

Tinker Tales

A Tangible Dialogue System for Child–AI Co-Creative Storytelling

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MOTIVATION

AI is already a common creative collaborator for adults: brainstorming, writing, design.

Children's AI use tells a different story



Adults & AI

A common creative partner: people brainstorm, draft, and iteratively develop ideas together with AI.



Kids & AI, today

Existing work centers on AI-led, instructional activities; guided reading, adaptive feedback, screen-based.



The real gap

Not whether kids can co-create with AI; but how its conversation design shapes what they contribute. Underexplored.

***Narrative activities** naturally invite shared idea-building; but young learners' contributions are directly shaped by **how the AI frames questions and structures elaboration**.*

MEET THE SYSTEM

This is what Tinker Tales looks like



Physical setup

The story board is laid out as four narrative stages (Start, Journey, Climax, End) with NFC-embedded toys.



Mobile app

The go-between: senses NFC scans and mediates the child–AI interaction through voice.

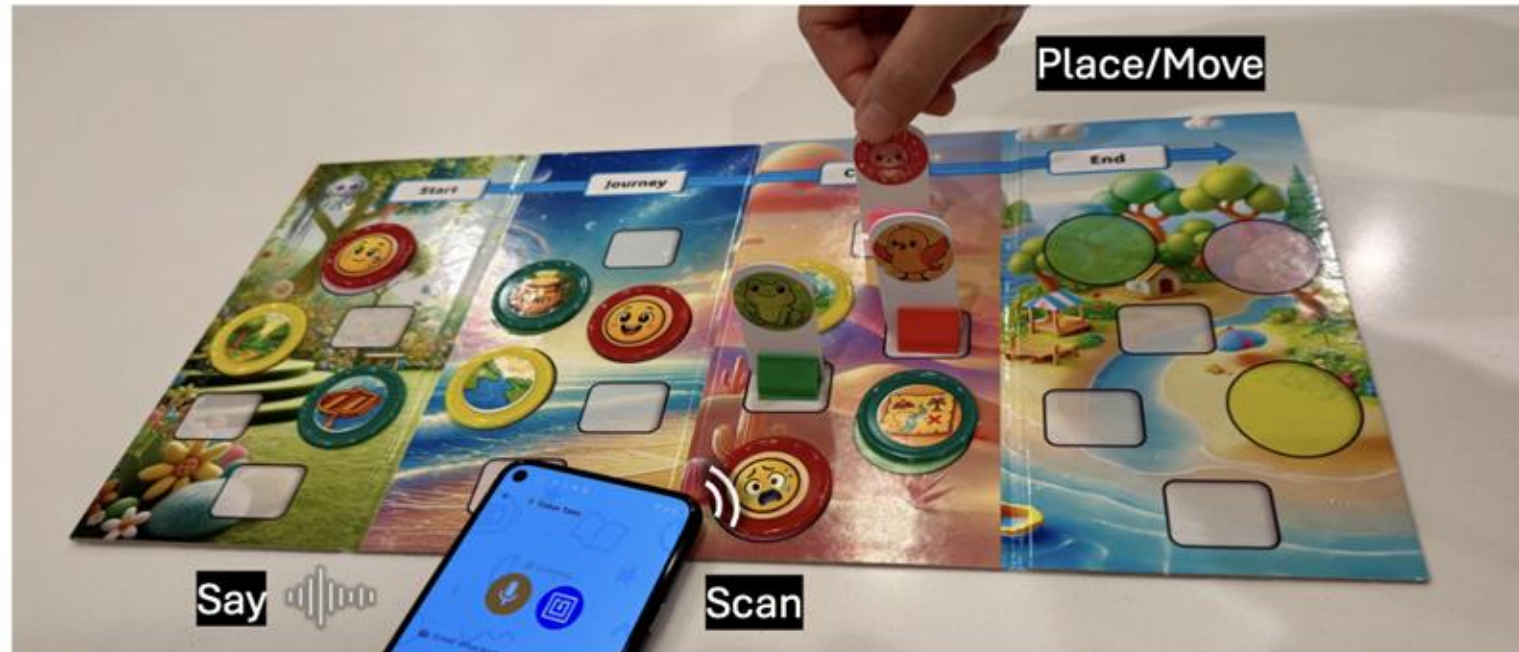


Co-creative AI

Not just a narrator but a co-creative partner. Its conversation design is exactly what we study.

*Children **iteratively develop and refine stories** through interaction with a conversational AI while placing and **moving tangible story elements** on a physical board.*

The co-creative loop: Place · Scan · Say



Place and scan NFC toys
(story elements: character,
place, item, emotion)



AI drafts a story segment
based on selected story
elements



Question to help child to
elaborate the story further



Updates the story and
narrates it back

How does conversation design shape child-AI co-creative storytelling?

01

Educational scaffolding

Applebee's narrative development model + CASEL's SEL framework, instantiated directly as conversation design.

02

Controllable yet flexible interaction

Structured dialogue graphs per activity phase; allows unscripted questions or side talk.

03

Dialogue analysis

A home-based study with 10 children showing how conversation design shapes child-AI co-creative activity.

Two design inspirations, two frameworks

Collaborative roles



Adult–AI creative writing

partial ideas in, AI-generated content out, iteratively developed.



Adult–child storytelling

caregivers elicit ideas while children keep control of narrative decisions.

Educational scaffolding



Applebee's Narrative Development

Heap → Sequence → Primitive → Chain → True narratives scaffolds event & causal elaboration.



CASEL Social–Emotional Learning

socially-oriented competencies guide to elicit characters' emotions & perspectives.

How each framework becomes a question

Applebee — Narrative Development Model

Narrative stage	Scaffolding
Heap / Sequence	<i>Selection & sequencing of story elements (tangible, not asked)</i>
Primitive narratives	Elaboration prompts for new events or actions
Chain narratives	Elaboration prompts targeting causal relations
True narratives	Post-story prompts: retell, then alternative endings

CASEL — Social–Emotional Learning Framework

SEL competency	Scaffolding
Self-awareness / Self-management	<i>not used (story centers on characters, not the child)</i>
Social awareness	Elaboration prompts to infer characters' emotions & perspectives
Relationship skills	Post-story prompts to reflect on characters' interactions
Responsible decision-making	Post-story prompts to suggest alternative actions

How each framework becomes a question

Dialogue Graph:

Applebee — Narrative Development Model

CASEL — Social–Emotional Learning Framework

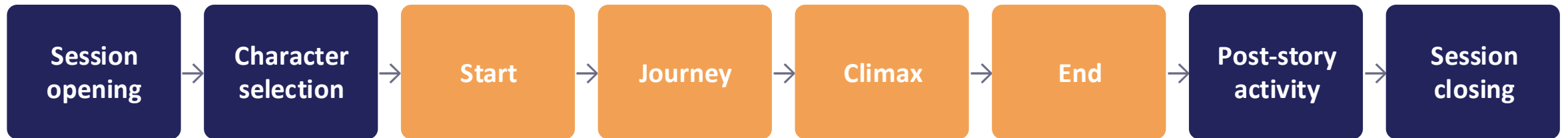
Narrative stage (A) ...	Scaffolding	SEL competency	Scaffolding
Heap / Sequence (B) ...	Selection & sequencing of story elements (tangible, not asked)	Self-awareness / Self-management	not used (story centers on characters, not the child)
Primitive narratives	Elaboration prompts for new events or actions	Social awareness	emotions & perspectives to infer characters'
Chain narratives	Elaboration prompts targeting causal relations	Relationship skills	to reflect on characters'
True narratives	Post-story prompts: reread, then alternative	Responsible decision-making	Post-story prompts to suggest alternative

(C) Ask a question that encourages the child to **elaborate and refine the story’s narrative**. Ground the question in the story created so far, and phrase it in a way that sparks the child’s imagination. Make sure to scaffold this question for the **Chain narratives** stage from Applebee’s narrative development model, which emphasizes the emergence of causal connections. For example, the question may be framed along the lines of: **"Why did [a character] do [an action]?"** or **"How did [an event] happen?"**

...

(A) -> (B) -> (C) -> ...

Eight scripted phases, structured yet flexible conversation



Progression rule

Phase-level Prompt Scheme

{Phase-level instruction}

Dialogue Graph:

(A) {Activity instruction 1}

> After response, go to (B).

(B) {Activity instruction 2}

> If yes, go to (C). If no, go to (D).

(C) {Activity instruction 3}

> After response, go to (E).

(D) {Activity instruction 4}

> Ask a follow-up question if needed.

> After then, go to (E).

...

(J) {Activity instruction N}

> All required steps completed → ##NEXT##

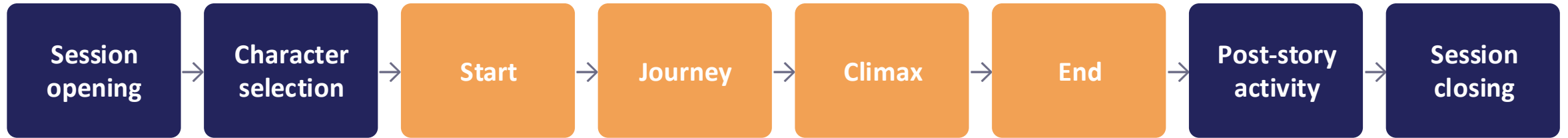
Possible Dialogue Paths:

1. (A) → (B) → (C) → ... → (J) → ##NEXT##

2. (A) → (B) → (D) → ... → (J) → ##NEXT##

- Each phase is a dialogue graph with conditional transitions.
- AI agent issues an explicit transition marker (##NEXT##) when the current dialogue graph is fulfilled. After the transition marker, the next phase prompt is provided to the AI.
- Can still answer unscripted questions or side talk along the way, within a phase.

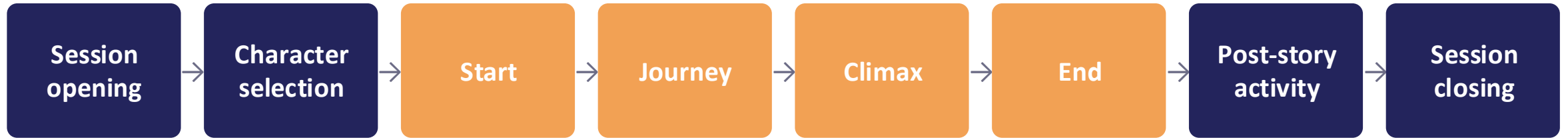
Eight scripted phases, structured yet flexible conversation



Within each narrative stage (Start – End):

- Move character pawns from the previous narrative stage
- Select and scan story elements (place, item, emotion tokens) for this stage
- AI generates a story draft based on the story progression so far
- Question to help child further elaborate the story
- Story updates

Eight scripted phases, structured yet flexible conversation



Within each narrative stage (Start – End):

- Move character pawns from the previous narrative stage
- Select and scan story elements (place, item, emotion tokens) for this stage
- AI generates a story draft based on the story progression so far
- **Question to help child further elaborate the story**
- Story updates

10 children, two conditions, home-based

10

children,
ages 6–8

2

conditions:
Structured vs. Generic

~32

minutes
per session

~53

turns
per session

⋮

	Start	Journey	Climax	End	Post-story activity
<i>Structured</i>	Primitive narratives: 1 Social awareness: 1	Chain narratives: 1 Social awareness: 1	Primitive narratives: 1 Social awareness: 1	Chain narratives: 1 Social awareness: 1	True narratives: 2 Relationship skills: 1 Responsible decision-making: 1
<i>Generic</i>	General elaboration: 1	General elaboration: 1	General elaboration: 1	General elaboration: 1	True narratives: 2 Relationship skills: 1 Responsible decision-making: 1

Table 1: Overview of scaffolding components applied across the activity phases by condition. The *Structured* condition posed questions aligned with a narrative development model and a SEL framework, while the *Generic* condition used general elaboration questions (see Appendix A.1 for details).

Coding child–AI dialogue, turn by turn

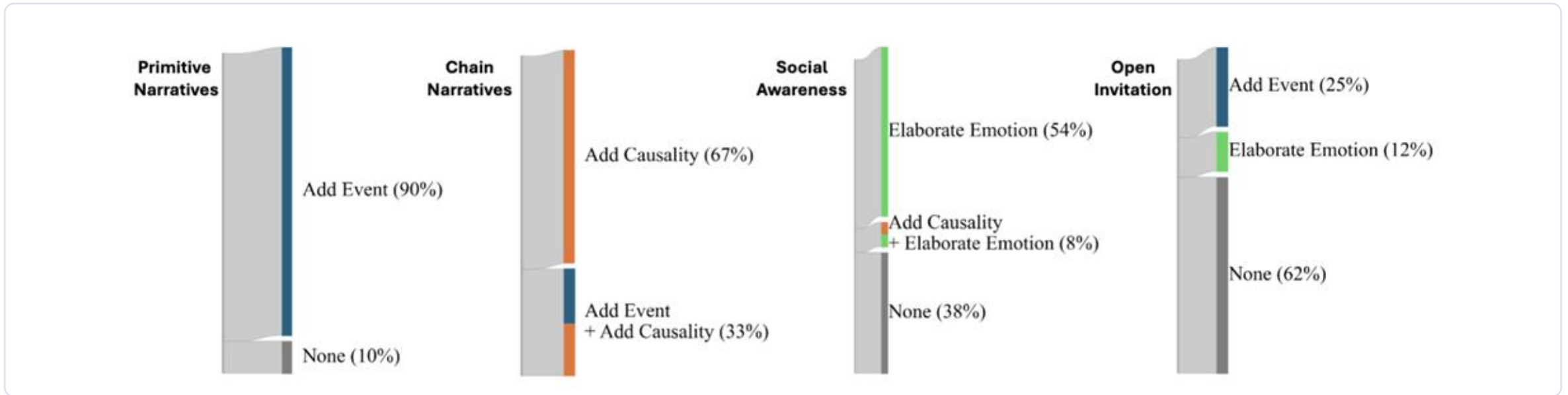
How children contributed to and refined narrative ideas, how the AI responded, and how stories were jointly constructed over multiple turns.

Scheme	Example	Label
Agent question framing	"What else do you think they might do at the river?"	Primitive narratives
	"Why do you think they decided to follow the Map?"	Chain narratives
	"How do they feel about each other right now?"	Social awareness
	"Would you like to add something to the story?"	Open invitation
Narrative functions of child input	"They see a turtle, and the turtle becomes a pet for them."	Add event
	"To find treasure."	Add causality
	"Excited, but a little nervous, like the first day of making new friends."	Elaborate emotion
	"Nothing.", "I don't know.", "Same."	None
Uptake of child contributions	Reflect all key changes introduced by the child; see Figure 6 and Figure 18.	Full uptake
	Reflect only a subset of changes introduced by the child; see Appendix Figure 20.	Partial uptake
	Does not reflect any changes introduced by the child; not observed.	No uptake

Table 2: Summary of the coding scheme used in our analysis, including agent question framing, narrative functions of child input, and uptake of child contributions. Example utterances are excerpted from our interaction logs.

FINDINGS

Scaffolding shapes whether and how children contribute



90%

Primitive narrative
scaffold → Add Event

100%

Chain narrative
scaffold → causal reasoning

62%

Social awareness
scaffold → Elaborate Emotion

P3, Structured Condition

AI: “What else might they do when they see the dragon?”

Child: “Rabbit will scream and the dragon will wake up.”

AI: “How do you think each of them feels about the dragon?”

Child: “The rabbit feels scared and the lion is frightened, and the bear wants to be friends with a dragon.”

STORY (DRAFT)

The boat carried the three friends to a dark cave by the riverbank. They grabbed the lantern and stepped inside to explore. The cave was big and mysterious, and all three friends felt scared. Suddenly, they heard a loud noise echo through the cave! The brave Lion held up the lantern to see what it was. Behind a pile of rocks, they found a huge sleeping dragon!

The Bear, Rabbit, and Lion froze in fear. Their hearts beat fast as the dragon began to wake up. Would they be able to escape, or would they have to face the dragon? The three friends looked at each other, scared but ready to be brave together.

...

AI: Can you tell me what else they might do when they see the dragon?
Child: Rabbit will scream and the dragon will wake up.
AI: So the Rabbit will scream and that wakes up the dragon. Good idea! Now I have another question for you. How do you think each of them feels about the dragon? Does one of them feel different from the others?
Child: The rabbit feels scared and the lion is frightened, and the bear wants to be friends with a dragon.

...

STORY (UPDATED)

The boat carried the three friends to a dark cave by the riverbank. They grabbed the lantern and stepped inside to explore. The cave was big and mysterious, and all three friends felt scared. Suddenly, they heard a loud noise echo through the cave! The brave Lion held up the lantern to see what it was. Behind a pile of rocks, they found a huge sleeping dragon! The Rabbit screamed loudly, which woke up the dragon. The light from the lantern frightened the Lion, making him jump back. But the kind Bear was not scared—he felt brave and wanted to be friends with the dragon! The Bear stepped forward slowly and spoke in a gentle voice. Even though the Rabbit and Lion were frightened, the Bear’s courage gave them hope.

Figure 6: Excerpt from a Climax-stage interaction (P3, *Structured*) after selecting Cave (Place), Lantern (Item) and Scared (Emotion). Highlighted text marks changes introduced by the child and taken up by the agent.

Breakdowns happen; repair keeps the story going

1

Agent-initiated repair

Agent detects ambiguity, rephrases and re-asks before moving on.

"I'm not sure what you mean. Let me ask again..."

Child: "scared and..." → AI: "Scared and... what? Tell me more."

2

Child-initiated repair

Child actively corrects the agent's misinterpretation.

Child: "No, Lion is not a liar, he is friendly and funny."

Child: "It was not a kid turtle. It was a baby turtle"

FINDINGS

Children primarily framed their experience as collaboratively making and developing, rather than as learning how the AI works or being instructed by it.

Post-study survey

1. How much do you enjoy making stories with the AI friend now? (1 = not fun at all, 5 = super fun!)

1 2 3 4 5
○ ○ ○ ○ ○

2. Is it easier to talk to the AI friend now than the first time?

(a) Much easier now (b) A little easier (c) About the same (d) Harder than before

3. Do you think you learned something new about AI from using Tinker Tales?

(a) Yes, a lot! (b) Yes, a little (c) I'm not sure (d) No, not really

4. What did you learn from using Tinker Tales? (Choose all that apply.)

- Making fun stories
- Talking with the AI friend
- Thinking of new ideas
- Understanding what the AI friend does

5. Now that you've played many times, how does the AI friend feel to you?

(a) Like a friend (b) Like a helper or tool (c) Like a teacher (d) A little scary (e) I don't know yet

6. What was your favorite thing about using Tinker Tales?

Response: _____

7. If you could tell the AI friend how to be better, what would you say?

Response: _____

“I enjoyed building the story together.”

“It was fun talking to Tinker Tales and making a story with Tinker Tales.”

“I can make stories.”

“I made fun stories.”

Conversation design shapes what children can contribute, while preserving their agency over the story.

- Pedagogically-grounded questions → far more consistent, elaborated contributions than open-ended ones
- Primitive vs. Chain scaffolds shape different narrative functions: events vs. causal reasoning
- Collaborative continuity needs both turn-level repair and monitoring of the broader interaction state

Thank you

Questions welcome.

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