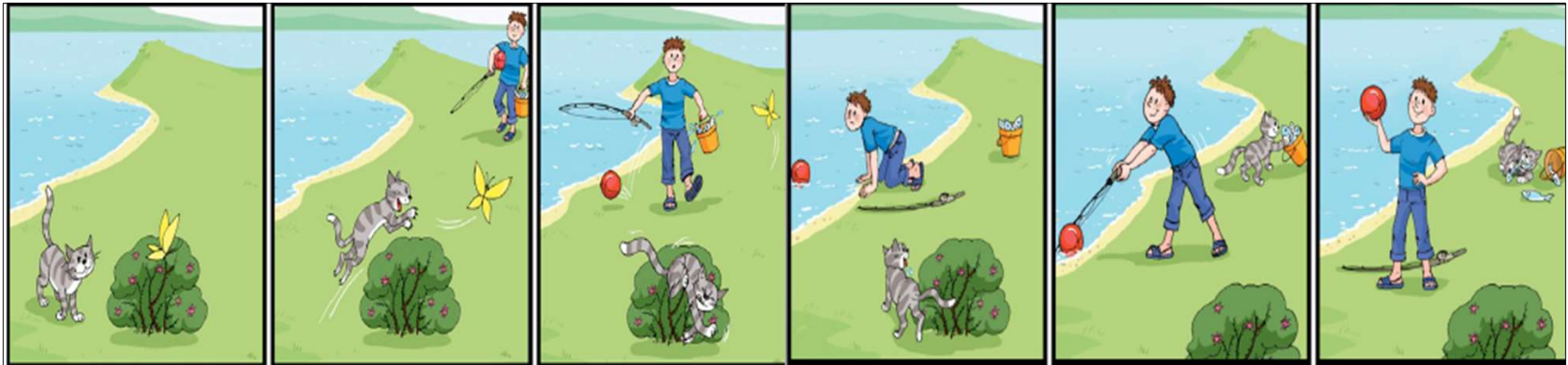
- *Can learners' abilities to use ToM be assessed through NCQs so that their 'knowledge-based' resources are not treated as 'false' answers?*
- *Do NCQs help learners generate the types of inferences and aid their text comprehension?*

Children profile from schools in Patna

City (State)	Mol	Number of children (N)	Age (range in years)	Age (Mean)	Mol overlap with HL	Parental occupation (with literacy practices)
Patna (Bihar)	Hindi	N=30 (F=14; M=16)	8 – 11 years	M= 9.44 (sd= 0.89)	100%	53.33%

Tasks

Narrative Retelling Task



THE CAT STORY

@MAIN manual: 2012

Internal State Terms (IST): *happy, sad, excited*

Narrative Comprehension Questions (NCQs)

	Questions	Correct response	Wrong response (note in Comments)	No response	Score	Comments
0	Did you like the story? क्या आपको कहानी अच्छी लगी?	For warming-up, no score				
1	Why does the cat jump/leap forward? (G1) (point to picture 2) बिल्ली आगे क्यों कूदी ?	wants/ to get the butterfly	she is leaving/ running / wants to jump		0 1	
2	a) How does the cat feel? (MS as IE) (point to picture 1) बिल्ली क्या महसूस कर रही है ?	good/fine/playful/hungry	bad/ she is running around		0 1 ¹	
	b) Why do you think that the cat is feeling good/playful/hungry etc.)? आपको ऐसा क्यों लगता है की बिल्ली अच्छा/भूक/चंचल महसूस कर रही है ?	... because he is jumping to get the butterfly / trying to get / catch the butterfly...	...because he is jumping into the bush / jumping around / because... or other irrelevant answer		0 1 ¹	
3	Why does the boy hold the fishing rod in the water? (G2) (point to picture 5) लड़के ने मछली पकड़ने वाला डंडा पानी में क्यों डबोया है ?	wants/to get his ball back	to play with water		0 1	

Comprehension questions : **Propositional Inferencing**

Question 1: Why does the cat jump forward?

बिल्ली आगे क्यों कूदी ?

Question 2b: Why do you think the cat is feeling hungry?

आपको ऐसा क्यों लगता है की बिल्ली अच्छा/भूक/चंचल महसूस कर रही है ?

Question 3: Why does the boy hold the fishing rod in the water?

लड़के ने मछली पकड़ने वाला डंडा पानी में क्यों डुबोया है ?

Question 5a: How does the boy feel?

लड़का क्या महसूस कर रहा है ?

Question 5b (causal): Why do you think the boy is feeling happy?

आपको ऐसा क्यों लगता है की लड़का अच्छा/ठीक/खुश/समाधानी महसूस कर रहा है ?

Comprehension questions : **Pragmatic Inferencing**

Question 2a: How does the cat feel?

बिल्ली क्या महसूस कर रही हैं ?

Question 4: Why is the cat grabbing the fish?

बिल्ली ने मछली को क्यों झपट्टा ?

Question 6 (perspective taking + causal)

Imagine that the boy sees the cat

कल्पना किजिए की लड़के ने बिल्ली को देख लिया हैं.

6a How does the boy feel?

आप बताईये की लड़का कैसे महसूस कर रहा होगा ?

6b Why do you think the boy feels bad?

आपको ऐसा क्यों लगता हैं की लड़के को बुरा लग रहा हैं ? गुस्सा आ रहा हैं? या वह पागल हैं ?

Findings

- The participants' answers to **propositional inferencing** questions were mostly **treated as correct** (Q5a- 97%; Q5b- 90%; Q3- 93%; Q1- 83%).
- Comparatively, the responses to the **pragmatic inferencing** questions were seen **treated as wrong** (Q2b- 0.33%; Q4- 67%; Q2a- 70%; Q6b- 73%)

Some instances of pragmatic inferencing

4. Why is the cat grabbing the fish?

Correct- decided/wants to have the fish for himself

Wrong- wants to play with the bucket

Differential responses: The cat grabbed the fish because:

S7: It **likes** fish (**emotion state term** + intentional reasoning)

S12: It **saw** the fishes (**perceptual** state term)

S17: It was **hungry** (**physiological term** + intentional reasoning)

S24: After seeing the fishes, it became **greedy** (**physiological term** + reasoning + cause effect relationship)

Some instances of pragmatic inferencing

6b. Imagine that the boy sees the cat.

Why do you think that the boy feels bad/angry/mad etc.?

Correct- ... because the cat is eating the boy's fish / has taken the fish

Incorrect-... because he is / because the fishing rod is on the ground or other irrelevant answer

Differential responses: The cat feels bad/ angry/ mad because:

S7: The boy struggled to get catch the fishes but the cat instead ate all of them.

(reasoning – cause effect relationship)

S22: It's not good manners to eat others things. *(perspective taking)*

S23: The boy was catching the fishes for longer time but could not eat *(reasoning – cause effect relationship)*

Pedagogical Implications

- Design comprehensive NRQs – propositional & pragmatic inferencing- which attend to ToM of the learners. So that, teachers to recognize the linguistic as well as cognitive growths of the learners.
- The acceptance and recognition of 'ToM' by the teachers will help learners fine-tune their responses than just getting penalizing.
- Teachers' acceptance of learner responses further motivates them to become more critical.

Pedagogical implication

- Learners' TOM abilities reveal a potential cognitive and linguistic growth. So, such responses can also be used to look at specific language properties- tense, lexical complexity and syntactic complexity. In a way, the developmental pattern of linguistic complexity that a child acquires can be documented.

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PhD in English Language Education (ELE)
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Vasim- The role of task complexity and task conditions in ESL speaking assessment

Shravasti- The understanding and use of metacognitive strategies in group discussions among first year engineering students: An exploratory study

Kankan- Role of working memory & comprehension monitoring on Reading Comprehension: A study of young ESL learners

References

- Chikalanga, I. (1992). A suggested taxonomy of inferences for the reading teacher. *Reading in a foreign language*, 8, 697-697.
- Cote, N., & Goldman R. (1999) Building Representations of Informational Text: Evidence from Children's Think-Aloud Protocols. *In The Construction of Mental Representations during Reading*, ed. Herre van Oostendorp and Susan R. Goldman. Mahwah, NJ: Erlbaum
- Gagarina, N., Klop, D., Kunnari, S., Tantele, K., Välimaa, T., Balciuniene, I., & Walters, J. (2012). Multilingual Assessment Instrument for Narratives (MAIN). *ZAS papers in linguistics*, 56, 1-140.
- Graesser, A. C. (1981). *Prose comprehension beyond the word*. New York: Springer-Verlag.
- Harris, R. J., & Monaco, G. E. (1978). Psychology of pragmatic implication: Information processing between the lines. *Journal of Experimental Psychology: General*, 107(1), 1-22.
- Hildyard, A. (1979). Children's production of inferences from oral texts. *Discourse Processes*, 2(1), 33-56.
- Long, D. L., & Golding, J. M. (1993). Superordinate goal inferences: Are they automatically generated during comprehension? *Discourse Processes*, 16(1-2), 55-73.
- Premack, D., & Woodruff V, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, 1, 515-526.



Thank you for your attention!!!

